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SOCIAL IMPACT OF THE LAKE FARMER TRAINING PROJECT

END-OF-PROJECT SURVEY AND ANALYSIS

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ORT
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"When we were children working in the wadi our parents were always after us to sweep up the leaves and other debris and throw them outside. Now we see there is a use for what we used to throw away."

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EXECUTIVE SUMMARY

I. METHODOLOGY:

Pilots, controls, 2nd and 3rd year wadis form a representative sample

II. CONCLUSIONS, OR "LESSONS LEARNED":

A. Most farmers in the project zone consider the project a success. It has succeeded in finding ways to resolve the farmers' most pressing problems: Food and Water. However the baseline, monthly and follow-up surveys give ambiguous results about the project's impact on income, savings and debt, and livestock purchases.

B. Wadis or farmers uninterested or refusing the project are fearful the project will take over control of their land or are shadoof farmers who consider the techniques to be better adapted to motorpumps.

III. PRESENT NEEDS OF INNOVATIVE AND NON-INNOVATIVE FARMERS:

The control wadi faces the same problems they did in 1987. The solutions the project has given farmers in 1st year wadis have brought 5 other problems to the fore: transportation to local markets; commercial credits; seed procurement; transportation to distant markets; wadi land preparation.

IV. RECOMMENDATIONS:

The Lake Farmer Training Project as originally designed was to last 10 years and have three phases. At the beginning of each phase research and trials would find the most appropriate solutions to the major problems farmers faced in wadi agriculture at that time. During the remainder of the project one objective would be to make these solutions self-sustainable. The 1st phase is about to be completed. This document helps to define the problems which farmers face at present and which should be the subject of research and trials in the next phase to find the best responses.

1. The 2nd phase of the Lake Farmer Training Project should continue with some modifications in emphasis for the problems

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that farmers in the project zone face at present.

- The emphasis on water extraction should be reduced. Pumps and wells have moved, for the most part, beyond the research and trial stage. The project should help the Motorpump Group continue.

- Agronomy and extension should be maintained because farmers are beginning to face commercial problems. They need advice on early and late varieties, better quality, diversification, transportability of produce, etc. Professional extension work must also remain part of the project in order for adequate knowledge to be diffused outside wadis already reached by the project..

- Increased emphasis on marketing and commercial credit because farmers benefitting from the project are becoming concerned with problems of transporting and marketing their produce and with commercial credit.

- A women's component for the women in project wadis who have evinced an interest in money-making or labor-saving opportunities.

- Agroforestry activities are some of the most visible and appealing attractions of the project both to participants and those who would like to join. They should be maintained.

2. Several aspects of the original project which have been particularly effective should be retained.

- Conducting trials, demonstrations and training <u>in</u> each project wadi.

- Free choice by the farmer of what techniques to try or reject.

- A "technical package" in which not <u>all</u> techniques must be adopted or else all fail.

- Trips to other wadis and other places.

3. The project should collaborate with the Motorpump Group to improve the timing of credit repayments, reduce the Motorpump Group workload, train other well teams in digging and simple management procedures, and confine the Motorpump Group's activities as much as possible to motorpump procurement and servicing and well improvement.

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4. Farmers earning 150,000 or more in annual agricultural income should be eligible for motorpump credits.

5. The project should set up a number of different kinds of credit, either with cooperatives or with the help of local merchants: seeds; transport; commercial credits; land preparation credits.

6. The project should identify and test a suitable method of land preparation to increase productivity.

7. The project should hire an integrated-pest-mangagement consultant.

8. The project should work with merchants in local market towns and major commercial centers who have more business experience than the farmers.

9. The project should develop a simple form of farm accounting which would help farmers keep track of income and expenses and their sources.

V. PROJECT BENEFICIARIES:

A. Control farmers have reacted enthusiastically to the project. This indicates remaining farmers would like to particpate. As a pilot the project has reached only a small part of the area's wadi farming population--perhaps 5%. Many farmers remain who could benefit from the model developed.

B. Only a small number of farmers is using motorpumps because many farmers in the region appear not to know about the motorpump credit group and so have no idea how to acquire a pump. Some farmers choose not to get a pump because they do not have enough wadi land to justify the expense of a pump, do not want to work in the wadi for 3/3 seasons in order to cover the motorpump's cost, fear getting put in jail for non-payment of motorpump credits, or cannot raise the money for the downpayment until the conditions for acquisition are changed.

VI. SOCIO-ECONOMIC SITUATION OF PROJECT AND CONTROL FARMERS AND THEIR FAMILIES:

A. Most distinctions between pilot/participants and control/non-participants quickly disappeared as many controls took part in the project. However, economic data gathered over the first year of the project showed that the main differences

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between responsive and unresponsive pilots and controls were income and sources of revenue.

B. Almost all those who participated in the project have benefitted, whether or not they have acquired motorpumps.

C. The project's positive impact can be seen on farmers' standard of living. They have steadier income, more housing, have accepted most techniques as giving better or easier results, have more food to eat, have an better lifestyle and their worries have decreased.

D. The findings about impact on income and debt are ambiguous.

E. Project impact is not shown by higher savings or a larger number of people saving, or by increased purchases of livestock, indicators chosen before the project began.

F. Farmers rejected or were slow to to adopt specific techniques for technical, not social reasons. But there are social factors which led to slow participation in the project.

1. The importance of non-farm income to the household budget;

2. The project provided grist for factions and fear of factionalism;

3. Lack of land, labor or money may be underlying reasons for not becoming involved in the project.

VII.\EXPECTED AND UNEXPECTED SOCIAL IMPACT OF THE PROJECT:

A. The project design expected that there might be certain positive and negative social impacts. Fortunately the positive impacts have measured up to or exceeded expectations. The negative social impact has been limited and is in part unavoidable. There have been no unexpected negative benefits. There has been an unexpected positive impact on social development: the growth of women's investment groups as well as motorpump and commercial credit groups.

VIII. HEALTH:

The health of project participants and people in the area does not appear to have been endangered by project irrigation.

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I. METHODOLOGY

A. Comparison of baseline and end-of-project data: pilot and control wadis and farmers

In June and July 1987 the project anthropologist carried out an initial baseline survey. 5 wadis were selected to participate in the project and 2 were chosen as controls, to be studied in the same way as the ORT wadis in order to determine what differences project intervention would make. In the 5 wadis farmers who wished to participate in the project and others who said they were uninterested and wished to continue with the techniques that their fathers' and fathers' fathers had used were asked to answer a monthly survey sheet after the initial baseline questions were asked. The local sociologist did not complete all the baseline questionnaires in the 5 wadis in June 1987 so in February 1988 the project anthropologist completed the baseline survey. Most of the information was, however, gathered in June 1987 and is, therefore, directly comparable to the information gathered at the same time of year in the follow-up survey which was conducted at the end of the first project phase in June 1990. Monthy socio-economic questionnaires were administered to the volonteer pilot farmers and controls (10% of the farmers in the project wadis) through February 1989; after that some social questions weres dropped since the replies consistently showed no changes.

The greatest modification in the social survey came about early in the project when one of the control wadis asked to be included in the project as a pilot wadi[1]. Thus 10 control farmers became pilot farmers. No control farmers were chosen to replace them. A few pilots and controls did not complete all of the monthly surveys because they took up commerce, but most of these merchants were contacted for the follow-up survey in 1990. 38/46 or 83% of the 1987 pilots and controls were re-interviewed in 1990: one was "unknown" and the others were on trips. The number of farmers from whom the information for Data Base Information is drawn is 68, not the 46 of the end-of-project surveyd, because the anthropologist used all the questionnaires which were administered in additional wadis examined during the selection of first year wadis. 50/68 of these people were followed as pilots

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1 A commentary on the positive value local farmers put on the project!

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and controls; 15 were in wadis not selected.

B. Additional surveys in 2nd and 3rd year project wadis complement the comparative survey of baseline and end-of-project data from pilot and control wadis

The comparative survey of baseline and end-of-project data has been supplemented by a survey of 2nd and 3rd year wadis which had been added to the project. 4/22 of the newer project wadis were selected at random and 12 farmers in these wadis were also interviewed. Though selected at random the wadis ended up being equally divided between second and third years.

C. Pilots, controls, 2nd and 3rd year wadis form a representative sample

i. All the controls were selected at random in 1987 from village census lists. They are therefore representative of the total population from which they were selected, i.e. all the wadi farmers in the project zone except those who wished initially to be included in the project.

ii. Likewise the pilots were selected at random in 1987 from the farmers in the pilot wadis who wished to participate in the project.

iii. The 2nd and 3rd year wadis surveyed for this final survey were selected at random from all the other wadis which joined the project in the second and third years.

a. At the beginning of the project the 2nd and 3rd year wadis did not yet belong to the project but belonged to the group of non-participating wadis. They, therefore, originally had the same chance as other wadis to be selected as controls. Hence they become a sub-sample of the total population of wadi farmers in the region before the project began.

b. Moreover, since the control wadi which subsequently joined the project and the control farmers who were initially disinterested but who later applied project techniques were all selected at random from the total population of farmers who did not initially wish to join the project, any changes which they made should be considered as representative of the population of the whole zone.

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iv. Any conclusions drawn from the 50 interviews conducted at the end of the project's first phase can, therefore, be considered as representative of the situation in 1990 in the project area as a whole.

v. The sample is too small for useful calculations of variances, deviations, etc. but every precaution was taken to make those selected as random and therefore as representative as possible.

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II. CONCLUSIONS, OR "LESSONS LEARNED"

A. Most farmers in the project zone consider the project a success. It has succeeded in finding ways to resolve the farmers' most pressing problems: Food and Water.

Why has the project been a success? The project has succeeded in the farmers' eyes because it has helped them resolve what to them had seemed overwhelming difficulties. In 1986, just after the drought and famine of the early eighties, farmers identified their principle problems as FOOD and WATER. By water they meant: rainfall; the problem of wells drying up and of a decreasing flow rate; and the physical labour involved in working the shadouf (see Project Design Document, Lake Farmer Training Project, Annex K, 1986). An additional and pressing problem was fencing against domestic animals (see Baseline Social Survey, 1987).

Clearly the project could do nothing about rainfall but even farmers in non-project wadis judge that ORT has found ways to resolve well problems, helped with pest problems and soil infertility and so increased wadi yields, added more lucrative crops to those traditionally cultivated, introduced live fencing and eased procurement of motorpumps. The project has reduced the physical labor of some 42 out of 389 farmers with 21 motorpumps, and more have expectations of avcquiring pumps. It has improved the flow rate in 188 wells in 29 wadis. Moreover, by fostering the creation of the Motorpump Group for the purchase of motorpumps and by training local farmers to improve wells without project assistance, still other farmers see that their problems may yet be resolved. The fear in some non-project wadis is that the Motorpump Group and the well team are not yet strong enough to stand on their own, that SODELAC will not provide the same level of extension services and that the project will end before their problems are resolved.

1. Food

The reason most frequently given for adopting new agricultural techniques introduced by the project was that they increased yield or produced more valuable products. That using the new techniques took less work ran a distant second. Increased

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yield eases the farmer's food problems because he can eat and sell more. More valuable produce also means more income; with more income he can buy more food, especially cereals to supplement his family's food supply. Hence the new techniques introduced by the project have helped some farmers improve their nutritional situation. In addition, a number of farmers who acquired motorpumps put additional wadi land under cereal cultivation, providing grain for home consumption or for sale so the cash could be used, among other things, to purchase other cereals.

2. Water

The project did not succeed in finding a cheap alternative to shadouf irrigation but farmers in those wadis involved in pump testing are now less naive and no longer hope to find an easy way to irrigate other than the shadouf or motorpump. Word of the troubles and trials with various manual and animal pumps has spread throughout the project zone so that even in non-project wadis those who have not seen the pumps have hilarious stories to tell. All farmers interviewed were resigned to living with the shadouf until they could perhaps acquire a motorpump. Some doubt they will ever be able to purchase one, but for many who must continue with the shadouf, their way of viewing it has altered: they now look for other ways to lighten their load. The fact that many can get a steady water supply out of improved wells means they have to spend less time irrigating, even though they must still manipulate the shadouf. Some of the techniques for soil preparation make weeding easier and increase yield with the same water application. These farmers, too, consider the project to have made major improvements; only 4/50 farmers interviewed felt the project had not benefitted them in any way.

3. Fencing

Farmers recognize the project's defense against incursions by domestic animals has been incomplete because of improper spacing of trees, inadequate watering and areas too large to be enclosed in the short time the project has been carrying out agroforestry, but they note with pleasure that animals seek to penetrate in places where there is no live fencing and that the fences also act as windbreaks and halt the flow of sand onto the wadi floor. While windbreaks within the wadi parcel and dune stabilisation have not interested the farmers , they themselves have observed that the trees planted as a living hedge also reduce the effects of wind and sand. So they see themselves on the way to resolving a number of problems over the next few years if only they can continue their tree planting.

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B. The baseline and follow-up survey provide measures of success.

From the farmers' point of view the project has been a success. This can be measured by the findings in the sample population, which should represent the total population of the project zone. These findings indicate that the "spread effect" within the project zone 2 has been extensive and occurred as the project had hoped and intended: "As the project continues, and others learn of the changes possible in alleviating labor and increasing yield, it is hoped that other owners of fields in the project wadis will join (Annex K, p 13)".

1. General approval of the project

- 45/50 farmers interviewed want the project to continue;

  4 others say that the project has had no direct impact on them but that they see others have benefitted and so the project should continue; only 1/50 wished the project to stop, because, as he said, although he had learned a number of agricultural techniques, he had not received the rewards he expected, such as tools or marketing credit.

- 9/14 non-project farmers followed from the beginning as controls because they proclaimed they were uninterested in the project at the beginning, have since adopted project techniques or pumps. 3/14 have not adopted any techniques and 2/14 were unavailable for follow-up interviews.

- Only 4/50 farmers claimed the project had had no positive impact on them, even though only 17/50 have motorpumps.

- Of the two wadis selected at the beginning of the project as controls, or wadis where the project would not intervene, one--Mangalma-- joined the project in

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2. The spread effect into the polders beyond the project zone will probably not occur soon. Farmers in the project zone are concentrating on improving productivity in the wadi and using profits to hire others to exploit the polders in the traditional way. Project techniques will not spread into the polders in the near future unless the project targets polder farmers in the polder region directly.

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its first year and the other--Loura--wants to be included, according to its wadi chief.

- An additional 11 farmers who had not originally joined the project but were working in project wadis have acquired motorpumps. 18 farmers are on the waiting list to purchase motorpumps on credit.

- In the Dibininchi/Ndjiguidada zone, for which information is available, 8 wadis asked of their own accord to be included in the third year of the project.

- The Chef de Canton of one of the Cantons in the project zone reports that wadi chiefs have been coming to him in the hopes that he can get their wadis included in the project3.

- In Ndjira, Canton Dibininchi, individuals have become so interested in the project that they hope to purchase pumps; in the meantime the project staff diffuses agronomic techniques every time they pass even though the wadi is not officially included in the project.

- In Assankadari wadi, where an individual has purchased a motorpump through the Motorpump Group, other farmers have volontarily followed the agricultural advice offered to the pump farmer.

\2. Food

No direct measures of the amount of food consumed were taken at the beginning or end of the project. Nevertheless:

- 1/3 of the people interviewed in the 1987 baseline survey felt that they grew and earned enough to provide food for their family;

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3 The Chief, who considers that the project has definitely benefited the people in the wadis where it has intervened, would tell the wadi or village chief that he himself had no control over which wadis were picked, that the project had its own criteria for choosing the wadis to work in, that the village or wadi should just be patient, their turn would come. His inability to explain to his subject just how the project decided on where to work points out how important an information campaign is (see Recommendation 9).

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- 2/3 interviewed in 1990 felt they grew and earned enough to provide food for their family 4.

- 62%, almost twice as many interviewees, felt in 1990 they had enough to eat; 30% felt that their situation had not altered since 1987; and 8% felt they were actually worse off now. The 1/3-2/3 ratio had reversed.

Because a farmer's food supply comes from his dune cereal crops, his wadi cereal and vegetable crops, livestock and non-agricultural revenue, this is only a general indicator that people are now better off and not a direct measure of project impact. All 4 factors play a role in how much food and income a farmer has and the role of each may become clearer on further analysis. The dune harvest over the last four years covered in the social survey has been highly irregular in different cantons because of rainfall and crickets. On the whole one could say that only 1 in 3 years has been good, but <u>which</u> year has been different for different wadis. Nevertheless one in three is still a better ratio than in the early 80s when the harvests between 1982 and 1985 grew successively worse, making 1981 the best in five years for the whole zone. Hence the dune cereal situation of the Lake farmer has, in most likelihood, improved somewhat since the project began, thus easing his food problems. However, throughout the project the subjects were asked whether it had been difficult for them to obtain food and how they had managed to get it. Most of them replied "through wadi agriculture" and it was only in the two or three months following the harvest that any attributed an increase in food consumption to dune cereals in the 4 years of the project survey. Therefore dune production, though it may have improved for some farmers over the project period, remained a minor factor in food availabilty.

- 31/50 farmers, or 62%, directly attributed their improved food situation, rise in income and their standard of living to the project.

Attributing their improved condition to the ORT project was always added by the person being interviewed and not elicited by

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4 While food availability and revenue are strongly influenced by the season of the year, this question was asked in both surveys at the beginning of the rainly season, the hungry season for most farmers.

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a question. Hence it cannot be concluded that the remaining 19/50 did not attribute their situation to the project, only that they did not volonteer their thoughts about what had caused the amelioration. It is perhaps remarkable that this many farmers felt strongly enough to offer such statements during individual interviews. A number went on to make estimates of how much their income had increased. While the project anthropologist would have been leery of such estimates at the time she collected baseline data, the monthly economic surveys done with these farmers after they joined the project have given them a far sounder grasp of their own economic situation. Some have mastered their accounts better than others, it is true. 22 felt so sure of their understanding of their economic situation that they volonteered estimates of how much their income had increased. These figures must be checked against the monthly economic data; they do however represent these farmers' perception of how much their revenue has been augmented by the project.

Table 1

Times increased	1/3x	1/2x	2x	3x	4x	10x*
Number farmers	2	4	8	4	3	1

* While this seems at first glance like an outrageous statement it may in fact be possible. The farmer in question had acquired a motokpump, vastly augmented his surface under cultivation, and diversified into money-making crops.

- 22/50 farmers considered that the project had augmented their income to such an extent that it bore comment.
- 18/22 felt their income had more than doubled.

Another possible boost to the local farmers' food balance may have come when a number of local people were hired to work on the Italian road being built in the area. Some farmers used the sudden capital windfall from their salaries to invest in trading during the dry season and left wadi agriculture. ORT also hired one as a construction worker and he too used his salary in this way and left off wadi farming even though he was a pilot farmer.

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3. Fencing

In the baseline survey farmers manifested great interest in fruit trees. Enthusiasm for live fencing was not registered at that time because farmers were essentially ignorant of live fencing, though they considered fencing to present a major dilemma. Since project inception the response to live fencing has parallelled closely that to fruit trees, which testifies to the great value farmers have attached to enclosures. Fruit trees are viewed as a money-making proposition; moreover only a few fruit trees are necessary and do not require too much extra effort with a shadouf. Live fencing is done on a grand scale, requires much more watering and brings in no cash.

- 31/46 control and pilot farmers planted fruit trees; 31/46 farmers planted and watered live fences; they wish to continue adding to their enclosures.

- 3/46 planted fruit trees but cared for them poorly; 5/46 farmers planted and cared for live fencing poorly; all but one say they regret not having worked harder and intend to add fencing this rainy season.

- 6/36 did not plant any fruit trees (3 already had lime trees); 6/46 did not plant live fencing and were uninterested;

- 4/46 wanted to plant fruit trees but could not get seeds; 1/46 filled his pots for live fencing but ran out of seeds; and

- 2/46 no answer on fruit trees; 2/46 no answer on live fencing.

- 39% of control and pilot farmers had fruit trees before the project began; in 1990 67% had fruit trees, an increase of 28%. Before the project no one had live fencing; now 78% of control and pilot farmers do5.

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5 While fruit trees definitely interest the farmers, the project anthropologist has concluded that live fencing is as interesting, indeed more interesting, to farmers than are fruit trees. This conclusion is at variance with the evaluation team's conclusion.

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C. The baseline, monthly and follow-up surveys give ambiguous results about the project's impact on income, savings and debt, and livestock purchases.

Income, savings and debt, and livestock purchases and sales were chosen prior to the project as being likely to respond to project impact. The randomly gathered income data shows a positive improvement in farmers' income, standard of living and endebtedness. Computer analyses available of the incomes of 12 of the 50 pitlots and controls show they have lower wadi incomes in 1989 than in 1987; these 12 farmers were not picked in a statistically sound way for analysis and are not representative. Nevertheless it is troubling that 11 out of the 50 pilots and coltrols should have a lower wadi income even though they have adopted from 6-13 new techniques and three of them have motorpumps. Savings and livestock purchases, it now appears in hindsight, are probably lagging indicators.

D. The overall conclusion is that the project has been a success. Farmers inside and outside the project want it to continue.

Most farmers in the project want it to continue and the control farmers who have joined the project or have not had access to it are also enthusiastic. Farmers feel their life is easier than it used to be, thanks to the project. Should the project continue, income, savings, livestock and surface are under new techniques need to be studied to see whether the ambiguous results obtained in this 1990 analysis become more clearly positive or negative. If they turn out to be negative the reasons must be clearly understood and a decision made about what to do with the project.

E. Wadis uninterested or refusing the project are fearful the project will take over their wadis and restrict their liberties, or will hand over control of the land to others; they have not received accurate information on how the project works

The success stories have been listed; on the other hand, the wadis of Ngoudoki, Arri and Galla Marne refused to be included in the project. It appears that their refusals were based on misinformation and misapprehensions. Ngoudoki and Arri, marked by previous experiences with SODELAC's attempts to extend wheat cultivation in the wadis, and other SODELAC interventions, were

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afraid of interference by outside authorities. Ngoudoki's wadi chief and farmers have, after observing more closely the way the project has worked in neighbouring wadis, asked on several occasions to be included in the project. Arri and Galla Marne have not changed their minds, Arri for fear they will run afoul of the local authorities if their animals cause any damage in wadi fields. Galla Marne, having observed political manovering in a neighbouring village, and with memories of SODELAC's efforts to get farmers to grow wheat, fears that the project will hand over control of the wadi to their political opposition, who is linked to the local authorities with whom the project cooperates. They do not understand that the project does not take control of wadi land.

F. The few control farmers who have not adopted project introductions consider the pain to outweigh the gain

For the most part, in project wadis, individual farmers who have not applied new techniques have not done so for one of two reasons:

1. they earn more from non-agricultural sources than from wadi farming.

2. they think they techniques are good for motorpumps but require too much water for a shadouf farmer.

This is the case for the 3/14 control farmers in project wadis who have not adopted any new agronomic techniques even though they could observe them being applied by others in their wadis. 2 out of the 3 earn far more money from non-agricultural activities than from wadi farming and the other farmer judges that though the techniques often increase yields they require too much water, hence too much effort from a shadouf farmer.

G. Farmers in the control wadi,although interested, are unwilling to take risks with new techniques until they receive adequate training

Though the farmers interviewed in the control wadi knew about the techniques, which they had observed in neighbouring wadis, they were afraid to apply the techniques. Not having received direct instruction from extension workers they feared

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they might not fully comprehend how to use the innovations and therefore they could risk loosing the crop planted in the new way. Others considered that the new techniques were probably only appropriate for use with motorpumps, which they did not have.

H. The way in which the Motorpump Cooperative was formed augurs well for its success. It has confined itself to water extraction and avoided water distribution, which is what leads to the downfall of many irrigation cooperatives.

The Motorpump Group was formed for the purchase and maintenance of motorpumps and the improvement of wells to be used by motorpumps--and by shadouf farmers. How the pumps are used is not its concern; whether it pumps water to one parcel or more, where those parcels are located, and how much water is pumped is not the concern of the cooperative but of the "moral individual" (as French jurisprudence puts it) to whom the motorpump was sold6. It is the problem of water distribution--watering schedules, lenght of time and amount of water pumped, improper maintenance of water distribution systems, and land redistribution--which leads to major conflicts within many irrigation groups. The Cooperative has done well to steer away from water distribution. In the project zone some farmers in a non-project village also tried to purchase a motorpump but the size and cost of the pump compelled them to cooperate not only in purchasing but in distributing the water pumped. The villagers could not agree over which villagers would get to use the pump or over the parcels, which had to be reconfigured and redistributed. So many contentions resulted that the pump was never used to irrigate and taken back by the governement agency which sold it. The project anthropologist suggestion during project design ("Any attempt to interfere with land distribution would appear designed to fail" Annex K, p. 16), that the project should avoid any parcel redistribution to facilitate water distribution seems to have been born out.

I. The Motorpump Group has been formed by individuals who wanted pumps and felt themselves able to take on credit, financial planning and management and who thought they could sustain the operating costs. The risks and financial burden were clearly

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6 The Cooperative treats anyone who purchases a motorpump as a "moral individual", whether or not the "moral individual" is one person or several who have agreed on their own and among themselves to cooperate.

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explained and understood by those who joined; they had no false illusions. Non-members in other wadis know that motorpumps have been siezed for non-payment of credit. The Group contains farmers who are able to pay and it has shown its teeth if they do not. This bodes well for the survival of the Group, unlike another non-Motorpump Group wadi in the area where farmers had to agree to purchase a pump whether or not they thought they could pay and where the payments dragged out for a year before the pump was seized.

In the project design the project anthropologist strongly suggested that any groups which were formed should be formed volontarily. "If the farmers themselves decide to band together to invest in technology too expensive for an individual, the credit and financial agreement arm of the project (at that time envisaged as VITA)...will help the farmers obtain credit and make sure they understand the implications of their investment. But the impetus to form cooperatives must come from the farmers themselves; it will not be imposed by the project (Project Design Document, Annex K, p.9)." "As the project is designed, only those who feel the need will have to take on the cultural baggage of credit, financial planning and management. Anyone involved in the project may do so, and they will receive training to help them understand the full implications of their actions (ibid. p.13)". Since the motorpumps are small they do not require that farmers group around one pump and one well and take turns at water distribution. Nor are farmers who are uninterested forced, for technical reasons of water distribution, to join the group and make credit payments, whether or not the farmer is fully motivated to do so. The Motorpump Group was formed by interested individuals who were informed of the obligations they were undertaking, as the project design suggested, and so far its payment rate has been good. One pump has been seized for non-payment, not because the farmer could not or would not pay but because he had been led to believe that someone else had undertaken to pay the credit for him, so he had not saved up for the credit payment. At present the farmer is trying to collect enough money on his own to make the credit payment and get the pump back. But as the next payment date approaches some farmers are trying to renegotiate the terms of the repayment. The anthropologist strongly recommends that these terms not be renegotiated with present credit holders; the idea that credits must be repaid must be reinforced. However, the terms should be adjusted for future debtors to reflect more closely the economic realities. Payments would then be easier and more certain (see recommendation 5).

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III. PRESENT NEEDS OF INNOVATIVE AND NON-INNOVATIVE FARMERS

A. Farmers in the project longest have resolved more of their original problems. The solutions have brought other problems to the fore.

The farmers trained since 1987 consider that many of the problems they encountered back then have been dealt with. Now they are beginning to face problems created by the very solutions they have used.

B. Most 1st year wadi farmers interviewed identified five problems which are developing as they apply project techniques.

In order of greatest concern first, the problems they cite are:

1. Lack of transportation to local markets;
2. Need for credits to buy and stock produce when prices are low and sell when high;
3. Difficulty in obtaining seeds (including live fencing and fruit trees);
4. Inaccessibility of distant markets where prices are higher;
5. Difficulty in preparing large amounts of wadi land for cultivation.

All of these problems have grown out of their increasing ability to grow more wadi produce for sale.

C. The control wadi faces the same problems they did in 1987; 3rd year wadis are beginning to resolve some of them. 2nd year wadis are beginning to face some of the marketing problems that 1st year wadis have.

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The link between the evolution in problems the farmers face and the number of years they have applied project technology is very clear.

Table 2

Yr	Trnspt	Crdt	Sds	Mkt	Lnd	Pmp	Accnt	Strg	Gas	Pest
1	26	19	16	15	14	5	14	4	2	1
2	4	2	3	3	2	2	0	1	0	0
3	0	0	3	0	0	2	0	0	0	1
Ctl	0	0	2	0	0	2	0	0	0	2

This table merits close scrutiny. The large difference in numbers between years 1 and all the others is not important: in year 1 there are 46 control and pilot farmers from the wadis which joined in 1987. Years two and three are represented only by the 4 wadis and 12 farmers selected at random to represent the later years. The control (Ctl) wadis are, of course, missing the 10 farmers who joined the project in 1987. The differences between the numbers given in 2,3 and control in the tables are all not statistically significant. The anthropologist has based her statements about increasing or decreasing numbers of farmers concerned about different problems not only on the figures in Table 2 but more importantly on group interviews with larger numbers of wadi farmers in the 2nd, 3rd and control wadis than were included in the individual questionnaires counted in Table 2. The crucial point is where the weight of the concerns of the people in each year lie. In the control wadis, which represent the untouched population of the project zone, the concerns are: "seeds", which includes a.) live fencing; b.) fruit trees; and c.) diversification into money-making crops; "pumps", or some control of water procurement and flow rate; and "pesticides", which are the easiest way to increase yield. In other words the concerns of untouched wadi farmers remain essentially Food and Water. In 3rd year wadis, which joined the project in 1989, the concerns are "seeds", or money-making crops and live fencing, "pumps", i.e. resolving water extraction problems with improved wells and motorpumps, and "pesticides" or increasing yields with minimum effort. Control and year 3 closely resemble one another but fewer year 3 farmers want pumps because some have already obtained them, and they are slightly more interested in diversification and money-making ("Sds"). Year 2 farmers-- some of whom have already obtained pumps or who have been applying agronomic technique--are interested in getting pumps and improved wells and increasing the amount of land (Lnd) they can prepare

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for cultivation with motorpumps. They continue to be concerned with the availability of seeds and live fencing, which are real problems in the area. They are also beginning to be concerned with transporting the produce which they are growing in increasing quantities (Trnspt). They also worry about obtaining marketing credits ("Crdt") from the project so that they can sell their produce when prices are high 7. In 1st year wadis, where some farmers have been involved since 1987, the major concerns have evolved into:

- o transport of the produce they are growing;
- o marketing credits to buy and sell at optimum prices;
- o selling their produce at distant markets where prices are higher ("Mkt").

Live fencing and diversification into money-making crops are

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7 Some farmers would also like to buy produce from other villages when the prices are low, stock it along with their own, and then sell when prices are high. At present the group pays the going market price for produce at the time when farmers are forced to sell because they need cash, then it sells the stored crops when the prices rise. The members get the cash they need--though only what they would get if they sold it on the regular market--when they need it and the difference between the price paid\the farmer and the price at which the group sells its stored stock when the price has risen belongs to the group. This profit is supposed to enable them to buy their produce again next season in the same way, and if the profits are great enough the group can share some out. In this scenario the idividual farmer does not benefit, the group does, unless the profits are great enough for a dividend. Nevertheless, the individual farmers who have participated in the program are enthusiastic because they consider that it brings each of them considerable benefits. Because they sell their produce for storage in the village they do not havwe to take it to market (the group has to deal with that problem when the time comes to sell). Thus they do no loose days going to market jut to get cash to live on and they do not have to load and trasport bulky sacks. More importantly, they do not have to pay for transportation if they do not own a beast of burden. Shipping onions by camel costs about 1000 CFA per camel per market. By vehicle the cost runs from 750-1500 CFA per sack, depending on the distance, which does not include passage for the farmer, which runs 250-500 CFA one way. The savings on transport costs alsone are thus very attractivwe to the farmers.

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still of interest, but growing better quality produce and even getting on to the market with early or late producing varieties is now a concern, as is land preparation which is a constraint to using the motorpump to its maximum. Some of those with motorpumps are beginning to worry about assuring a constant supply of gas and about the incessant need to provide cash to purchase it ("Gas"), a few are concerned about storage facilities ("Strg") in the village for the produce they are stocking for sale at higher prices. They are also considering the problem of storage at markets ("Strg"), which is really another aspect of transportation ("Trnspt") since without storage at markets they must transport any unsold produce back home. Access to pesticides remains a concern, though a minor one. A phenomenon attributable to the fact that 1st year wadi farmers have been questionned monthly for 3 years about their incomes, expenses, inputs, yields, etc. is the interest many express in mastering their income and outlay. Some express this as a desire for the monthly surveys to continue, others for a night school in basic farm management and accounting ("Acont").

Simply getting what they produce to local markets seems to become the farmers' greatest concern when their production improves.The category Transportation ("Trnspt") subsumes two different problems. 26/46 1st year farmers are concerned with getting some means to transport their produce to local markets to sell. Most local transport is done either by donkey or camel, and sometimes by the "occasion" of a passing vehicle which can be paid to carry a load or passengers. 15 farmers are also beginning to consider finding ways to transport their produce to distant markets where it will sell for higher prices. Transport to distant markets is done either by camel or by "occasion". 2nd year farmers are also concerned with getting their crops to local markets and also to distant spots where prices are better. Local transport is of greater concern than is access to distant centers (26:15 in the 1st year, 4:3 in the 2nd year). Given the differences in distance and the more frequent trips to local markets, transport animals may be a more viable solution for local markets, and vehicles for more distant ones.

E. <u>The concerns of the majority of wadi farmers in the project area remain food and water. Only those in the first and second year wadis, fewer even than the 400 farmers so far aided by the project, have grown concerned about marketing. The wadis and farmers represented by the control wadis and control farmers far outnumber the farmers already touched by the project. The greater part of the project zone has not yet profited from the project.</u>

It is of considerable importance to remember that although

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only 2 farmers are listed in the control wadi as concerned with motorpumps and 5 in 1st year wadis, that 2 represents a greater proportion of farmers in the control wadi than does 5 among the pilots and controls, ie more control wadi farmers are interested in motorpumps than farmers in the 1st year wadis. Also the control wadi (and to some extent 2nd and 3rd year wadis, which started out in the total population of the project zone represented by the control wadi) represents a far greater number of wadi farmers than do the 1st year wadis. Hence in 1990 more farmers in the project zone are likely to be concerned with water extraction, fencing and getting enough food than are concerned with transporting high value crops to Ndjamena or Mao or with getting some training in farm management.

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IV. RECOMMENDATIONS

The Lake Farmer Training Project as originally designed was to last 10 years and have three phases. At the beginning of each phase research and trials would find the most appropriate solutions to the major problems farmers faced in wadi agriculture at that time. During the remainder of the project one objective would be to make these solutions self-sustainable. The 1st phase is about to be completed, with perhaps an extension of several months. This document helps to define the problems which farmers face at present and which should be the subject of research and trials to find the best responses.

1. It is recommended that the 2nd phase of the Lake Farmer Training Project continue as is but with some modifications in emphasis. These changes in emphasis are in keeping with the problems that farmers in the project zone face at present.

- The emphasis on water extraction should be reduced.
- The emphasis on motorpumps, agronomy and extension should be maintained.
- The emphasis on marketing and commercial credit should be increased.
- A women's component should be added.
- Agroforestry activities should be maintained.

A. Why reduced emphasis on water extraction?

Pumps and wells have moved, for the most part, beyond the research and trial stage. A proven well technology has been developed and a Motorpump Cooperative established. But water

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extraction still remains the most pressing problem for most farmers in the project zone. Now that the project has developed a viable model it should be used to help the farmers in the region.

Personnel:

One expert in wells and motorpumps primarily to oversee the training of farmers as technical delegates for additional well teams and pump maintenance. He can continue the development of the Motorpump Cooperative's spare parts capacity and management. He should continue to monitor the cost and availability of gas for motorpumps, since recent government controls may reduce its availability and raise its cost; should the situation warrant he should propose steps to resolve problems with gas.

The water expert should do further research on the rate of water applications and pump speeds in order to optimize the costs of motorpump operation for the farmer.

B. Why maintain the emphasis on agronomy and motorpumps?

i. Agronomy

The greatest number of farmers, both those already included in the project and those outside, can continue to benefit from these two activities. Motorpump farmers need training in appropriate techniques. Farmers who are alread using some techniques want to learn more; "ORT has many secrets we haven't yet learned" several farmers said. Shadouf farmers can benefit from new agronomic techniques too, as many have learned. The project should continue to overcome shadouf farmers' fear that some new techniques are only useful with motorpumps. The project should continue to push new techniques and diversification for shadouf farmers because raising their income will increase their standard of living and may hasten the day when they can buy a motorpump.

Continued emphasis on agronomy is necessary if farmers are to address the commercial problems which some beginning to face. They need advice on early and late varieties, better quality, diversification, transportability of produce, etc.

The project has developed a model for viable agronomic techniques and successful extension. This model should be used

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for the benefit of the farmers in the region. The model is successful in two ways:

1 -farmers have adopted new techniques:

2 -farmers can be trained as Technical Delegates to continue extension activities with other farmers in their wadis.

Professional extension work must also remain part of the project in order for adequate knowledge to be diffused outside wadis already reached by the project. Because of the self-contained nature of each wadi farming area and the limits on the time a Technical Delegate can devote to training other farmers it is important for professional extension to continue if the project is to reach yet more farmers.

Although Agricultural Technical Delegates seem to have learned their jobs and are able to diffuse techniques their impact is limited by the physical nature of the project zone. Unless farmers in non-project wadis also have fields in a project wadi or visit friends in other, project, wadis they will not see the new techniques in action. The Technical Delegates are also available to show and explain to other farmers in their own wadi but will not come into contact with and be able to show his techniques to farmers from other wadis, unless they have come to visit for some ceremony or other. He will run into non-project farmers at market but he can only discuss, not demonstrate, whatever may interest them. It would be idealistic to expect Technical Delegates to travel from one non-project wadi to another to extend new techniques: they are farmers busy earning their living in their wadi fields: learning and teaching in their own wadis benefits both the delegate and his neighbours without causing him too much inconvenience. But asking them to act as professional extension workers without recompensing them as professional extension workers is unrealistic.

Agronomic training should also be continued in order to consolidate gains already made.

The element of time should not be forgotten in evaluating how permanent the change in farmers' techniques has been. As the project evaluation noted, farmers in the 1st year wadis have adopted more techniques than those in later wadis. In part this is because the project staff has had more time to introduce more techniques to 1st year farmers. It is probable that farmers in 1st year wadis who have had the chance to apply a new technique during the 2nd and 3rd year will continue to use these

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techniques. But some techniques were introduced to them later and they have had less time to appreciate and learn about them. In 2nd, and especially 3rd year wadis the farmers are only beginning to see and learn techniques which the 1st year wadis show they will probably adopt, given time. The "learning curve" appears favorable; if farmers in more recent wadis are shown and advised in the same way as the farmers in the 1st year wadis have been they will probably adopt more new techniques. This means continued work by Technical Delegates and project extension workers.

ii. Motorpumps

More farmers in the project zone want to acquire motorpumps. The project has shown that the pumps:

- increase production by allowing more water applications
- increase production because motorpump farmers experiment more freely with new techniques
- increase production by bringing people back into wadi agriculture.
- increase production by allowing farmers to exploit more surface area

\A successful way, therefore, to increase production is to continue to help more farmers use motorpumps. At present their are two constraints on increasing the number of motorpumps in the area:

1. the ability of the Motorpump Group to provide pumps.
2. the number of farmers who can sustain the capital and operating costs of the pumps.

In phase 2 the project should continue to help the Motorpump Group become a sustainable institution. It should also continue to aid farmers get motorpumps, perhaps in part by increasing the amount of money in the revolving fund.

<u>Personnel</u>:

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One agronomist to oversee the training and activities of more agricultural technical delegates in wadis which join the project in phase 2. He should also oversee the training of more project extension workers since the present workers are already stretched to their limits. They feel they can adequately cover 2-3 wadis, at a maximum 4. He should introduce still more innovative techniques and reemphasize their value for shadouf farmers as well as for motorpump farmers. One of his (or the water expert's-this needs to be clearly defined) major activities should continue to be advising and supporting the Motorpump Cooperative so that it can become self-sustaining. The agronomist should also make a major effort to identify an appropriate method for easier preparation of wadi fields for planting. He should undertake on-site research in project wadis on appropriate varieties to plant, the optimal mix of crops to increase income and production while providing some food security, and experiment with extending growing seasons and introducing yet more exotic plants. Farmers have neither the means to identify and obtain different cultivars for trial nor are they willing to take the same amount of risk that the agronomist will since to do so would be at the expense of their own production.

C. Why increase emphasis on marketing and commercial credit?

Farmers benefitting from the project are becoming increasingly concerned with problems of transporting and marketing their produce and with commercial credit. The project should enlarge the commercial credit activities of the project. It should hire someone to develop a viable model of commercial activities for farmers in the zone. By the end of the 2nd phase of the project this person should have accomplished what the project did in water extraction at the end of the 1st phase, i.e. spend his initial time researching the marketing and transportation problems the farmers face and the ways they currently cope with them, then develop and test different approaches so that by the end of phase 2 he will have developed a model marketing and credit program and applied it with with 1st year and other farmers.

The project should work with local merchants and traders, as well as merchants in major commercial centers, so that they can respond to the marketing and procurement needs of project farmers. The Motorpump Cooperative has already found that it may be easier to go through merchants for some business than to take it upon itself. They and the merchants should be encouraged to decide which activities each can most practically carry out and work out the modalities and conventions between them. Merchants

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can also work with the project or other commercial groups on such things as seed procurement.

Personnel:

One person with experience in commercial credit groups, marketing and transportation in both local and distant markets, and in organizing marketing activities and groups. He should work with the Motorpump Cooperative and any other commercial groups which spring up on developing viable relations with merchants. He should also work with merchants to help them seize the commercial opportunities growing out of developments in agriculture and marketing. He should discuss with farmers in various wadis, with any Groups and with interested merchants how they go about procurement and marketing, define with them the problems which need to be resolved and then work with them to find solutions. He should walk them through the solutions so they get experience doing it themselves. If any problems arise he should help resolve them so that the people he is training can continue on their own. He should consider whether it would eventually be useful to create a savings and credit institution. He should also consider, in conjunction with the project anthropologist on a short-term consultancy, the advisability of mutual credit groups or other means of guaranteeing loans.

D. Why add emphasis to women's activities?

A number of women in project wadis have evinced an interest in money-making or labor-saving opportunities. The 2nd phase of the project should be prepared to help interested women implement their promising ideas. The project design should not pre-define the sorts of activities the project will help women implement, in other words not limit project intervention solely to "social development", or "commercial activities", or "health", "crafts", etc. The women who have shown interest in working with the project have been particularly fertile in coming up with ideas; their creativity should be used, not restricted.

Supporting women's activities may require proportionately more investments by donors than other project activities since women are less able to make initial investments or repay loans. Women in the project zone do not have any legal rights to revenue except what they are given as gifts, hence they have limited financial resources and no legal discretion over how household income is spent. Coming up with large amounts of capital to invest is for them almost impossible. Helping women with an initial investment should not be considered supporting an "unsustainable" activity. While it is true, for example, that

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must continue. Increasing the number of farmers and increasing the quantities they produce means that the Motorpump Cooperative must continue to be supported since it is not yet strong enough to stand on its own.

For all these reasons it is impossible to envisage marketing and commercial activities succeeding in the Lake Farmer Training Project zone without the project continuing many of the activities it already has underway.

4. **Aspects of the original project which have been particularly effective should be retained in the next phase. Many farmers were profuse in their praises and appreciated how the project was designed.**

They especially appreciated:

- Conducting trials, demonstrations and training <u>in each project wadi</u>. All farmers could see and judge for themselves the results of different activities. Often they had justifiable criticisms which helped the agronomist improve the techniques. Training in the wadi rather than on a training farm or demonstration plot gave the farmers hands-on experience.

- Free choice by the farmer of what techniques to try or reject. Previous interventions in the wadis had forced farmers to abandon their own farming activities and adopt the proposed agricultural changes. Once farmers found they were free to decide what risks to take with this project they became less adverse.

- A "technical package" in which not <u>all</u> techniques must be adopted or else all fail. Motorpump farmers can increase their yield without necessarily adopting all new agronomic techniques; shadouf farmers can improve their output without using a motorpump. Farmers can change slowly, take fewer risks and adopt techniques when they have seen their advantages.

- Trips to other wadis and other places. For the farmers "seeing was believing" and hearing how techniques worked "from the horse's mouth" convinced many farmers to take risks.

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5. The project should collaborate with the Motorpump Group in resolving a number of difficulties the group is encountering.

i. Credit repayments:

a. When farmers give money to pay part of their credit they should receive a receipt. They will thus have proof that they have handed over money and the person who received it will be less tempted to use the money for himself since he will have to produce the money represented by receipts given. A simple accounting and receipts system should be developed for the treasurers and farmers informed that they should hand over money only to those who can give them receipts.

b. A trimestrial meeting of the Treasurers of Motorpump Cooperative should be scheduled for market days at Dibininchi, and perhaps Ngouri. On these days farmers can go to market and make their credit payments at the same time. This will get around the difficulty, common in many irrigation projects, which treasurers have of going around to member's homes to collect and of member's having to travel to the Treasurer's village in order to pay. Everyone has business he can conduct at the local market.

c. To reduce the chances farmers will be unable to make their credit payments the dates for repayment of <u>future</u> pump sales should be changed. Fixing farmers' repayment schedules in terms of the best time for selling produce at high prices rather than in terms of farming seasons, as at present, should make it easier for the farmers to pay. The repayment dates for outstanding credits should remain as they are in order to avoid constant manouvering to put off payments. The best dates to schedule repayment would be:

- July/August, when farmers can sell their goats at good prices and have harvested some gumbo;
- November, when the price of onions is high;
- March/April, after the cold season which is the primary season for wadi exploitation.

d. The credit payments could also be staggered in size. The post-hot season/ early rainy season payment has been the hardest for farmers to make because this is the least productive time of year for wadi agriculture. Perhaps the rainy season

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payment should be reduced in size and the difference added to the other two payments.

e. The Motorpump Group should be urged to resist the recommendation of some of its members that credit repayments be scheduled only twice a year. It is already difficult for farmers to get together the large sums for three payments a year without spending some of it for other needs; saving money long enough to reach the next payment date will be even harder with only two payments. Adopting payment dates linked to sales rather than harvests (see above) should reduce the demand to go to two payments per year.

f. The Motorpump Group should resist suggestions by its members that payments in kind should be accepted. Members are tempted by in-kind payments since they need not worry about transporting the produce for sale at the market and they hope that the Group will hold the produce back for the farmer until it can be sold at a high price, reducing the amount the farmer must sell to pay his debt. Until transportation problems are eased the Group should not be saddled with the problem of getting produce to market in order to get the cash it is due; let the individual farmer handle the problem himself. Nor should be Group have to take the risks of stocking produce and choosing the moment to sell. If the dates for credit repayments are scheduled according to optimal marketing times (see iii) farmers will have less reason to argue for in-kind payments.

ii. Reduce the Motorpump Group workload.

The project needs to work with the group to reduce and simplify as much as possible the work load of the Motorpump Board. The Board members are working so much on group business that some are beginning to suffer economically. Certain actions can be taken to reduce their work load (see recommendations 5 i b & f, and 6, as additional ways to reduce the workload). Regular monthly, or bi-monthly meeting of the Motorpump Board should be scheduled on market days at Gibininchi, and perhaps Ngouri. Board members can meet and then do their marketing; since Board members already go to market under their own steam to buy and sell, scheduling meetings for market days will minimize the inconvenience. At present the Board has trouble meeting and is usually dependent on ORT transportation.

iii. The project should reduce the chances of factions developing within the Motorpump Group.

The well team within the Group is torn between being neighbourly and non-profit and earning what the market will bear as professional well diggers. The project should train other well teams in digging and in simple management procedures (using

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Arabic, symbols, form letters, etc.) to introduce competition to the area, thus lessening the impact of a possible factional split to the group. The project should also help develope relationships with merchants who are experienced in placing and filling orders and can take on some of the management burden at present born by the well team; this will allow a well team with less literate members to be functional.

6. **The project should advise the Motorpump Group to confine its activities as much as possible to motorpump procurement and servicing and well improvement 10.**

The Group should resist getting involved in commercial credits, marketing, gas purchases, and so forth. It may be tempted by these opportunities to increase the amount of money in its account, but experiences of irrigation groups around the world show that the groups work best when they confine themselves to irrigation. USAID's advice in this matter was "right on".

7. **Farmers earning 150,000 or more in annual agricultural income should be eligible for motorpump credits. The number of farmers eligible for pumps should not determine the speed at which pumps are distributed. This speed should depend on:**

   a. the capacity of the area to absorb motorpumps and motorpump produce; and

   b. the amount of credit, purchasing and repair the Motorpump Group can handle.

It is interesting that multiple analyses indicate the figure 150,000 CFA is a sound one for defining who is creditworthy. Unfortunately it will be difficult to determine farmer's agricultural income to prove creditworthiness. The "modalities" (economic surveys, "commission de constat", etc.) for determining a farmer's creditworthiness may involve direct measures of income or other, indirect measures will have to be decided on. What measures are used will depend on the design of

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10 The exception to this is when the activities involve procuring machines and servicing by mechanics, activities with which the Group already has experience. Such an activity might be the purchase of rototillers. The rototiller fund should be a separate fund from the motorpump one though it would be handled by the same organization.

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the next project phase (the oversight capacity of project personnel and the number of extension workers and the plans for developing the Motorpump Group's capacities).

Farmers who are credit-worthy can inscribe themselves on the waiting list. The actual number of pumps which are available should not only depend on the number of requests but also on the number of mechanics and spare parts available, the repayment record of previous loans and the ability of farmers to sell their wadi produce.

8. The downpayment on a motorpump should be reduced for future purchasers of pumps in order to make it available to more farmers.

The downpayment, rather than the size of the credit payments, seems to be the major hurdle keeping farmers from purchasing motorpumps. Reducing the downpayment would enable more farmers to acquire pumps. Money could be added at an opportune moment to be decided by the project and Motorpump Group to increase the Motorpump Group's revolving fund so that more pumps can be purchased and the initial downpayment required from some or all farmers be reduced. **The gas requirement should be retained since the fuel is necessary to run the pump and farmers should develope the idea of keeping a stock on hand.** The amount by which the downpayment is reduced can be equally divided among the credit payments; this will not increase the quarterly payments by much. The precise decrease and the conditions which the farmer must meet should be such that only farmers with incomes of 150,000 or more CFA/year from agricultural income wilkl be eligible. The decrease and conditions will be determined by the design of the next project phase. Members of the Motorpump Group have suggested a "commision de constat" through which the Motorpump Group can observe the quality and quantity of the fields the farmer is already exploiting and ask for character references in the farmer's village, then vote on whether he is a good credit risk. If this commission is decided on the characteristics of fields of farmers who earn 150,000+ CFA/year should be outlined and used as guidelines. Farmers also thought that the project could carry out several month's economic surveys of the farmers. Which course is followed depends on the project's manpower resources and how quickly the Motorpump Groups problems with traveling and meeting are resolved. Economic surveys will demand work from the local project staff and extension workers whereas a commission would demand time and travel from members of the Motorpump group, who are already overworked. Perhaps the project's economic surveillance could be phased into a commission as more and more of the transportation and logistical problems of the Motorpump Group are resolved.

In sum, some sort of downpayment should be retained and

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other criteria added to weed out bad credit risks.

9. **It is possible that income-earners between 60-149,000 are capable of purchasing pumps on credit if the price of the pump were lower or the down payment less, but other conditions would have to be stricter since they are less creditworthy. Farmers in this income category are 30% of the sample population. Although this is large a part of the population, the anthropologist recommends that it not be directly targeted in the next phase of the project.**

Dealing with this part of the population increases the risks of losing money from the revolving fund and the time spent on supervision for strict conditions would be better spent on the half of the population which is a good credit risk. This part of the population could be targeted at a later date.

10. **The existing revolving motorpump credit fund should either be increased at an appropriate time or a supplemental revolving fund could be established which is open to present owners of motorpumps who need to replace them.**

Once the motorpumps already distributed get near the end of their life expectancy the question of replacing them will become crucial. In previous discussions the members of the Motorpump Group have stoutly resisted the suggestion that they pay amortization of their pumps. (In a discussion the project anthkopologist had in June 1990 with a motorpump owner at Assankadari, not only did the owner not faint at the thought of amortizing the pump but he actually said that he would agree to adding an additional credit payment for amortization. The subject thus bears being rediscussed with the Group.) All members of the Motorpump Group with whom the anthropologist consulted firmly stated that a member had to go to the bottom of the list and wait his turn for funds to become available, even if he already had crops under cultivation with a motorpump which was beyond repair. These farmers were, of course, responding to a theoretical discussion and not watching their crops wilt. Increasing the size of the motorpump fund would mean that more pumps could be purchased and farmers would not have to wait as long. A better alternative, unless it creates an administrative nightmare, would be to establish a second revolving fund to which farmers who have already purchased a pump through the group would have access. They would then go onto a separate waiting list which would both speed their getting a replacement pump and keep them from competing with farmers waiting to get their first pumps.

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11. A major constraint to the expansion of project impact is many farmers' lack of accurate information about the project. An effort to inform local authorities and traditional leaders about how the project works needs to be made. An extension worker could be "tasked" with meeting with local authorities and with farmers in non-project wadis to inform them about the project during the rainy season, which is an off time for the extension workers.

Some farmers in the zone do not know that a Motorpump Group has been formed. Nor do they all know the terms on which the project will undertake to train wadi farmers. The misunderstanding on the part of some wadi chiefs and their subjects that ORT will oblige them to stop growing their usual crops for their own use and instead to grow project recommended crops for sale to the project has also limited farmers' willingness to become involved in the project. If local Administrative Officials, Canton Chiefs and local village and wadi chiefs were informed of how wadis and farmers can obtain motorpumps or be included in the project they could act as an information channel to the farmers who come to them to inquire how to be included in the project or who report that they fear joining the project. SODELAC has not been able to diffuse information to the extent necessary. The project should also make an effort to clarify the fact that the commercial credit fund (and any other credit groups to be established in the future) is unrelated to the Motorpump Group since farmers are confused about who provides the different credits and on what terms.

12. The project should investigate setting up a number of different kinds of credit, either with cooperatives or with the help of local merchants. These credits would help the farmers resolve several of the problems which face them at present (but NB recommendation 6). The marketing/commercial person in the project should work with farmers and merchants to set up appropriate procurement and payment systems and train them in their use. It is recommended that credits be kept separate for separate purposes rather than grouped as one comprehensive credit. Specific credits fit with the traditional way of giving credit in the area and with experiences of irrigation cooperatives elsewhere that management and repayment are easier when they concern limited matters.

i. Seeds:

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An initial fund can be established, either with local merchants, in a seed group, under project supervision, or by some other arrangement. Farmers will be given credit with which they can purchase seeds which the organization or merchants will procure. The organization or merchants can use this initial procurement as a learning experience. At the end of the farming season the farmer will repay the seed loan--in cash, not in seeds--and at the same time place an order and pay in advance for the seeds he wants for the next seasons. The farmer thus has the money to buy the seeds he needs and has assured that they will be available when he needs them. A merchant is more likely to purchase seeds with these conditions since he has pre-sold them and is so not taking a risk in stocking them. The initial "seed" money can revert back to the project for other uses or remain in a revolving fund to be lend out to other farmers on the same terms. The seed credit should be handled as a separate activity and with a separate fund from the marketing credit program, even though they might be handled by the same organization. The marketing credit program was intended to help farmers procure seeds but farmers have not used the funds in this way and they lack knowledge about how to purchase anything other than local seeds. SODELAC's experiences with advancing seeds and expecting reimbursement in kind before the next growning season have been very disappointing. The problem springs in part from the farmers' perception that the seeds are government seeds and therefore should not have to be repaid. Running the seed credit through merchants should avoid this problem. SODELAC also advanced seeds and required repayment in kind in order to control the quality of the seeds being planted. Likewise the Motorpump Group is interested in doing seed purchases itself to insure seed quality. This is one approach to the problem, but it is yet another demand on the Group's time. Having the project marketing and credit person work with merchants to develope a reliable source of seeds is another.

ii. Transport

The problem of transport to local markets can be eased without extensive study of the transport situation, unlike transport to distant markets. A transport credit can be made available through some organization, a cooperative, the project, or some other arrangement. Farmers, small groups of farmers in a village, farmers'wives, or groups of farmers' wives in the village or "quartier" can use the loans to purchase donkeys or camels. If the project's experiment with an animal cart turns out to be more successful than it promises at present (since it only works well on wadi floors) loans could also be made for carts. Purchasers can set aside a small sum after each market, in a group treasury, a special "piggy bank", or by some other convention. Since donkeys sell for as little as 4,000 CFA and

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large camels rarely for more than 75,000 CFA the total funds involved and the size of the loans to be repaid are not large. Farmers and farmers' wives with whom the project anthropologist discussed such a credit were unanimous in saying that if the animal died or was stolen that the purchaser was still obligated to repay the loan, since he had purchased it on credit. If land preparation with animal traction is the technique suggested to farmers by the project the transport fund could be broadened to handle draught animals and purchases of plows (and, perhaps, weeders).

iii. Commercial credits

The size of the revolving commercial credit fund could be increased now that the first trial run has shown that it can work successfully. With a larger fund more villages can have access to the credit. The three villages which have already received such credits are, in priniciple, supposed to use the profits which they gained while the fund was at their disposal to carry on future commercial activities. The two which have realized their profits want more credit to become available so that they can establish a larger capital base to reinvest. The project should consider setting up a second revolving fund open to villages which prove they can manage the first disbursement well.

Farmers are very tempted by the easy money they can make by buying low and selling high, but the first experimental commercial credit groups learned from their experiences that it is important for the group to buy only good quality merchandise and build appropriate storage or else their losses to rot, etc. are high. Selected members of newly formed commercial groups who are about to receive their first loan should be taken for visits with experienced commercial groups who can give their "lessons learned".

iv. Land preparation credits

Once the project has identified one or more effective and labor- or time-saving methods of soil preparation it should make credit available to farmers to purchase the equipment necessary. If the costs are low, however, no such credit would be needed. The credit should not be used for hiring laborers to prepare the land or for renting material to till the fields. If the method selected is mechanical the credit should be handled through the Motorpump Group which already has experience in procuring machinery and has trained mechanics. If the method involves

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animal traction it should go through the transport animal group; if some other non-mechanical kind of work a separate organization should perhaps be set up. The project will have to find the balance between creating an administrative nightmare for itself and the fact that groups tend to work best when they are involved only in one kind of activity. Also, running many activities through the motorpump group will demand too much work of the Group's Board who are working pro bono.

13. Credits should be made available to at least one village in each canton in order to avoid the appearance of favoritism and the growth of factionalism.

The growth of factionalism, which is typical of the region, is fostered by the belief that someone else is being favored. Favoritism and factionalism are two sides of the same coin. Whoever does not receive a favor can maintain his position by using the resentment of those who did not receive the favor to solidify a faction behind him. The project made a point of selecting at least one wadi in each Canton at the beginning of the project to avoid aggravating factionalism: it should continue to maintain the farmers' perception of fair treatment and equal opportunity to profit from the project by conducting a trial of each new activity, such as credits, in each Canton.

14. Land preparation is beginning to constrain the amount of land motorpump farmers can exploit. It is also a burdensome task for shadouf farmers. Improved land preparation would help increase yield. The project should identify and test for a suitable method of land preparation.

The methods selected for trial should either ease the farmer's job or reduce the amount of time required (which the long-handled hoe did not do because though it dug deeper than a regular hoe it did not break up the clods of earth, so the farmer had to make a second pass to crush the dry clumps of dirt) and, if possible, increase the depth to which he can work the soil. In selecting various methods the project should keep in mind the extremely small size of the group which usually does the work in a wadi parcel.

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Table 3

	#	%
one male	19	38
adult males	13	26
man and woman	8	16
man, woman & children	5	10
man & children	5	10
total	50	100

Some farmers are already aware of rototillers and animal plows. They are of the opinion that the western plow (houe occidentale) is inadequate to turn over the hard wadi dirt and are in favor of some sort of rototiller. They were unacquainted with the Manga plow (houe Manga). Both rototillers and animal traction have disadvantages which are clear even before they are tried. Other methods which should be tried will also have disadvantages as well and so rototillers and animal traction should also be tried since the farmers are predisposed to them, which can be important, as the project's experience with motorpumps has shown.

i. Animal-drawn plow

An animal-drawn plow is not cheap or easy to use. Another drawback is that it requires two adults to operate. Most wadi farmers do not have cattle, though donkeys could be used. Some farmers do not even have donkeys and would have to arrange to borrow them. The animals must be trained to pull the plow. On the other hand, the farmer could use his plow and team to prepare his dune fields, which might be an advantage.
Farmers who own plows and trained teams could work others' fields for a fee and so earn more money.

ii. Rototiller

A rototiller is expensive and requires gas, maintenance and repair. The motorpump mechanics could probably be trained to care for the rototillers. Rototillers would be hard to move from

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wadi to wadi if a regional group purchased and loaned them out. A group like the Kida Boulim could provide credits for individual farmers to purchase rototillers. Although the farmer would use it for his own fields for only a few days each season he might be interested in renting it out to other farmers in his wadi.

15. Agroforestry should be retained as a component of the project. In the eyes of farmers in project and non-project wadis it is one of the prime attractions of the project. It has been supprisingly successful, given that most farmers must irrigate the trees by shadouf, because it has answered one of their primary needs:fencing.

Farmers interviewed, when faced by the project anthropologist with the theoretical choice of making agroforestry self-sustaining or with giving it up,twisted their brains to come up with ways to make it self-sustaining. The two major problems they forsaw were: pots and seeds. The project anthropologist had been informed by a nursery technicial delegate that the pots cost about 15 CFA apiece[11], which the farmers corsidered far to expensive and stated that they would be unable and unwilling to purchase pots at this price since so many pots are needed for live fencing. Some farmers suggested planting trees directly in the soil in nurseries and transplanting them, others suggested trying whether they could be sown directly and watered in the spots for which they were destined. One farmer at Ygra has planted the trees directly in a nursery and has had encouraging results so far. The project should continue to look for ways to produce seedlings without pots.

Farmers felt that they would have no trouble asking farmers in wadis with live fencing for seeds, but they were unsure how many seeds they would be able to procure in this way and exactly how to go about gathering them. The project should help educate farmers, or at least the nursery technical delegates about how and when to gather seeds and about ways to plant without pots.

16. The project should hire an integrated-pest-mangagement specialist for a short-term consultancy. Since soil fertility and crop diversification are in their infancy in the wadis now is the ideal time to teach farmers integrated-pest-management techniques and reduce their need for insecticides. USAID should also consider helping farmers

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11 The cost per pot when delivered to the project <u>in NDjamena</u> was 9.16 CFA in December 1988.

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obtain "good" pesticides, perhaps through the intermediary of local merchants.

Pesticides are very attractive to farmers in the project zone because they are an easy way to increase yield. One of the three major demands of non-project wadis and farmers who have not applied many project techniques is for pesticides. Farmers in control and 2nd and 3rd year wadis said that the four things which first attracted them to the project, all equally interesting, were:

a. pesticides
b. trees
c. motorpumps
d. seeds

Trying to add integrated-pest-management techniques to those already being taught the farmer should help increase yield while reducing the demand for pesticides. Since farmers are only now learning techniques of soil enrichement and crop rotation no old and ingrained bad habits need to be undone. Integrated-pest-management has virgin soil. It may be unrealistic, however, to expect shadouf farmers to introduce leguminous forage crops, even if they help the soil, since they will not consider it worth a human's effort to water animals' food-- but it can be tried.

85% of farmers interviewed in 1990 were using pesticides they obtained through SODELAC or in the market. They use whaqtever pesticides they can obtain without regard for their designated purpose or whether they are dangerous for human consumption. Teaching farmers to correctly identify the most common pest problems and providing information on the correct use of common pesticides, and even going so far as to promote the use of the "good" pesticides on USAID's list of acceptable pesticides would be preferable to washing one's hands of the problem.

17. The project should work with merchants in local market towns and major commercial centers. With the right incentives merchants can be persuaded it is worth their while to take risks since they already have more business experience than the farmers.

Merchants have more commercial experience and can travel or place orders more easily than farmers. Farmers should take advantage of this expertise and should be willing to pay reasonable fees for it, even if it means the farmer will have to

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pay more than if he took the risks himself. Farmers and farmer groups should realize that they have the power to demand that the merchants provide the quality the farmers specify. Farmers and groups should be given training in setting up agreements and contracts with merchants.

18. The project should retain as a goal spreading agronomic techniques to shadouf farmers as well as motorpump farmers. The shadouf farmers need to be convinced that though with some new techniques irrigation must be done more frequently, nevertheless overall water requirements are less and water application more effective with these techniques. At the same time the agronomist and waterlifting/irrigation specialist should continue their work on developing optimal water applications to squares/rows not only with motorpumps but also with shadoufs. The optimal application would take into account not only productivity but the typical non-agricultural demands on his time which a shadouf farmer encounters. They need to find a balance where the shadouf farmer does not feel that the proposed agricultural techniques are beyond his capacity and where the modified techniques still give improved results.

The extension workers are already making a real effort but reaching shadouf farmers and working in wadis without motorpumps should remain a major object of the project. Shadouf farmers' perception that new agricultural techniques will only work with motorpumps should be targeted. The fact that 46/50 farmers felt that the project had benefitted them even though only 17/50 had purchased motorpumps emphasises how important the other aspects of the project, such as agronomy and agroforestry are. The project is not just motorpumps. It also emphasises how much promise there is in working with shadouf farmers. The importance of working with shadoof farmers is reinforced by the fact that less than half the farmers in the region can probably afford motorpumps (see VI. A. 2.below).

19. The project should develop a simple form of farm accounting which would help farmers keep track of income and expenses and their sources, monies spent on motorpumps, fuel, maintenance, seeds and other agricultural inputs, and other simple calculations. The same sort of accounting would be helpful for members of groups managing various credits introduced by the project. The accounting should be taught

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in night school in the wadis. This will necessitate some literacy training, though a form of accounting using symbols, etc, can be developed.

Farmers at Made who had a short experience with the project teaching adult literacy at a night school in their village were eager for the night school to begin again if project resources allowed. 5/6 farmers there included a night school, mostly for accounting for themselves and for their wives who were becoming involved in a motorpump group and a village grain mill, on their list of present wants. Middle-aged farmers thought that the writing and calculation should be in Arabic for them since they have had some Coranic education. But if younger people learn they should learn to calculate in French, which would give them a wider window on the world. At Mangalma and other wadis where farmers have been questioned monthly about their economic activities their request was that the economic surveys be continued because through them they managed to control their accounts and were learning farm management. The need all these farmers are expressing is for some form of accounting by which they can control their affairs and training in simple accounting should respond to this desire.

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V. PROJECT BENEFICIARIES

A. **Control farmers have reacted enthusiastically to the project. This indicates remaining farmers would like to particpate. As a pilot the project has reached only a small part of the area's wadi farming population--perhaps 5%. Many farmers remain who could benefit from the model developed.**

The project has officially worked with just under 400 farmers in 28 wadis in Ngouri Sub-Prefecture. Other farmers have benefitted from informal advice and demonstrations. No survey has been done of the total number of wadi farmers in the project zone; such a survey would give only an approximate idea of the total number of wadi farmers in any case, since the numbers vary with the season of the year and the size of the dune harvest, which increases or lessens the need for wadi produce. But it would be interesting to estimate how many farmers in the project zone remain to be reached. One of the few figures available is the the voting population (men and women over 15 years of age) of the project zone in 1985.

Table 4

\Ngouri Canton	3,881
Baderi Canton	3,409
Dibinentichi	8,602
Yalita Canton	4,271
Djiguidada	5,105
	25,268

Since most people age 15+ form part of the active dune farming population these figures can give us a very rough idea of how many farmers can still benefit from the project. 80% of the population are cultivators (Enquete Agricole, Bol, p.10) so about 20,000 are farmers. Since few women have their own wadi fields but constitute about half the population we can subtract 10,000 women from the farming population, which leaves about 10,000 male dune farmers. Then the project would have trained 400/10,000 or about 4% of the male agricultural population. Not all men have wadi fields so 10,000 is probably more than the number of wadi farmers in these 5 cantons. Supposing 3/4 of male dune farmers

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also have wadi fields, which is probably a generous guess, then the project has trained about 400/7,500 wadi farmers, or about 5% of the wadi farmers. If the control wadis are representative of the total population of the zone many of these farmers are eager to participate but only a few have yet had the occasion.

If, as it appears from the project evaluation, the project has developed a viable model for agricultural development and increased food production in the area, a large number of farmers could benefit from this model. If the control wadis and control farmers are as representative of the zone as they should be, statistically speaking, many of these untargeted farmers want to participate in the project. They are just waiting for their turn to come, as many of those interviewed put it.

B. Only a small number of farmers is using motorpumps; this is not necessarily discouraging.

11% (42/400) of project participants are using motorpumps. Using our very rough estimate of 7,500 wadi farmers in the area less than 1% have acquired motorpumps. We need to understand why these numbers are so low and what, if anything, should be done to raise them.

Reasons for low number of pump owners:

1. One aim of the project was to find appropriate water extraction technologies. The project determined that motorpumps were an appropriate technique only midway through the project. Pumps and pump credits have not been available for long. If the project and/or the motorpump group continues this situation will improve.

2. Many farmers in the region appear not to know about the motorpump credit group and so have no idea how to acquire a pump. More effort needs to be made to inform authorities and farmers about the motorpump group.

3. Some farmers choose not to get a pump. Some farmers:

i. have decided not to get a pump because they do not have enough wadi land to justify the expense. This is a rational economic decision and they should not be targeted for pump acquisition.

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ii. do not want to work in the wadi for 3/3 seasons in order to cover the motorpump's cost. This is a rational decision about "lifestyle" and they should not be targeted.

iii. fear getting into debt because they think they will be put in jail for non-payment. This is a result of misinformation; they should be targeted for a clearer explanation of how the motorpump group credit works.

iv. cannot raise the money for the downpayment and gas even though they would like a pump. If the conditions for acquisition were changed these farmers would get a pump since once they have the pump they can earn enough income to make the monthly payments.

v. who are on the waiting list cannot raise enough money for the downpayment and gas. If the conditions were changed they would take a pump.

C. An analysis of the economic data gathered in the database and final surveys plus the information collected during the project period gives a numerical basis for deciding who can afford to use motorpumps.

- Farmers with 150,000 CFA/year in agricultural income, somewhat less than half the farming population, could probably afford the monthly payments on a motorpump if the conditions were modified. These farmers should be targeted. The changed requirements for credit must be aimed at farmers with this amount of income and the downpayment and gas credit should remain large enough to weed out bad credit risks and ensure that the owner can maintain his pump.

- Farmers with 240,000 CFA/year in agricultural income can probably afford pumps under the present conditions.

- Farmers who earn more than 149,000 CFA/year from agriculture appear, on a number of counts, to be a good credit risk.

- Farmers earning 60-149,000 CFA/year from agriculture could be considered for loans with additional conditions.

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- Farmers earning under 60,000 CFA/year from agriculture are bad credit risks.

D. Half the farmers in this zone would be good credit risks.

Figures gathered in the 1987 Data Base study using 68 farmers chosen at random in the area show that the median income from all sources, not just agriculture, was 153,000 CFA. This means that half the farmers of the area would be good credit risks. The data base modal, or most frequent income, was under 60,000, which means that a number of people are bad credit risks for motorpumps. These figures are supported by other calculations, see VI.

E. While it is intellectually satisfying that there is a rational economic basis for predicting who can or cannot afford and maintain motorpumps, using this base may be very difficult. Gathering the income data from a farmer to determine his qualification for the program will demand that the data be gathered over a long period and require project or Motorpump Group personnel. In undertaking the next phase of the project it may be wiser for the anthropologist and agronomist to analyse their sets of data together to determine what agronomic cofactors (e.g. surface area, types of crops, irrigation frequency/water level, and so forth) can be found which are characteristic of farmers with qualifying incomes. The project could then set up a list of criteria which are more easily measured but are also reliable indicators.

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VI. SOCIO-ECONOMIC SITUATION OF PROJECT AND CONTROL FARMERS AND THEIR FAMILIES

A. To compare the socio-economic situation of project and control farmers and families the project surveyed pilots and controls throughout the project period. The pre-project distinctions revealed by the database survey were not great (see Data Base Information). Most distinctions between pilot/participants and control/non-participants quickly disappeared as many controls took part in the project. However, economic data gathered over the first year of the project showed that the main differences between responsive and unresponsive pilots and controls were income and sources of revenue. At the beginning of the project there was a clear income difference between farmers who have acquired pumps and those who have not. Those who are on the waiting list but having difficulty raising the downpayment fall in between. The same differences existed between those who responded actively to the project and did not.

An examination of the economic situation of 29 participants in the first year of the project, participants for whom a wide range of information is available, shows the economic differences between those who later acquired pumps and other particpants. This difference exists not in overall income but in <u>agricultural</u> income.

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TABLE 5

Agricultural Income in Year before Pumps Introduced

	All Participants	Pump Owners	Wait List
Average Income	149,000 CFA	241,000 CFA	218,000 CFA
Median Income	122,000 CFA	266,000 CFA	210-227,000
Modal Income	6/29 under 50,000 CFA	no owners below 50,000	220,000 CFA
	6/29 above 250,000 CFA	4/17 above 250,000 CFA	

1. The median income of the 7 pump owners among the 29 farmers, was 266,000. 3 of the 7 had incomes under the median income of pump owners, but two of these were above, or almost above, the median income for all participants, ie 122,000.

5/7 earned above 200,000, well above the average income for all farmers of 149,000. The other two earned between 60,000-149,000.

In addition, the 2/29 farmers who are on the waiting list for pumps had incomes considerably above the median and average incomes of all participants, though slightly below those of the present pump owners. The remaining pump owner had an annual agricultural income of just 60,000 CFA but bought the project's trial pump at an amortized price and has been able to support the credit payments. Farmers in his situation, ie an annual agricultural income between 60,000 and 149,000 CFA could probably purchase cheaper pumps on credit.

2. The 29 farmers whose economic history contained the most extensive information, gathered during the baseline and end of project surveys, monthly questionnaires and agronomic data, formed a population whose pre-pump annual agricultural income distribution was as follows:

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TABLE 6

Income less than	%	#
60,000	24	7/29
150,000	31	9/29
200,000	10	3/29
300,000	28	8/29
400,000	7	2/29

3. During the first year of the project all farmers who later acquired pumps earned over 60,000/year from agriculture and had savings (defined in this case as the difference between agricultural income and food expenses, but not expenses for ceremonies, clothes, etc.,) of 86,000 CFA or more.

4. Everyone (21/29) who earned more than 60,000 from farming was able to save 12 . The average savings of all farmers with incomes of over 60,000 CFA/year was 62,000/year. No one (7/29) who earned less than 60,000 CFA from farming was able to

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12. There is one exception. One farmer had no savings but joined a group of 5 who tried out a motorpump as an experiment. They concluded that 5 people were too many to use one pump, 1 or 2 ideal and 3 the maximum. He was eager to buy the pump at an amortized price but the group's members could not agree among themselves who would have the privilege of purchasing it and who would have to do without. His pre-pump income was 103,000 CFA but his food expenses were 134,000, hence he had no savings. He would like a pump but is not on the waiting list because he feels he could not afford the monthly credit payments although he could have paid the maintenance on a pump purchased at the amortized price. The experience of the other trial pump user, mentioned just above, who had a limited income but has been able to support the maintenance of the pump lends his claim support.

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save; in fact they were an average of 66,000 CFA in the hole. Clearly 60,000/year in agricultural income is a breaking point.

The savings of the two farmers now on the waiting list for pumps were 3,000 and 43,000.

B. **All farmers who acquired pumps have continued to save, if the monthly figures for 1987 and 1990 are compared, though their savings have dropped considerably, by an average of 75,000. This bears out their initial judgement that they could support the cost of the pump.**

1. This drop in savings does, however, raise two important questions.

a. Will the pump owners be able to afford to replace their pumps if they are no longer in the same economically advantageous position? Instead of having an average of 86,000 CFA in savings versus the average of 62,000 for farmers above 60,000/year in income, they now have an average of 7,600 in savings. The credit payments as now structured--at the demand of the pump owners--make no provision for the amortization of the pumps so that when a pump dies an owner will have no automatic savings with which to purchase another. If the pumps last longer than the period of credit repayments (which they have been predicted to do) the farmers will have to save enough from their increased production to meet the credit requirements for another pump. Will they do this or spend the money? One cannot predict but the project can educate the owners about the future.

b. Are the pump owners really better off because of the project if their savings have declined as a result? In considering this question we must remember: first, these are <u>average</u> savings, so some pump owners are saving more than they used to. Second, the drop in their savings was comparable to the drop of some shadouf farmers, but many shadouf farmers' income dropped less, so the pump farmers are at the end of the spectrum which suffered most. Third, even so, all pump owners still have <u>some</u> savings. Fourth, pump owners are unanimous in claiming their life has improved since they acquired pumps even though the figures show their savings are down. The anthropologist would make the informed guess that this is because the problem of maintaining a steady cash flow has been helped by the pumps and the project.

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C. From the data we can conclude that:

- o bad credit risks earn under 60,000 CFA in agricultural income per year.
- o medium credit risks earn between 60-240,000 in agricultural income per year.
- o good credit risks earn above 240,000 in agricultural income per year.

However, if we look at the pre-pump income of those who became pump owners 5 earned over 200,000, the other 2 between 60-149,000. We could therefore extend the range and say that those who earn over 200,000 are good credit risks.

Moreover, the average savings of participants who earned between 60-149,000 were only 25,000.

Whereas those who earned between 150-199,000 had annual agricultural savings of 85,000, which is very close indeed to the 86,000 average savings of all those who later became pump owners.

Hence:

- o <u>it is likely that anyone earning over 149,000/year in agricultural income is a good credit risk.</u>

D. It is possible that income-earners between 60-149,000 can purchase pumps on credit if the price of the pump were lower or the down payment less, but other conditions would have to be stricter since they are less creditworthy. If the dalou proves efficient in this zone these farmers would/could be targeted for it.

This conclusion is derived from the fact that 2 farmers who earn between 60-149,000 purchased amortized pumps and 1 has a pump on credit and has been able to make the payments.

Farmers in this income category (60-149,000) are 30% of the sample population. Although this is large a part of the population, the anthropologist recommends that it not be directly targeted for motorpump use in the next phase of the project. Dealing with this part of the population increases the risks of losing money for the revolving fund and the time spent on

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supervision for strict conditions would be better spent on the half of the population which is a good credit risk.

E. **Almost all those who participated in the project have benefitted, whether or not they have acquired motorpumps. Project families' training has increased the amount of food available, increased wadi production and increased income.**

- Dune and polder cereal production have not been crucial to most wadi farmers consumption since the 1980s drought began. Instead improved wadi agriculture (vegetables and grain) has eased many wadi farmers' access to grain.

- Improved wadi agriculture has increased many wadi farming families' standard of living; they have more food and a steadier cash flow.

- Improved wadi agriculture has led to increased consumption rather than increased investment in savings or livestock. Some farmers have invested in motorpumps.

1. The project's positive impact can be seen on farmers' standard of living in that they:

   a. have steadier income;
   b. housing;
   c. have accepted most techniques as giving better or easier results;
   d. have more food to eat;
   e. have an better lifestyle and their worries have decreased.

2. The findings about impact on income and debt are ambiguous.

   f. income;
   g. debt.

3. Some indicators chosen before the project began as measures of project impact do not show any change. Project impact cannot be directly tied to:

   h. higher savings or a larger number of people saving;

   i. increased purchases of livestock.

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These indicators h and i may show no impact because there was none. Or they may be lagging indicators. Savings and livestock purchases may show an increase once income increases more or grows steadier since people at present may be spending their additional income on improving their standard of living, which for most was marginal in the pre-project period. It is also possible that in the future these indicators may not show much impact because people will be spending their increased income on pump credit payments or pump replacement. Before concluding from these unchanged indicators that the project had no impact we need to see what happens in the next phase.

The most worrisome indicator is f, income, which is ambiguous in its results. So many farmers who claim that their life is easier are showing less net profit than at the beginning of the project. The anthropologist worries that the pump farmers may be getting into a situation where they have a greater cash flow but higher expenses so that there is no real eeconomic improvement.

F. **According to the baseline and end-of-project survey wadi production has improved the standard of living of project farmers.**

Since the project's purpose was to increase wadi production in Ngouri Sub-Prefecture while maintaining or improving soil fertility it is of primary importance to determine whether the project helped the target population increase wadi production while maintaining soil fertility, increased the amount of food they had to eat, or increased their income or standard of living. At the time the project was undertaken, increasing wadi production was important because continuous drought in earlier years had decimated Ngouri farmers' stocks of cereals and their savings in livestock. Many people in the project zone were just scraping by. They were constantly worried about getting enough to eat and about earning enough money just to pay taxes and buy the necessities of life, not to speak of investing in livestock. Since dune cereal production had been erratic, wadi farming was targeted as being the most likely source of increased and dependable food production (the project goal and the sector goal of USAID at the time). Dune production continued to be erratic during the project period; at Ngouri in 1989, for example, it rained only twice and farmers did not even bother to sow the dunes.

G. **FOOD: Dune produce was not enough in 1987 or 1990 in any village surveyed for people to eat well year-round. Wadi produce made the difference in the months after the farmers' dune crop had given out.**

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No direct measures of the amount of food consumed were taken at the beginning or end of the project since such research would have been far too complicated. However, throughout the the project subjects were asked on the monthly surveys whether it had been difficult for them to obtain food and how they had managed to get it. Because a farmer's food supply comes jointly from his dune cereal crops, his wadi cereal and vegetable crops (some of which he sells to buy cereals), livestock and non-agricultural revenue, this is only a general indicator that people are now better off and not a direct measure of wadi production and project impact.

Respondants at Ygra and Ngouri said from January to August in 1987 that it was hard to get enough food to eat; they also replied after the dune harvest that food was not hard until December or January. Respondants at Molori, Boui and Mangalma said that food was not difficult in any month but attributed their food mostly to wadi production. For farmers at Made food was was easy in September 1987, after the harvest; decreasing numbers had enough food to eat in each successive month, so that by January food was difficult for about half the families. The other half scraped by on wadi produce until June, when food became very difficult for them too.

Thus in the deep water wadis of Ngouri Molo and Ygra wadi produce helped in 1987 but was insufficient; food was plentiful only in the months right after the dune harvest. At Made, where water is deep but less difficult, food was easy for everyone after the dune harvest 1987 and some wadi farmers also grew enough in the cool and hot but not the rainy season. In the medium and shallow wadis of Boui, Molori and Mangalma food was not a problem for practically all farmers interviewed from the dune harvest through November and after that all but 2 of the wadi farmers grew enough wadi produce to meet their food needs.

The differences in wadi production in different areas are supported by figures on 1987 agricultural income data. At Ygra and Molo the agricultural income of all but one farmer interviewed was less than what they spen on food; the one exceptiion just broke even. Ie they had to have some non-agricultural source of outside income to buy enough food. At Made about half the farmers made an adequate income-about what all the farmers at Mangalma made-the rest were up with Molori and Boui where the agricultural incomes were high.

Dune, wadi, livestock and non-farm income--play a role in how much food and income a farmer has. To help clarify further the role that dune and polder grain vs. wadi production has

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played, the anthropologist asked each farmer interviewed for how many months he had eaten his last dune crop and also his polder crop, if he had one.

Table 7

# months dunes	# farmers	%	# months polders	#farm-ers	%	Total months dune/pldr # frmrs	%
0	26*	53	0	40@	83	18	38
1	8	16	1	2	4	10	21
2	8	16	2	2	4	10	21
3	1	2	3	2	4	1	2
4	3	6	4	0	0	1	2
5	2	4	5	1	2	5	10
6	0	0	6	0	0	1	2
7	0	0	7	1	2	1	2
12	1 +	2	12	0	0	1	2

* 2\ of these farmers did not bother to sow at all, the rest received nothing or at the most 15 days worth because of crickets or lack of rainfall. One farmer who had nothing from the dunes had 8 months of cereal from sorghum and wheat produced in the wadi; he has taken a polder field this year. 2 farmers also has céreal stocked from the year before, one had 50 days' worth, the other 4 months; these stocks were not counted in the number of months'cereal available from 1989. The number of farmers is only 49 and not 50 because one was traveling during the rainy season.

+ The farmer has a household with 4 members old enough to work in the dunes and is himself an enterprising farmer; his village is one of the few that had a reasonable millet harvest in 1989.

@ One "No Answer".

- According to the farmers interviewed a little over half had dune crops which were non-existant or lasted their family less than 20 days. In addition, 83% of the

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farmers had no grain from a polder crop, either because they did not own a polder field or because they had not planted.

- 18/49 or 37% reported that they had no dune harvest at all and that they had no polder fields; they were, therefore, completely dependent on wadi agriculture, livestock and non-farm revenue for their familys' cereal needs.

- 85% of farmers harvested enough dune grain to last no more that 2 months.

Though dune production may have improved for some farmers over the project period, according to their monthly statements about how they had managed to obtain most of their food and Table 5, dune production was not as important a factor in food availabilty as was wadi farming. Dune production was important, rather, in easing in the post-harvest months the constant pressure to purchase cereals.

H. 31/50 farmers, or 62%, directly attributed their improved food situation, rise in income and their standard of living to the project.

During the end-of-project survey a number of farmers volontarily attributed their improved condition to the ORT project. This was not elicited by a question but added by the person being interviewed. It is perhaps remarkable that this many farmers felt strongly enough to offer such statements during individual interviews. 22 felt so sure of their grasp of their economic situation that they volonteered estimates of how much their income had increased. While the project anthropologist would have been leery of such estimates at the time she collected baseline data, the monthly economic surveys done with these farmers after they joined the project have given them a far sounder grasp of their own economic situation. Some have mastered their accounts better than others, it is true. These figures must be checked against the monthly economic data; they do however represent these farmers' perception of how much their revenue has been augmented by the project. Their estimates ranged from an increase of 1/3 to 10 times (this last may not, in fact, be as implausible as it sounds, given the farmer's circumstances). 14/22 judged that their income had doubled to quadrupled due to increases in yield or value of produce brought about by the project.

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I. **INCOME: Farmers attribute the improvements in their lives directly to the project's techniques, education, wells and pumps; non-project farmers perceive their future participation in the project as a way of improving their lives. However, there is, at the level of economic analysis done, no link between the number of techniques adopted and increased income. The income data is, moreover, ambiguous; some figures show an improvement in income, some that income has gone down.**

a. The reason for no link appearing between increased income and project participation would be interesting to know. The anthropologist suspects, from her discussions with the project agronomist, that grain plays an important part in this surprising result. In the zones where dune crops grew, farmers' monetary income may have stayed the same <u>because</u> wadi production had improved and had become steadier. If farmers had more wadi produce to sell, they could keep and consume the grain which they had previously been forced to sell to raise money for necessities and later had to buy back when they needed grain to eat. With the project they may have been eating the grain and spending their income on other items; hence their standard of living would have improved even though their income stayed the same.

Another reason for no impact on income showing up may be that many of the pump farmers used their pumps to expand the surface area under grain in their wadi parcels. (They are perceiving that this is not an efficient use of the pump). The grain would not be sold for money and so would not appear in the accounts.

These possibilities can be explored when the agronomic data is available.

b. Farmers' pre-project income seems to be related to the number of techniques the farmer later tried. Farmers with a very low agricultural income (under 60,000 CFA/year) either tried very few (0-4) new techniques--these were farmers who engaged in very little wadi farming--or tried lots of techniques(5-9, 10-14)--these were poor farmers who relied heavily on wadi farming.

The remaining farmers with less than average agricultural income (60-149,000) did not try as many techniques (0-4, 5-9) as those poorer or better off did (5-9, 10-14). Farmers with motorpumps have been open to trying new techniques (see End-of-Project Evaluation Report for ORT, p.27, draft) since irrigation is easier and they have more free time. If we consider <u>only shadoof farmers</u> in order to remove the influence of free time it

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still holds true that the poorest farmers either engange very little in wadi farming and tried few techniques or depended on wadi farming and tried lots. Below average income (60-149,000) shadoof farmers tried fewer techniques than well-off shadouf farmers who tried, for the most part, between 5-9 techniques. They tended not to try more because many felt that large squares and furrows took too much water and were more suitable to motorpump farming than shadoof irrigation so they did not try them. Also without pumps they were less likely to try improved wells unless they had real water extraction problems so they did not try this new technique.

This leads us again to reemphasize the need for extension agents to work with shadoof farmers and their perceptions to demonstrate to them that although irrigation must be done more frequently, overall water requirements are less, with the new techniques, and water application more effective. At the same time the agronomist and water lifting/irrigation specialist should continue their work on developing optimal water applications and variations on square/row construction to take into account other demands on shadoof farmers time which may keep them from reaching optimal productivity with water applications. They need a balance where shadoof farmers do not feel that the proposed agronomic techniques are beyond their capacity to irrigate and where the modified techniques still give improved results.

There is a weak indication that the number of techniques adopted played a role in this overall amelioration in farmers' economic situation. Among the 29 extensively well-surveyed farmers, of those who moved from spending more in 1987 than they earned in agricultural income to earning more than they spent in 1990, 3 used 5-9 techniques, 2 used 10-14 and only 1 used 1 new technique only.

Contradictory results come from the agronomic data available on 12/50 farmrs. These 12 are among the 50 pilots and controls but were chosen for analysis only becuse computer data was at present available on them. They are, therefore, not representative. 11/12 had less gross wadi income in 1989 than in 1987, even though they had tried between 6-13 new techniques. One farmer with a pump had increased his income but the other three pump owners had decreased.

These last findings look grim. When added to the fact that there is no direct link between the number of techniques tried and increased income, the project appears to have had no, or even a negative effect on farmers' incomes. The income data is ambiguous, some positive, some negative and some neither. In addition, certain indicator--savings and livestock purchases--show no project impact. On the other hand, farmers' improved access to food, standard of living, steadier income, what appears

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to be lessened debt, housing, and an overall positive response to the project, indicate the project has had a positive impact.

c. While there is no direct link between techniques adopted and amount of increased income, data gathered from 50 people in the baseline and end of project survey show that many people are no longer in a precarious economic situation.

Table 8

June/July	%1987	%1990
saved	49%	54%
income= expenses	6%	20%
expenses> income	45%	26%
positive income	55%	74%
negative income	45%	26%

The big change has been between the number of people who earned enough to cover their expenses vs. those who had to use their savings or go into debt. In toto 19% of farmers have shifted from having a "negative income" in 1987 to the positive side of the balance sheet in 1990. Thus it would appear that, even though the number of farmers who are able to save money has not increased much, farmers income has improved and they are less likely to go into debt. Another indication of this positive improvement is the Deputy Sub-Prefect's observation that standing onion crops are rarely sold now in order to raise money, in contrast to 1987.

58% of farmers considered (these numbers represent their perception of their financial situation based on their monthly reports on income and outlay!) that their income had increased over the entire project period and only 6% felt that their income had declined. So 86% of farmers would place themselves on the positive side of the balance sheet in 1990. It must be remembered that June/July/August are the hardest months of the year and the most likely time a farmer will have cash problems; if a few more

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farmers think that their overall economic situation is more positive than the actual amounts saved and spent in June and July indicate, their perception may be accurate.

d. The project has not had a noticable impact on savings. If the ability to save is considered a sign of adequate income, the comparison between the number of control and pilot farmers who saved in the month prior to the surveys in 1987 and 1990 indicates that there has been only a slight increase in the number of farmers who have saved money. The reason the savings rate may not be greater is that farmers may be spending more on an improved standard of living. This appears to be the case.

J. **STANDARD OF LIVING: Twice as many farmers felt they had an adequete standard of living at the end of the project.**

- 1/3 farmers in 1987 said they had an adequate standard of living;
- 2/3 farmers in 1990 said they had an adequate standard of living.

a. Lifestyle has improved.

Farmers in the project felt their lifestyle, over all, had improved. They had more to eat and fewer worries about food, could buy tea, sugar and pomade more often and fell into debt less often. The commentaries they gave on their standard of living, in response to the same question in 1987 and 1990 show they feel their standard of living has improved. Twice as many are better-off in 1990, by their own admission. The project has reversed the proportions.

b. Brut numbers on housing construction do not show that the project has had an impact.

The number of houses built in 1989-90 is greater than in 1987 but appears unrelated to increased income or the degree to which different wadis took advantage of project techniques. Farmers were asked on the baseline and final surveys if they had built any houses during the last year, since construction can demand a large money investment. The anthropologist supposed that an increase in housing construction might indicate more disposable income. However, construction increased in 5 of the 6 first-year project villages, whether or not they used lots of project techniques or had much increase in income. Thus Ngouri

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and Ygra, which benefitted the least from the project increased their construction as much as did Mangalma, which has "model" farmers. At Made, where farmers used many new techniques and had increased income, people built the same number of houses in 1990 as in 1987.

However, if one looks at the amount spent on housing and the source of the income, the picture shows a positive project impact. At Ygra the money spend on housing came from sources other tahn wadi agriculture, except for one famrer who spent 10,000 CFA he had earned both from the wadi and working as a laborer. At Ngouri the money came from wadi farming but the buildings cost less and 4,000 CFA, except for the one built by the very progressive pump farmer/well team member who spent 120,000 CFA. In contrast, all the money spent on housing at Mangalma came from wadi farming. The indications at Made and Boui remain ambiguous; at Boui the housing was constructed entirely by the owners without any costs and at Made, though the money came from wadi produce, one house cost only 500 CFA, the other 7,500.

K. **INVESTMENTS: The project has not had an impact on investments. Farmers are not saving more or purchasing more livestock as a result of the project.**

Another reason the savings rate may be low could be that farmers are spending money on livestock and saving on the hoof. Farmers do not, however, seem to have invested more in livestock after the project began, so no project impact can be seen.

a. Although the project anthropologist collected data on livestock in 1987, faced with limited time for fieldwork in 1990, she dropped questions she felt elicited the most unreliable responses. Number of livestock was one such question. There is, therefore, no information directly comparable to what was found in 1987. Farmers were asked if they had bought or sold livestock within the last year.

- 1/2 farmers owned goats in 1987.
  1/5 farmers owned cattle, the most valued livestock, in 1987.

- 40% had purchased animals in 1989-90.
  50% had not purchased animals (3 because they had to use their money for motorpump payments).
  10% no answer on animal purchases.
  42% had sold livestock.

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b. The information we can glean from the data on debt is ambiguous. Whereas there is a complete series of data for all the months from August 1987 to September 1988, only data for June 1990 was available. In 1987-88 the CFA or more) the deep wadis of Made and Ygra wer deeply in debt (farmers had 20,000 CFA or more of debts), Mangalma and Ngouri Molo moderately (12-14,000), and Boui and Molori less so (1-6,000). At the same time farmers at Ygra gave out no loans, while Made, Molo and BOui gave out very small ones (250-3,000). In contrast farmers at Molori, the least indebted, lent out an average of 25,000 CFA. This debt data refelcts the economic situation in these wadis in 1987, with deep wadi farmers hard up for money, especially at Ygra. Though Molo is a deep wadi it was somewhat less indebted because so many farmers had extra-agricultural sources of income.

The 1990 data shows only that farmers at Ygra are less indebted and are actually lending out a little money, an improvement in their situation. Otherwise the data is unrevealing.

c. Livestock purchases and sales, which were almost equal during the project period, do not indicate an improved or worsening economic situation since 21/50 reported that they had sold livestock in the last year. This seems to say that many farmers still suffered times when cash was short and they had to cash in their animal savings. One of the aims of project staff was to introduce crops which would bring in a fairly steady income so that the farmer could cover his usual expenses, this finding might indicate the project has not stabilized monthly income sufficiently. The answer to this is diversification of production and early and late season cultivars.

A number of farmers volonteered the reason for which they had sold their animals.

Table 9

pump	millet	necessities (sugar/sauce/clothes)	ceremonies	gas	trade
3	3	3	3	2	1

These figures cannot indicate the general situation since they are incomplete but they do tell us why some farmers were selling their animals. The reasons include the same old reasons as in 1987--life is hard and farmers need to buy food and meet

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social obligations--but farmers are now also selling animals to purchase motorpumps and keep them running. A by-word among project staff is that if farmers start selling their valuable cattle to buy pumps this will be a real sign of project success. One farmer reported he sold a cow to help pay for his pump and buy fuel--one success story, at least.

L. **No more farmers owned transport animals in 1990 than in 1987. Farmers have not invested in beasts of burden or in other animals.**

Since transportation was of great concern to farmers in 1990, the anthropologist did inquire directly about how many beasts of burden each farmer interviewed owned.

- 3/4 farmers in 1987 owned transport animals
  3/4 farmers in 1990 owned transport animals.

The proportion of farmers owning beasts of burden has not changed betwee 1987 and 1990. Even though farmers consider transport to be a problem they do not appear to be investing in it. This is rather puzzling since farmers consider transportation to be such a pressing problem. This should be examined before any animal transportation credit program is implemented.

If transportation is a problem why are not more farmers investing in it? A possible answer, which should be examined, is that donkeys are cheap (under 10,000 CFA) but cannot carry much. 22 farmers owned only one donkey, only 6 owned two and 2 owned three donkeys. For most of these farmers, then, though they have beasts of burden they cannot move much produce at one time. Horses are mid-priced (25,000 and up, depending on quality) but are used mainly for human transportation; only 5 farmers owned horses, in any case. 13 farmers, less than half the number who owned donkeys, own camels. Camels, which are the most powerful form of transport, are expensive (65,000 CFA and up) and require a large investment. Thus efficient transportation perhaps requires more than some farmers are willing to invest.

M. **The social and economic situations of farm families which did or did not adopt new techniques cannot be compared by measuring impact on income, since income does not (as yet?) reflect any differences. The number of techniques adopted is not reflected in any socio-economic differences, either.The proof of the value of the project is revealed by the number of farmers who adopted new techniques and the low rate of rejection of new techniques. Farmers feel their standard of living has improved and their life has been eased.**

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To measure the impact on the standard of living of adopting new techniques the baseline survey set up controls, who said they were uninterested in the new techniques, and pilots, who said they were. The adoption of new agronomic techniques was considered in three ways, comparing:

1. pilots and controls

2. wadi to wadi

3. many techniques used or few.

1. Pilots vs. controls: The pilots adopted slightly more techniques than controls. The average number of techniques tried by pilots was 9, by controls 7, and the mode, or number of techniques most frequently adopted, was pilots 9-11, controls 7-8. The range of number of techniques each group tried was also similar: pilots 0-14, controls 0-13. While it is true that the pilots were slightly more adventurous than the controls in trying and adopting new techniqes, the remarkable thing is that the supposedly "risk-adverse" controls, who did not choose to join the project, tried and adopted almost as many new techniques as the less conservative pilots. From the point of view of number of techniques there is little difference between pilots and controls.

2. Wadi to wadi: In some wadis farmers tended to adopt more techniques than in others.

TABLE 10

Loura	0-5	control not visited by project
Ygra	0-13	pilots averaged 8
Ngouri	1-14	pilots 8;one control 13,another 1
Boui	2-11	pillot 9; control 2
Molori	4-13	pilot 10; control 5
Youloulia	4	3rd year wadi
Made	7-13	pilot 12; control 10
Mangalma	7-12	pilot 10; control 10
Ngoudoki	9-10	2nd year wadi
Assan-kadari	9-10	3rd year wadi

Farmers in control wadi Loura, i.e. a wadi which was not participating and was not trained by the project, tried up to 5 new techniques, having observed and inquired about them at project wadis. Wadi farmers with pumps in 2nd and 3rd year wadis

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tried lots of techniques. In wadis like Mangalma and Made, pilots and controls were equally eager to try new techniques whereas in other wadis, where the project staff feels they have been less successful, such as Boui, Ngouri and Ygra, some farmers have tried just as many techniques as elsewhere but others, especially controls, did not try as many, i.e. the project was successful with the pilots, who were the target population, but did not have as many volontary control participants. Some farmers at Boui and Ngouri said in the final survey that they have benefitted less from the project than other wadis; however, they were the farmers who had tried fewer techniques. Boui and Ngouri also were not picked for trial commercial credits, which angered some farmers there.

3. Many techniques or few: Rejection of techniques is a better measure of project success than is acceptance since the data we have is not detailed enough for us to know whether a farmer did not accept a technique because he did not want to or because he could not, either because the technique was not demonstrated to him or, as in the case of seeds or tools, because the material was not available.

- o 19/47 accepted all the techniques (up to 14 in number) which they tried.
- o 28/47 rejected at least 1 out of the techniques they tried.

The most frequent rate of rejection was by farmers who tried 8-9 techniques and rejected 1-2. Farmers who tried more than 8-9 rejected very few. This is where the conservative element showed up most strongly. The farmers who tried 8-9 techniques ususally rejected irrigating in large squares or in rows, because they felt it took too much water for a shadouf or that the evaporation rate was too great. Farmers who tried more techniques more often had motorpumps and those who tried fewer than 8-9 techniques usually did not try the squares/rows, which were the techniques most frequently rejected.

a. Income and techniques: Surprisingly, a farmer's income in 1990 appeared, according to the survey data, to be unrelated to the number of techniques the farmer had tried. The incomes of the head of household who had adopted more techniques were not, on the whole, higher than those who adopted few.

The conclusion is then, either:

1. that the new agronomic techniques have not raised farmers' income; or

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2. it is not simply the number of techniques tried but also other factors such as area under new tecniques, skill in using new techniques, etc. which impacts income.

Before accepting 1. the agronomist and anthropologist need to compare and analyse their data more extensively to see if 2. is true. That income has not been increased fits with some of the economic data but not with some other (see I. above) or with the farmers' comments or the rate at which farmers accepted/rejected the techniques.

b. Technical reasons for rejecting techniques are listed as follows. The techniques can probably be modified to lessen their disadvantages.

i. size of squares:

The most frequenly rejected technique by shadouf farmers, who gave up because they thought it took too much water. They usually noted the plants did very well but thought it was a technique better suited for motorpump irrigation which took less work to extract a visibly large quantity of water. In fact the amount of water is about the same but it takes longer to fill a large square.

ii. cultivating in rows:

Farmers felt that gumbo did not get enough water when cultivated in rows, though other plants did well. The agronomist agrees and has modified the technique, which he is now trying with some farmers.

iii. manure:

While most farmers were enthusiastic, some farmers found it took too much effort to transport it to the wadi or they did not have enough manure for their fields. A few claimed manure attracted insects which then attacked the plants.

iv. compost:

Most farmers who tried compost were enthusiastic; a few thought it attracted insects which attacked the plants.

v. tools:

The long-handled hoe worked the ground more deeply than the traditional hoe, which gave it an advantage, but did not break up the clods of dry earth at the same time, which the short-handled hoe does. Consequently the farmers had to go over their fields a second time to crush the clumps, which lost time and negated for them the advantage of working the ground deeply. Farmers want

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something which will work deep like the long-handled hoe but save time (see Recommendation 13).

N. The importance of social factors regarding the acceptance or rejection of project innovations needs to be examined to see which factors can be controlled by the project so that the project will have better results and those which are inalterable forces. It is important to note that farmers rejected specific techniques for technical, not social reasons. Likewise, many farmers who were slow to adopt new techniques were so for what they considered "technical" reasons, ie. they considered them inappropriate to shadouf farming. But there are 4 social factors which led to slow adoption of techniques.

1. The importance of non-farm income to the household budget: At Ngouri and Ygra some poor (less than 80,000 CFA) wadi farmers were already quite dependent on non-farm income to survive; wadi farming was only one among several, not the major, sources of money. These farmers did not increase, or did not increase for long, their committment to wadi farming, especially because they were able to ride a wave of increasing prices, hence bigger profits, in their major source of non-farm income (hides). These farmers may eventually put more effort into wadi farming and using new techniques (especially since the price of hides is now falling) but they will probably do so only when they have observed that wadi farming has become a good source of income for other poor farmers (ie those who have less than 80,000 but who depend heavily on wadi farming and so work with the project). It would be more profitable to continue working with receptive farmers than to target this off-farm income group.

2. The project created jealousies among factions: Factionalism plays an important part in the political and kinship systems of the project area. "A major characteristic of the political system is the growth of factions which do not support the instituted leaders and a frequent line of cleavage is between brothers (real and classificatory)(Baseline Survey, Annex K, p 36)". "The village chiefs and canton chiefs try to maintain a delicate balance between unity and factionalism (ibid, p30)." At Boui factionalism has cropped up twice and those on one side have refused to adopt techniques as a sign of their opposition.

The first time two pre-existing factions in the village sought to join the project. One faction gained the upper hand by excluding the other from the project wadi. In return the loosing faction made a point of disdaining the project.

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The second time, the village chief/wadi chief and a younger brother are forming incipient factions. The chief is malcontent because he has been unable to "deliver the goods" to his villagers which he initially envisaged would come from the project (pumps to ease irrigation, commercial credits). His younger brother, in contrast, has been one of the most interested and involved of the wadi's participants. Despite the chief's failure to deliver the goods farmers were beginning to see they might benefit from trying some of the new techniques. The situation was aggravated just at this time by the chief's failure to receive an experimental commercial credit, which has made the Chief/mara blai feel he needs to reinforce his position by creating solidarity through factionalism and by criticising the project.

The project can mitigate this social problem by being as equitable as possible in handing out the 'goodies" (see recommendation 13) but the project and its goodies provide a battle ground and weapons for existing factions to war with one another. Factional problems will be impossible to avoid.

Boui farmers also rejected some project initiatives because Boui was a prime trial site, hence many techniques were tried here which did not ultimately succeed, such as manual pumps. Some farmers became discouraged and did not participate with much enthusiasm until the last year of the project. Moreover, wadi farming at Boui is relatively easy because of the water level and rich soil. But farmers had given up growing the lucrative onion because of disease. When SODELAC agents visited the wadi frequently because of the project the farmers were able to get insecticide from them and begin growing onions again. So income rose rapidly at the beginning of the project with very little effort from the farmers, hence they had little incentive to try other techniques. The difference between pilots and controls is most striking at Boui, where the average number of techniques tried by pilots was 9, by controls 2. This reflects the growth of factions and the low incentives for many farmers to join the project. The light interest some farmers demonstrated also fits with the fact that farmers (including the Chief/mara blai) at Boui in 1987 fell into the 60-149,000 CFA income category, which turned out to be the group of farmers least responsive to the project in <u>all</u> wadis, or, like the younger brother, fell into the higher income group which responded well to the project in <u>all</u> wadis.

All the project can do is remember these lessons in picking new sites.

3. Fear of what factionalism can do has also led some wadis to turn down the project cold.

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All wadis have clear memories of, and still fear, SODELAC's promotion of wheat growing, when the agency told farmers what to plant. Others are aware of the recent (1986-present) struggle between political factions which was fought using a SODELAC irrigation pump and control of wadi land as weapons. Some wadis want to steer clear of anything which they think might lead to something similar.

The project can undertake to make clearer to non-participating wadis the conditions with which the project intervenes in a wadi (see recommendation 11). However the possibility of a wadi becoming a pawn of opposing factions is inescapable and some wadis may choose not to run the risk.

4. Lack of land, labor or money may be underlying reasons for not becoming involved in the project.

a. land: Farmers with little land have been and will be unlikely to invest in motorpumps, which would be overkill for their small surfaces. Farmers with little land have either depended on non-agricultural sources of income, such as hides, as well as wadi farming and tended not to increase their investment of time and effort in wadi farming, or have been willling to try lots of new ideas in an attempt to increase their wadi income, when it is their main source of revenue. There is little that the project can do to increase the amount of land a farmer has; there is plenty of land available but the farmer must himself want to cultivate more and ask for it.

b. labor: Farmers may have enough land but not enough labor available to prepare a large area for cultivation or to irrigate a big surface. If the project finds an easier method of land cultivation and continues to introduce pumps into the area these constraints can be overcome.

c. money: Income has turned out to be a good predictor of farmers' reactions to the project. Farmers who had large wadi incomes (240,000+) in the pre-project period were farmers who were already putting a lot of effort into wadi farming and depended on it heavily for income. It is not surprising that they would continue their investment in time and labor with the project. Wadi farmers with very low incomes (less than 60,000) who depended primarily on the wadi for their revenue were also likely to seek to increase their wadi income since it was their main resource. Farmers with below-average incomes (60-145,000) turned out to be the least interested in the project. The anthropologist feels this reaction requires further study to be fully understood but it may in part be related to their position mid-way between the other groups. Their income may indicate that they were not in the precarious position of the poorer farmers, and so lacked the pressure of desperation, but at the same time

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did not see wadi farming as a possible source of considerable income without an investment of considerable effort. The project should target the two most receptive groups.

Lack of money for a downpayment has also constrained some farmers and kept them from using motorpumps and some techniques. The project has two ways to ameliorate the situation:

1. Reduce the downpayment to a level which creditworthy farmers can afford (see recommendation 8).

2. Continue working with shadouf farmers to improve their agricultural techniques in order to increase their income to the point they can afford pumps (see recommendation 18).

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VII. EXPECTED AND UNEXPECTED SOCIAL IMPACT OF THE PROJECT

A. The project design expected that there might be certain positive and negative social impacts. Fortunately the positive impacts have measured up to or exceeded expectations. The negative social impact has been limited and is in part unavoidable. There have been unexpected positive benefits but no negative ones.

1. Expected positive impact on well-being of participants.

2. Expected possible negative impact on traditional leaders did not occur.

3. Expected negative impact of factionalism did occur.

4. Unexpected positive impact on social development.

B. The possible negative impact on traditional leader was forseen and planned for and thus avoided.

The project learned from the negative experiences of earlier interventions in the Lake Area that traditional leaders could be obstructionist if their authority was reduced or ignored. The project design included the traditional leaders and their involvement has been crucial to success of the project. As the project load has increased, however, over-worked staff have not kept traditional leaders at all levels as informed as possible. Contact with these leaders should be made a higher priority (see recommendation 10).

C. The pervasivness of factionalism in political and social life was noted at the time the project was designed. Its upswelling is probably unavoidable; like "sibling rivalry" it will always find some place to crop up. The project has given factions another ground over which they could fight.

a. The virulence with which factions would fight to benefit from the project and deny the opposition access was underestimated. At Boui it led to court suits over access to wadi land at the Sub-Prefectural level. This problem has faded away for the moment but the existence of factions at Boui must not be forgotten.

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b. The jealousy among wadis over access to commercial credits was also expectable. It is similar to the jealousy over initial access to the project which was avoided by including in the project all five cantons where wadis are located (Baseline Social Survey, p.36). The jealousy over credits does not appear to be crippling and can probably be countered by a judicious repartition of the next credits.

D. The development of a Motorpump Group, Commercial Credit Fund, and women's investment groups was an unexpected positive.

The active fostering of social development was not designed into the project because people in the wadi zone expressed no need for it during the pre-project and baseline survey period. The anthropologist works on the principle that people will work hard as individuals or together to solve what they see as problems, therefore pushing social development before people perceived a need for it would be wasted effort. She did, however, give guidelines for channeling any desire for social development in culturally appropriate ways as the need arose (Annex K, Lake Farmer Training Project, p. 9,13). The most important guideline was that groups should be made up only of people who volontarily joined, ie who saw their own interest in the group and who were willing to work with the other members.

1. The project when designed did not forsee that the pump technology of choice would be the small motorpump. It was hoped that lower cost methods could be found because "very few farmers are able to make any sort of major monetary investment in increasing their yield. Many cultivators have neither the money to invest nor the annual income to keep up credit payments. They would be unable to continue using any expensive technological changes much beyond the lifetime of the project, unless the changes could guarantee not only that they would reach self-sufficiency, but obtain considerable discretionary income (Annex K, p 7)." However, <u>small</u> motorpumps turned out to be the most effective acceptable form of water extraction other than the shadouf. Small motorpumps required substantial monetary investment (though far less than the massive motorpumps which SODELAC had proposed for the region, which cost over 500,000 CFA apiece). This raised the problem of how to finance them since few farmers had the money to buy. The project's experience with trial motorpumps showed that once a pump was in place a farmer's income increased sufficiently for him to maintain the pump and to carry credit payments. What farmers did not have the resources to do was to invest in purchasing a pump in the first place. After the credit window with VITA, proposed for better-off farmers in the project design, turned out to be impossible, the project staff, in conjunction with the farmers who had used or had seen and wished to purchase motorpumps, developed a revolving credit fund

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to "help them invest and to continue managing more expensive technologies (Annex K, p. 7)".

The design of the revolving fund was proposed by project staff and fits well into the situation in the area, where once the pump is in place the farmer seems to be able to keep it up. It also fits with the individualized nature of small motorpump irrigation; when a farmer decides he wants a pump he joins the group and eventually the money will revolve around to him. It is not necessary with small motorpumps for all farmers in a wadi to make an investment in an irrigation network at the same time. The motorpump group was formed by volunteers who saw an advantage in joining, as was proposed in the project design. "If the farmers themselves decide to band together to invest in technology too expensive for an individual, the credit and financial...arm...will help the farmers obtain credit and make sure they understand the implications of their investment. But the impetus to form cooperatives must come from the farmers themelves (Annex K, p.9)".

In the Baseline Social Survey, 1987, the anthropologist wrote that because of factionalism cooperatives would not succeed in the area; this was written in response to the proposal being considered at the time that the large pumps available from SODELAC be used for pump irrigation. This would have meant neighbours (very often brothers/fathers/sons) would have to work together on water distribution and credit repayments. It would also have meant that fields would have to be reconfigured. The anthropologist recommended against that then and now. Small motorpumps avoid these problems of forcing potential factions to work togehter in cooperatives and the existing motorpump group is formed voluntarily by people from any wadi who are willing to work together, minimizing problems of conflict within families and wadis.

Farmers in the group are delighted with the way it has allowed them to get pumps and --an unexpected surprise for them-- how much they enjoy travelling, meeting and working with farmers in other wadis. Inter-wadi cooperation is in its nascent stage, however, and members of the group have to make a conscious effort to overcome their tendency to favor their own wadi. An unexpected disadvantage has been the heavy demand on time which the pro bono Motorpump Board has made of its members; the president of the group, who has borne the heaviest burden, cleared only 150 CFA (sic) in wadi revenue after paying pump credits, etc. because he was too busy to plant onions. He is still committed to the group but others who have made sacrifices are beginning to wonder if they should not be recompenses. As the pump fees are now set the group cannot afford to pay its board members. If the down payment is reduced (see recommendation 8), the amount of money in the kitty will be lessened and it will be even harder to pay members. Instead it is advisable that the group function as

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efficiently as possible by reducing the time demanded of its leaders (recommendations 5 & 6).

The motorpump group solved the problems of expensive technology by creating a credit and purchasing mechanism for those who wished to procure a pump. It has been those who had "access to larger sums of money (Annex K, p.7)", mainly those with income above 200,000 CFA, who have taken on the burden of credit. Those with less money have turned to improved wells and improved agricultural techniques as a low investment way of increasing their yield. The project is trying to resulve the problems of using an expensive technology beyond the lifetime of the project by setting up a support infrastructure for maintaining the technical package:

1) training local farmers as mechanics:

2) setting up spare parts village stores and ordering networks.

The problem which is as yet unresolved is how the pump owners will replace their pumps since the total purchase price may still be beyond them when their present pumps fail (see recomendation 10).

2. Well Team: The other technology which has made a difference in wadi productivity is improved wells. Local farmers have been trained to put in the wells and are exploring ways of ordering and transporting materials without outside help. The purchase of pumps has superceded the local construction of pumps, still every attempt is being made to keep the well team personnel local and in charge of the whole process. The well team is, however, in an ambiguous position, somewhere between the helpful neighbour who helps another farmer in his wadi dig out his well for free, and the few professional well diggers/liners who charged for their services, ie. they are caught between pro bono and profit-making. The Well Team belongs to he Motorpump Group which is non-profit and installs wells at the lowest possible cost for its members, while giving the well team members some payment for their efforts. Some members of the well team see the large sums spent on well materials, etc., and wonder why they, who are like professionals, cannot charge what the market will bear. Two factions are developing within the Motorpump Group between pump owners and the well team but both groups are trying to keep a lid on the problem and reach an accomodation. It is unlikely, however, that the problem will go away and the project should look for ways to train other well teams not only in well-digging but also in simple management procedures, using Arabic, symbols and order forms to fill out. Developing relationships with merchants who can place orders would also ease the problems which will arise if the well team faction splits off.

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3. Commercial Credit Groups: The idea of commercial credit grew from the farmers' need for steady income. The same need which pushes them to cultivate crops which mature over a period of time and to go to market every week or two to sell produce, also pushes them to sell their crops when they need money rather than when prices are high. The project staff was sensitive to this need and after positive experiences with the motorpump group's credit, developed the ideal of a similar revolving commercial credit fund. The farmer response has been highly enthusiastic and the trial groups have gained considerable experience about purchasing, storage and sale. They should be invited to pass on their experience to other credit groups. The commercial credit has been a positive experience for the participants, even for those who lost their stores in a terrible fire. It has, however, created envy in other wadis, which as the fund revolves to other wadis, should be reduced if the repartition seems equitable to the farmers in the region.

4. Women's Investment Groups: The development of women's investment groups was unforseen. Since most women do not directly engage in wadi production, but rather in harvesting and transformation (which are appropriate targets for improvement at a later phase of the project), and sometimes help with irrigation, they were not directly targeted 13. Nor do women have any major sources of income which is their own; wadi and dune profits belong to the male head of family. Women sometimes get the small change left over from marketing, money from tressing hair, or gifts of small animals from relatives (though at the same time women are the business managers of the household and have a good degree of financial, management and business expertise, just no money to invest. Morever, certain women who are not forbidden by social custom (Haddad) are very enterprising in finding ways to earn money for the family). At the beginning of the project the anthropologist therefore concluded that "women's well-being will not be directly affected by the project. Rather, improvement will be indirect, through increased household income (Annex K, p. 7)".

The women's investment groups have grown up because their creativity and enterprise have suggested to them ways of making money and the project staff responded by finding the initial investment capital and helped them to organize. When some women saw how the motorpump eased irrigation and how much profits went up they began to consider if they could benefit. The project staff made a pump available to them and they set up their own

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13. It was, however, suggested in Data Base Information that they and children be targeted for education about some agronomic techniques, since "it is evident that many people, women especially, receive much of their training in wadi farming while they are children (p.9)".

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wadi field, with help from their male relatives. Once women had developed the idea of working together to earn income and the obstacle of no investment capital was overcome, women developed many ideas for earning money. They had the idea of a village flour mill run by the women to lessen their labour in food preparation and to give them profits which they intend to invest in other money-making opportunities such as sewing machines. Because women have shown ingenuity in coming up with the ideas and the staff has helped find ways to implement them, it is recommended (recommendation 1 D) that the next project phase use the women's skill at finding investment opportunities and the project staff's skill at developing organizations to help them women implement their ideas.

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VIII. HEALTH

A. The health of project participants and people in the area does not appear to have been endangered by project irrigation.

The project should have monitored the following irrigation-related diseases:

1. schistosomiasis;
2. guinea worm;
3. dracunculiasis;
4. malaria;
5. filariasis;
6. yellow fever.

B. Exact monitoring was impossible, given the lack of diagnistic capacity in the project zone and the classification by which health statistics are kept for the Ministry of Health.

The only diseases which are believed to occur in the area are:

1. schistosomiasis;
2. malaria.

To monitor these diseases District Infirmaries' monthly health reports to the MOH were watched. At the individual level, all pilots and controls were asked if they had any symptoms of these two diseases. Their responses were analysed to see any increase in symptoms.

C. Reports of hematuria were down, of fever up.

According to Dispensary figures there was slightly less hematuria, which was taken as indicative of schistosomiasis,

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reported in 1990 than in 1987-89. A bit more--5% more cases--fever, symptomatic of malaria (as well as many other things) was reported in 1990 than in previous years.

According to surveyed responses of pilots and controls, by wadi, there is less hematuria and fever among all wadis except Boui, where one farmer (who has worked the last five years in a polder by the Lake, where schistosomiasis is prevalent) reports he now has hematuria, and Mangalma, where noone reported malaria-like symptoms in 1987 but 4 farmers had them in 1990. The overall decrease in hematuria among the surveyed population fits with the decrease in hematuria seen in the dispensary figures. The Dispensary figures also show a slight increase in fevers; in the survey population fevers decreased except at Mangalma. Mangalma fits with the overall trend and the rest of the wadis appear to be slightly healthier than in 1987. It would therefore appear that the changes in irrigation practices brought about by the project have not damaged the health status of the population involved.

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