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MID-TERM EVALUATION

OF

APPROPRIATE TECHNOLOGY INTERNATIONL

AFRICA REGION REPORT

CDIE WORKING PAPER NO. 61

by

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The views an interpretations expressed in this report are those of the authors and should not be attributed to the Agency for International Development.

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EXECUTIVE SUMMARY

A. Background

Appropriate Technology International (ATI) was created in 1977 by an act of the US Congress with the mandate to address the needs of the poor in developing countries by facilitating their access to and own capabilities to develop and utilize technologies appropriate to their resource endowments, e.g. labor using and capital saving, locally manufactured and easily maintained, etc. Under a Grant from the Agency for International Development (AID), ATI spent approximately 23.7 million dollars between 1977 and 1983. In 1983 the relationship changed and AID sought to gain closer cooperation with ATI in part because of a 1982 evaluation by AID which was critical of ATI's diffused operations all over the developing world. In particular, AID sought to redirect ATI's earlier program under the AID/ATI grant

ATI's current three-year Cooperative Agreement with AID was signed September 30, 1983. Its purpose was to strengthen ATI's capacity to facilitate the choice, development, transfer, adaptation, commercialization assessment and replication of technologies appropriate to the poor in developing countries. The Agreement provides for $16.5 million over three years, but this has been reduced to less than $4 million annually.

The Cooperative Agreement called for ATI to:

o Concentrate on a limited number of priority technical

fields;

- Support innovative, inherently risky activities with high potential for sustainability;

- Achieve a balance between technical and institutional aspects of appropriate technology promotion;

- Focus on small-scale enterprises and organizations providing services or support to these;

- Emphasize field activities in developing countries;

- Emphasize activities based on "hard" technologies; and

- Play a catalytic role in activities it supports, getting as much leverage as possible from limited amounts of resources.

ATI works through contracts to implementing organizations (IOs) which fund productive activities (PAs) and enterprises utilizing technologies in the priority technical fields of (1) agriculture products processing and utilization of agricultural wastes (APP), (2) local mineral resource development (LMR), (3) equipment and support for small farm (ESF), and (4) truly unique and special opportunities (TUO).

B. <u>The Mid-Term Evaluation</u>

The present report is one of three regional reports, which together with the main report present the findings and conclusions of a mid-term evaluation of ATI's performance under the Cooperative Agreement.

Each regional report is based on a field trip to ATI project sites, carried out in November 1985, and on discussions with ATI staff and the AID technical manager and senior management. The regional reports contribute to the main report which synthesizes and summarizes the findings and conclusions with the overall purpose to:

- Evaluate ATI's performance under the first 24 months of the Cooperative Agreement, i.e., through October, 1985;

- Determine lessons of broader significance to be learned from ATI's program about the technology transfer process and the promotion of small and medium-scale industry; and

- Analyze ATI's planning for and capability to carry out an increased program focus on replicating innovative elements of its successful projects.

The mid-term evaluation was designed around a concept of ATI field operations which examines the critical actors and links in the process of technology development and transfer from source to the technology

productive enterprises. The basic unit of analysis was the productive activities, and the central focus of the field studies was on the implementing organizations. As the evaluation is restricted to the 24 months of ATI operations since the signing of the cooperative agreement, it is too early for many of the productive activities to have established commercial viability, but nonetheless, the team evaluated the original assessment of commercial viability and the market for the technologies and products.

The overall seven-person evaluation team met together for pre- and post-field work discussions but split into three groups to visit projects in each of Africa, Asia, and Latin America. The present evaluation report is that of the two members of the Africa sub-team and concentrates on the three countries that they visited--Botswana, Tanzania, and Kenya.

As of November 1985, the ATI Africa program consisted of 14 projects started under the Cooperative Agreement in six countries. The Evaluation Team visited nine of these projects. The projects each centered around a hard technology. The priority technical field of local mineral resources was well represented: a limeyard project in Botswana, brickyard upgrading and improvements using manually operated brick presses and clay crushers and a modified kiln design, and rural potteries upgrading through fire brick and glaze production in Tanzania. The Ceramic-Lined Jikos Project is disseminating an improved charcoal burning woodstove -- ATI's interest is in the dispersed

manufacture of the ceramic liner to a sufficient quality. Because of earlier funding under the Grant which assisted in the development of the improved cookstove, it is considered to be a replication project.

ATI has three projects in the agricultural products processing technical field. Two in Tanzania have exciting possibilities for villagers growing sunflower to capture the value added from pressing the oilseeds with a manually operated oil press. The Evaluation and Technology Development Group of ATI contributed to technology development process by designing and testing a continuous process press which is an alternative to the Tanzania generated design. As both will be disseminated under the projects, the spread of the pressing technology should provide valuable lessons. A project in Botswana is promoting grapple processing. Grapple is a desert plant whose roots have medicinal properties. The project will challenge European firms who process the exported root by introducing local processing in rural villages.

C. Summary Conclusions and Recommendations

1. ATI's Africa region program experiments with unproven technologies, and risky markets

- The project portfolio and priority technical fields could be more representative at the sub-regional level.

Recommendation: ATI should strive for a representative set of projects in each subregion, if not each country.

- The technologies promoted in ATI projects are in various developmental stages. ATI is taking necessary risks with technologies that are unproven, but promise a high return. The amount of time necessary to develop and test prototypes is underestimated and projects schedules are not always realistic. While the program shows a sensitivity to social, cultural, and ecological requirements, the soft technology aspects of technological change were slighted in several projects.

  Recommendations: ATI should cross check the initial status of the technologies, and schedule go, no-go decision points for the project, i.e. ATI needs to take a more contingent approach to commercialization of an untried technology. Project designs should take into account socio-technical aspects of change.

- Markets and the commercial viability of projects have been assessed, but the task is difficult. Technologies are promoted where the market is yet to be established and implementing organizations have not always responded to changing economic circumstances, despite ATI's efforts.

Recommendation: More effort is needed to develop a consistent market assessment methodology and its application to the planning process, including transfer of this technological skill to implementing organizations and productive enterprises. Follow on projects with the same IO should wait for evidence that the IO has mastered the skills and has the will to apply them.

2. ATI Africa projects aim at helping the rural poor and small-scale enterprises but the impact can not yet be estimated

Recommendation: ATI needs to study the extension capabilities of the IOs and adjust the project design for clearer responsibility for outreach.

3. ATI Africa field operations are understaffed

o The increased Africa program demands (closing down Grant projects, monitoring Cooperative Agreement projects and new project development) on the ATI project Officers have not been matched by staff position increases. The Africa region is understaffed relative to the funding targets. The scarcity of management skills in IOs argues for smaller, more manageable projects which are easier to supervise.

Recommendation: The funding targets for the Africa region should be matched to the staff available. ATI should develop smaller projects, but not more of them without additional staff.

4. ATI Project Officers background, interests and working styles result in different outcomes for ATI's Africa program

- The institutionally-oriented operating style emphasizes building in-country capability to open up a broad range of productive activities. Judgement of institutional capabilities of the IOs is therefore crucial.

- The entrepreneur-oriented operating style emphasizes achieving results directly from productive enterprises. By establishing direct links with an established firm, it shortcuts institutional and bureaucratic channels. ATI's potential leverage to replicate the project can be reduced when the proprietary interests are not resolved.

- The different approaches could complement each other.

Recommendation: ATi field operations could benefit from blending of styles through more joint work of project officers. Backstopping from ATI headquarters which can provide greater consistency of approach should be improved as

staff positions are filled.

5. Feedback from ATI's Africa program to headquarters is inconsistent and should be rationalized

o The key mode of feedback, briefings by Project officers returning from the field are not structured around a consistent check list of issues directly comparable across projects. A reliance on ad hoc feedback increases the vulnerability of ATI field operations to interpersonal vagaries. Progress reports each quarter are probably unnecessarily frequent for the pace of African development projects and burdensome to small organizations and enterprises. The Project Monitoring and Evaluation System (PMES) has yet to prove its usefulness.

Recommendations: ATI should examine its own management guidelines and information flows, beginning with a common checklist of key project implementation concerns, and together with AID, rationalize the reporting system to meet ATI's requirements. The PMES needs careful review and clarification of its objectives.

D. Overall Conclusions on the Africa Program

The Africa program as seen by the Evaluation Team has several

exciting projects, dedicated hardworking staff with distinctive approaches and operating styles, and room for improvements. ATI is promoting appropriate technologies to help the poor, working with a variety of implementing organizations, and working directly and constructively with private enterprises. The progress since the signing of the Cooperative Agreement has been slowed by unfinished business from the Grant period, by inadequate numbers of staff, and by cumbersome reporting requirements.

ATI is seen by implementing organizations as a responsive and concerned funding mechanism. It is not seen as a strong organization for providing technical assistance. USAID missions in the three countries visited were mildly interested in ATI activities. In Tanzania, there was keen interest and a supportive staff and Mission Director.

ATI cooperates with the activities of ITDG in Africa and offers a healthy competition, especially with ATI's emphasis on commercially-viable activities for the poor and small-scale enterprises and ITDG's growing appreciation of the importance of promoting profit-making technologies.

Has ATI made a difference to the appropriate technology process in Africa? It has changed its operating style in constructive ways from the Grant period mode of assistance, but the significance of the changes and the consequences for the advancement of the appropriate

technology on a widespread scale for the benefit of the poor are yet to be determined.

I. OVERVIEW OF ATI'S INVOLVEMENT IN AFRICA

A. Funding and History of ATI's Africa Program

The aim of Appropriate Technology International (ATI), according to the Executive Director, is to put appropriate technology in the hands of the rural poor.[1] Africa, with its large rural population and relative poverty, has always been the focus of ATI's attention, both in number of countries in which ATI is involved and the number of projects. Presently, the Africa portfolio takes about half of the total projects (14 of 28) and about 43 percent of project funding, a total of $1.8 million. The average size of the project portfolio is about the same as in the Latin American region, about $131,000. This is a lot smaller than the average Asian portfolio size of $230,000 (refer to Table 1).

Prior to the cooperative agreement, ATI worked in seventeen countries, but had funded projects in only eight. Involvement in other countries was limited to exploratory missions and one mini-grant, (which had no intention of a follow-on). ATI's country concentration has shifted significantly since the Cooperative Agreement. It remains in only three of the original countries (Cameroon, Kenya and Mali) and has expanded to include four other countries (Botswana, Tanzania, Zaire and Zimbabwe.) Table 2 shows the changing program.

The reasons for withdrawal from these countries stems [redacted]

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[1]Meeting with the Mid-Term Evaluation Team, December 5, 1985

Table 1: List of ATI Projects in Africa

Country	Project Name	Implementing Organization[a]	Funding (000 US$)	Priority Technical Field[b]
Botswana	Brick Production	SRDA/MHT	90.4	LMR
	Lime Production	SRDA/MHT	95.0	LMR
	Animal-Driven Pumps	KIP/RIIC	108.0	ESF
	Grapple Processing	TL	37.1	APP
Cameroon	Oil Extraction Units	APICA	304.3	APP
	Anguh Maize Mills	APICA	157.6	APP
Kenya	Ceramic-Lined Jikos	KENGO	249.0	LMR
Mali	Biogas Refrigeration	GRAT	11.5	APP
	Shea Nut Butter	CEPAZE	52.1	APP
Tanzania	Oil Press Production	CAMARTEC	112.3	APP
	Rural Potteries	CAMARTEC	97.5	LMR
	Improved Bricks	CAMARTEC	156.5	LMR
	Village Oil Press	LWR/ELCT	42.7	APP
Zimbabwe	Agro-Industries	SP/FEP	223.5	APP
Total Funding Since Cooperative Agreement			1,800.0	
Average Funding Level			131.0	

[a]See Glossary for names of Implementing Organizations.

[b]Priority Technical Fields: APP = Agricultural products processing and the utilization of agricultural wastes; ESF = Equipment and support for small farms; LMR = Local mineral resource development.

Table 2: Countries of ATI Operations in Africa, Past and Present

PRE COOP. AGREEMENT	SINCE COOP. AGREEMENT
9/78 - 9/83	10/83 - Present
Cameroon	Botswana
Kenya	Cameroon
Lesotho	Kenya
Malawi	Mali
Mali	Tanzania
Sierra Leone	Zaire
Swaziland	Zimbabwe
Togo	
Exploratory Missions	Exploratory Missions
Botswana	Gambia
Burkina Faso	Mauritius
Mauritius	Senegal
Niger	
Senegal	
Tanzania	
Zambia	
Mini-Grant	
Somalia	

Source: Cathy Forte.

partly from problems associated with the projects in those countries. For example, the project in Lesotho started under the Grant, was envisioned to be a six-month project but has run for five years. Along with many time delays, the Africa Regional Manager felt that the Country has few institutions that are capable of implementing a project which are not already being heavily funded. The program in Malawi is being shut down because of too much government interference.[2]

B. Staffing the Africa Field Operation

As of November 1985, three ATI staff work in Africa, each covering one of the following areas: Southern Africa, East Africa and West Africa. The East Africa region presently includes Zaire, Tanzania and Kenya as project countries. Southern Africa has Zimbabwe, Malawi and Botswana. West Africa has Cameroon and Mali. Because of the large number of projects in this region, ATI plans to add an additional staff member early in 1986, mainly to assist in implementing the replication strategy amendment to the Cooperative Agreement with AID.

The staff assigned to the region includes the Regional Manager with a background in economics and AID Project Officer experience, and who has been with ATI since 1980; a pottery expert with extensive small business experience in East Africa with ATI since early 1984; and a regional planner who joined ATI in 1985 after working for AID. An

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[2]AID has carried out a country study of the private sector in Malawi which supports this view. See PPC/CDIE Special Study No. ___.

administrative officer is also assigned to the Africa region and has been with ATI since 1982.

C. Priority Technical Fields

The Africa portfolio covers the three main priority technical fields as shown in Table 1. Eight projects are in the field of agricultural products processing and utilization of agricultural wastes (APP); the Mid-Term Evaluation Team visited three of these projects. Five projects are in the priority technical field of local mineral resource technologies (LMR); the Evaluation Team visited all of these projects. One project is in the field of equipment and support for small farms (ESF) and was visited by the Team in Botswana.

II. FIELD OPERATIONS IN BOTSWANA

A. Overview of ATI's Planning and Field Operations in Botswana

1. History and staffing - a profile of the Project Officer's role

ATI now has four projects in Botswana with three implementing organizations. The projects cover all the priority areas under the Cooperative Agreement and its amendments. The first project was initiated at the time of the negotiations between ATI and AID on the Cooperative Agreement, and started October 1, 1983 as the first "new" project.

ATI's Director of Field Operations worked in Botswana for over 10 years and the country's development concerns and institutional capabilities are thus well known to ATI senior management. Although the ATI Project Officer had visited Botswana on an exploratory mission in 1981, it was not until 1983 that the ATI project cycle began in earnest.

ATI's field operations in Botswana consist of monitoring existing projects, developing new projects and exploring interesting ideas for new projects. The Project Officer for Botswana is also the Africa Regional Manager, which has limited the amount of time devoted to managing the regional project portfolio.

The Project Officer for Botswana visits this country about three times a year. She supervises the four on-going projects, a small

grant, and keeps alert for new project opportunities. On her recent trip to Africa, the Project Officer spent about 12 days of the 34-day trip, over 35 percent of her time, on project development. The remaining 21 days, or 65 percent of her time was spent on project monitoring.

In-country work involves consulting with a variety of institutional contacts as well as entrepreneurs seeking new venture funding. ATI is seen as one of many alternative sources of funding. In Botswana's relatively small international assistance community, knowledge of who has money and can move quickly circulates through the network of interested institutions, organizations and individuals.

The Project Officer develops new concepts as they are identified, a process which may take years of fieldwork. For example, the Project Officer is presently considering a groundnut processing proposal from a Botswana Church Group. On her last visit, she requested a written proposal from them, and will await any further action for project development until the organization puts their thoughts on paper.

The judgement of the Project Officer is a critical factor in the ATI project cycle from the concept through supervision to successful conclusions of project productive activities, i.e., commercialization of the technology. Major tasks are deciding which opportunities to pursue and which implementing organizations to work with identifying qualified institutions to provide feasibility studies on the technology

and market and evaluating institutional capacity.

The ATI Project Officer realizes the need to call on expert sources of opinion and will call in additional talent to supplement her own judgement. In the case of Botswana projects, ATI's in-house technical expertise has been used. Four individuals from ATI, not including the Project Officer, have each visited Botswana projects once or twice in the last three years to provide their expertise: ATI's lime kiln expert, the Eastern Africa Project Officer who provided technical expertise on the brick kiln, a business specialist, and staff from the monitoring and evaluation unit. (See Table 3.)

2. <u>The Botswana Projects</u>

The ATI mechanism for funding projects is through a contract to the IO with a budget and project plan geared around a particular technology.

ATI's four projects are being carried out by three implementing organizations in Botswana, as follows:

- Southern Rural Development Association (SRDA): Upgrading Small-Scale Brick Making, project no. 84-0058; Local Lime Production, project no. 84-680;

- Rural Industries Promotions (RIP): Animal Driven Pump,

Table 3: ATI Field Visits to Botswana

February 1983:	Fort (ADP)
July 1983:	Fort (ADP and MHT) C. Lola (MHT bricks and lime)
November 1983:	Fort (bricks and Thusano Lefatsheng)
March 1984:	Fort (bricks and Thusano Lefatsheng) H. Aller (bricks)
July 1984:	Fort (lime and grapple) C. Lola (lime)
November 1984:	Fort (lime and grapple) T. Cor 1 (PMES and data collection systems)
March 1985:	Fort (Monitoring with project development)
July 1985:	Fort (Monitoring with project development) T. Cor 1 (PMES and data collection systems)
October - November 1985:	Fort (monitoring and project development) R. Strauss (MHT production records and project accounts) H. Allen (bricks)

project no. 84-02; and

- Thusano Lefatsheng: Grapple Processing, project no. 85-0001.

The Evaluation Team visited all four project sites and describe findings and conclusions in following sections of this Chapter, beginning with background on the implementing organizations (IO). The presentation is organized by IOs: descriptions and findings for each project's supported productive activities (PAs) are followed by the Evaluation Team's conclusions about the IOs capabilities and performance.

B. Description and Findings of IOs and Projects in Botswana

1. SRDA/MHT: Description and findings

SRDA is the implementing organization for two ATI projects, Upgrading Small Scale Brick Making, and Local Lime Production. Tables 4 and 5 summarize the two projects.

a. History and funding

The Minerals Holding Trust (MHT) is a development trust wholly owned by the Southern Rural Development Association (SRDA). Although the organizations have separate Boards of Directors, there is

Table 4: Botswana: Upgrading Small-Scale Brick Making Project Summary

Region: Africa

Project No.: 84-0058

Country:	Botswana
Location of Project:	Kanye
Name of Project:	Upgrading Small-Scale Brick Making
Implementing Organization (IO):	Southern Rural Development Association, Minerals Holding Trust (SRDA/MHT)
Productive Activity:	Same as IO
Starting Date of Project:	July 1, 1984
Number of Months Elapsed at Time of Evaluation:	16 months
Scheduled End of Project Date:	June 30, 1987
Total Funding:	$90,400
Purpose of Project:	To establish two small-scale brickyards to produce high quality bricks that are less expensive than imported bricks and within the means of low income people.
Description of Technologies:	The central technologies are a hand-operated, low moisture brick press and a continuous firing kiln. Other production technology changes include alterations in each step of brick production.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

Table 5: Local Lime Production Project Summary

Region: Africa

Project No.: 84-680

Country:	Botswana
Location of Project:	Kanye
Name of Project:	Local Lime Production
Implementing Organization (IO):	Southern Rural Development Association, Minerals Holding Trust (SRDA/MHT)
Productive Activity:	Same as IO
Starting Date of Project:	February 1, 1985
Number of Months Elapsed at Time of Evaluation:	9 Months
Scheduled End of Project Date:	December 31, 1987
Total Funding:	$95,000
Purpose of Project:	To establish a small-scale lime yard that produces a high quality product, to develop lime-based products for new small industries, and provide technical, financial and marketing assistance to establish other lime yards.
Description of Technologies:	The project will use a modified version of an Indian designed, mixed feed, vertical shaft kiln together with a slaking platform to produce high quality lime.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

very little distinction between MHT and SRDA. MHT is the grantee for the brickyard project, but funding is given to SRDA to be passed to MHT. At the time of the evaluation, MHT was in effect being run directly by the management of SRDA and its office in Kayne had been closed. It is not known how long this status will continue. The Evaluation Team was unable to meet with the Administrator of the MHT who was in Holland for short-term training. Day-to-day operations of the MHT enterprises (lime, cement, and brick production) were under the direct supervision of SRDA management.

MHT's primary objective "is to organize rural people into commercially viable units which produce building materials and industrial minerals for sale on the local market. These enterprises include the production of clay bricks, and the mining and processing of lime, slate, and pigments."[1] Approximately 325 people are employed in MHT activities in gathering, transporting and processing materials. SRDA has similar objectives of establishing production units which will develop into independent businesses, but their activities are more diverse. They include: shoe production, cement, crafts, sorghum mill, tannery and a hardware store. The Evaluation Team visited the shoe factory and cement plant and found both to be on very small scale operations.

SRDA was founded by the Frederick Ebert Foundation (FEF), which continues to substantially fund the organization. Support from CUSO, a

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[1]Brick Making Project Plan, p. 6.

Canadian agency, the Dutch government and USAID have supplied assistance to MHT since its inception in 1982. Over the past five or six years FEF has provided approximately P 800,000[2] to SRDA, and continues to provide 60 percent of all administrative and overhead costs for SRDA.[3]

During the 1984/5 year SRDA received a total of P 153,500 (US$ 75,200). The majority was received from FEF, which supplied P 90,000 or 58 percent. ATI provided another P 39,500 (or 26 percent) and other sources including Bread for the World and UNDP supplied P 24,000. FEF also provides two full-time technical advisors.

b. Management and overview of current activities

MHT and SRDA manage production activities in each of the above mentioned areas. They design activities, seek funding for their implementation, and aim to "decentralize" the activities once they reach commercial viability. SRDA's stated objective of "decentralization" is to develop activities which are autonomous from MHT/SRDA: i.e., capable of sustaining production activities with their own management, organization and funding. SRDA believes it can use two means to divest itself of ownership of these enterprises once they become viable: a sale of shares to workers of the production activity or sale of the activities to entrepreneurs.

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[2] 1 Pula = US$ 0.63. Nov., 1985.

[3] Khadar, Review of SRDA Financial Operations, 1985.

Most SRDA activities are not commercially viable. Of the ten SRDA/MHT activity categories (brickyard, stone crushing, hardware, etc.) only one activity made a profit: cement. A profit of P 1,500 was made on sales of P 23,000. The brickyard and one other activity just about broke even. All other activities suffered losses, some quite significant. Accumulated losses for the year totaled P 40,000. The three primary reasons for the high losses on production units given by the consultant hired to review SRDA financial records were (1) poor or no marketing strategy, (2) pricing of goods with no relation to cost of production or market prices, and (3) theft by SRDA/MHT employees. Although theft did not significantly affect the brickyard project, one brickyard worker was reportedly fired for theft of approximately P 200 of materials.[4]

c. Resources committed to ATI-funded activities

SRDA is financially committed to the brickyard project, and willing to commit its own resources to keep the project going, if necessary. ATI support for the project is P 96,100 (US$ 47,100), which includes support for upgrading the present brickyard, and construction of another yard. The budget for the project, expenditures on brickyard improvements and ATI and SRDA expenses are listed in Table 6.

Although the financial records for SRDA are under review, SRDA

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[4]Khadar, Consultant to SRDA.

Table 6: Botswana: Brick Yard Budget and Expenditures

	ATI Budget	ATI Funds Spent	SRDA Resources	Total Spent[a]
Moshenang Brick Yard	26.5	22.4	16.1	38.6
New Brick Yard	57.5	.3	0	.3
Project Management	12.1	7.1	0	0
Total	96.1	29.8	16.1	38.9

[a]SRDA = Southern Rural Development Association.

estimates that P 38,600 was spent for the brickyard. The cost for constructing the new brick kiln pushed the project over its "major category" limit by P 16,100. The ATI Project Officer discussed with SRDA management that project resources from other line items in the brickyard project could be allocated to cover the brick kiln cost overrun. Instead of taking advantage of this offer, SRDA management volunteered to pay for the cost overruns, presumably drawing on FEF resources. SRDA estimates that the cost of construction can be reduced by at least 30 percent, as indicated in Table 7.

SRDA has two projects with ATI, the brickyard project and a lime kiln project. Because of misallocation of funds by SRDA between project accounts, ATI stopped all allocation of funds to the organization until the accounts are put in order (See Chapter IIB3). Nevertheless, SRDA's financial commitment to the project is demonstrated by the willingness of SRDA to continue funding the project from their own resources, until the matter is settled, or other resources are secured.

Human resources devoted to the project by SRDA include all labor provided by the brickyard, as the project funding does not cover salaries. The budget included a salary for a project manager but this was used for technical assistance for laboratory work. Project management assistance is estimated at 5 percent of the FEF Technical

Table 7: COST OF BRICK KILN, BOTSWANA

	FIRST KILN	NEXT KILM
GROUND PREPARATION		
LABOR (15 WORKERS; 6 WKS; P 4.75/DAY)*	2138	500
CONCRETE FLOOR & MORTOR		
LABOR (15 WORKERS; 2 WKS; P 4.75/DAY)*	713	350
MATERIAL - CEMENT	1200	1200
SAND	1200	1200
CRUSHED STONE	900	900
REINFORCING WIRE	2500	2500
BRICKS		
LABOR - FOREMAN (1; 5.5 MO; P 600/MO)*	3300	3300
MORTAR PREP (4 WORKERS;3 DAY; P 4.75)/DAY*	57	60
BRICK LAYING (10 WORKERS; 22 WKS; P 4.75)/DAY*	5225	2600
MATERIAL (60,000 BRICKS; P 59/1000)	2950	3000
CHIMNEY		
LABOR (13 DAYS; OUTSIDE HELP)**	1100	700
MATERIAL	200	150
ROOF		
LABOR (6 WORKERS; 2 WKS; P 4.75)/DAY	285	150
MATERIAL	3000	1200
TOTAL COST	24767	
COST, NEXT KILM		17310

* Estimated Cost of Kiln Built for ATI Project at Moshenay Brickyards

** Estimated Cost of any Future Kilns

Advisor's time,[5] and technical assistance to the project is estimated at 35 percent of another staff member's time. Unfortunately, as the MHT technical advisor, an Indian National, was seriously injured in January 1985, little technical assistance has been provided to the project. No one qualified in kiln operation or brickyard production has been involved with the project since the accident of the technical advisor, except that provided by ATI.

2. Description and findings of SRDA projects

a. Upgrading small-scale brick making, project no.84-0058

The Evaluation Team examined each project with an informal checklist pointing to aspects which could be compared and contrasted across projects in the overall conclusions. This report thus describes the Team's findings about the projects' (1) purpose and objectives, (2) the actors and intermediary organizations involved in the technology development, transfer and utilization (3) the technologies and innovations involved in the project (4) the progress to plan, (5) the apparent or assessed commercial viability of the productive enterprises, and the (6) likely impacts on the projects' targeted beneficiaries. The report attempts to separate findings from conclusions, and the latter are summarized for the IO and productive enterprises after these following sections describing each project.

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[5]The FEF Technical Advisor plays a leading role in SRDA's strategic and day-to-day management.

(1) Purpose and Objective of the Brickyard Project

The purpose of the project as described in the Project Plan of May 30, 1984, is "to demonstrate that commercially viable small scale brick making yards can be established to produce a high quality brick which is (1) half the price of an imported brick and (2) within the means of low income people to afford."[6] The objectives of the project as described in the Project Plan are to: double the supply of low cost building materials, increase the local value added from the brickyard operation, and realize foreign exchange savings by substituting locally-produced bricks for imported bricks.[7]

The plan proposed to upgrade an existing brickyard at the village of Moshenang near the town of Kanye in Southern Botswana, and then in a second phase to capitalize on the technological and production experience thus gained to open a new brickyard at Ntlhantlhe.

The project had a further objective to demonstrate that "locally owned and operated small industries in the mining and minerals sector can be established which are commercially viable,and at the same time, offer employment and income opportunities to poor people living in the rural areas."[8] The replication potential of the MHT-type

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[6]Project Plan, p.1

[7]Ibid., p.19

[8]Page 15.

brickyard was thus to be "demonstrated by the readiness of local financial institutions to invest in similar enterprises."[9]

(2) Description of the enterprises involved in implementing the productive activities

As noted above, there is little distinction between MHT which runs the brickyard and the SRDA which holds the contract with ATI. (See IIB1.)

(3) Description of the technologies

The Moshenang Brickyard technology and organization for production in 1983 differed little except in scale from the very small "backyard" operations producing poor quality bricks fired by small field clamps. Bricks are stacked with spacing for air and coal, then the pile is covered with dirt and fired. The result is very uneven and extremely slow firing of the bricks. The Evaluation Team found many capital improvements to the Moshenang Brickyard in November 1985. The change in technologies represented by these improvements are briefly described in Table 8. The Table presents the prior technology as part of the production sequence, and the new technology which supplements or replaced it. Slop molding of bricks has been improved, but not altogether replaced by brick presses.

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[9]Page 21.

Table 8: A Summary of the Changes in the Brickyard Production Technologies

Step in Process	Old Technology	Changes in Place, November 85	Planned changes
1. Digging clays	taken from yard by wheelbarrow	experimenting with Quira Qwa high quality clays	pay transport for Quira Qwa only if used 100%
2. Stockpiling clay	not done	no change	two week supply
3. Coal supply	lumps which must be broken	scrounging for coal dust (no credit at present)	pay account to restore supply
4. Soaking pit	unlined requires 8 people	concrete lined reduce to 6 people	not necessary if use all brick presses
5. Molding bricks			
a. Slop molding	wooden molds	metal trays from RIIC workshop[1]	replace with presses in stages
b. Brick pressing	slop molding only (no presses)	2 people pressing 250 bricks/day	4 people with changed workflow pressing 1500/day; incentive pay
6. Drying			
a. Slop molded bricks	One shed, open sided, drying for 8 days; overflowing space with low stacks	dry 2 days flat, 1 day erect in 2 sheds with low walls	ATI recommended stacking arrangement to save space
b. Pressed bricks	none	stacking 20 high to roof	use cart to transport new concrete floor to ease material handling, pressed bricks direct to kiln for loading

Table 8: A Summary of the Changes in the Brickyard Production Technologies (cont.)

Step in Process	Old Technology	Changes in Place, November 85	Planned changes
8. Firing bricks	field clamp with 30,000 bricks, 20% wastage	new kiln fired like a field clamp with 80,000 bricks	kiln properly fired 12 cycles per year 6% wastage
9. Loading and unloading kiln	wheelbarrows	experimenting with new wheelbarrows	unloading while firing kiln at far end
10. kiln operation (firing efficiency)	did not exist	no stoking holes in chimneys (construction error)	chimneys to be corrected and stoking fires used
11. grading and sorting fired bricks	over and under-firing from field clamps	no changes (underfired bricks refired)	misfirings should be greatly reduced by new kiln
12. testing	GOB Minerals Testing Service 40 kms away	on site experimentation ended with accident	no plans

[1]The Rural Industries Innovation Center (RIIC) in Kanye fabricated new metal trays. RIIC is implementing ATI's Animal Driven Pump Project.

Source: Project Plan, interviews with SRDA and MHT Brickyard staff, and ATI PO for East Africa, November 1985.

Three aspects of the technological changes introduced by the ATI project require further comment, as they indicate how deviations from Project Plans arise as a result of changes initiated in the early phases. These are: (1) the experimentation with raw material mixes, (2) the substitution of the planned ITDG-type brick press by an apparently better model, and (3) the innovations in the kiln design and operations. As often happens, a small investment leads to unforeseen problems and unexpected opportunities for productivity and quality improvements.

By chance, the Project Manager's wife was a qualified ceramics expert and ATI took advantage of this to build a simple laboratory facility adjacent to their residence. Her experiments led to the removal of ash from the clay mixture which eliminated the need to purchase of machinery to process the ash into a finer mixture. The discovery and testing of Qwa Qwa clay with superior properties led to immediate improvements in the slop molded bricks,and potentially significant improvements in pressed bricks possibly made 100 percent from the clay.

After the project began, ATI recommended the substitution of the Belgian made Tersatam Brick Press for the proposed ITDG model. It costs half as much and doubles the output. The funds intended for coal preparation machinery were then allocated to purchasing two brick presses. As it turns out from the Evaluation Team's findings (see Commercial analysis below), it may be necessary to purchase four such

presses (two additional) in order to fill two thirds of the kiln's monthly capacity. Effective utilization of the presses, however, will require redesign of the materials handling, and perhaps introduction of piece work incentives, as outlined by ATI's Eastern Africa Project Officer, a kiln expert, on a visit to the brickyard November 1985.[10]

The characteristics of pressed bricks permits them to be stacked immediately from the press or to be moved directly to the kiln. As a result, less drying area is required. Carting the bricks away from the press can be improved with specially designed carts rolling on a concrete shed floor. In other words, one incremental technological change leads to a series of other production flow-work place changes in order to capture the full productivity benefits.

(4) Progress to plan

The project started in July 1984 and thus in November 1985, it was nearly halfway through its life of 36 months, but about one year behind schedule. According to the timetable of activities and outputs, the first phase of the project, the upgrading of the Moshenang brickyard was to be completed by the last quarter of 1985. A number of physical improvements were made to the brickyard including the construction of walls around the old drying sheds, a new drying shed, new pits, and the installation of fencing around the brickyard, as well as numerous technological improvements. (See Table 8.)

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[10]Hugh Allen Memorandum to Cathy Forte, November 1, 1985.

A central component of the improved brickyard is the construction of a new kiln based on different operating principles. According to SRDA management, the construction of the kiln should take six weeks, but took six months. As a consequence, the kiln--to have been completed by December 1984, was just completing its first firing at the time of the Evaluation Team's visit in November 1985.

There are a number of reasons for the delay: the design of the kiln was not constructed on schedule, blasting to remove rocks caused damage to nearby buildings, subsequently requiring repairs. The kiln was over-designed with excessive number of buttresses and to massive a roof structure (according to ATI technical expertise). The construction force, drawn from the brickyard laborers was "slow and unproductive" according to SRDA management.

An unrealistic project design also slowed progress. The Project Plan assumed a production level from technological changes which would be near theoretical production output. For example, the plan estimated output of the brick presses close to the 3 200-brick per day capacity, rather than the 400-brick output presently being achieved.

Objectives set in the Project Plan were based on erroneous information of present brickyard production. Although output at he brickyard was estimated at 4,000 bricks daily in the Project Plan,

actual production is estimated by the foreman at about 2,000 bricks. The Evaluation Team is not aware of a significant decline in production which would explain the discrepancy. Consequently, the project target of doubling capacity to 8,000 daily output is actually a goal of quadrupling production output to 168,000 bricks per month. This was unrealistic and not technically possible based on the capacity of the kiln, according to ATI technical expertise. Furthermore, to reach the revised target plan of 120,000 bricks per month[11] will require the staff to work seven days a week to support the continuously firing kiln. This revised target of 120,000 bricks per month equates to a daily production output of 5,700, based on a 21-day work month.

A number of constraints still must be overcome for the project to meet its revised target. These include lack of managerial talent to oversee operations, lack of technically qualified staff to efficiently utilize existing technology, and low labor productivity. Unless these three constraints are removed, the project is likely to not progress according to the Project Plan.

The second phase of the project, to open a new brickyard, has not started due to delays in the first phase as well as a problem that developed over poor quality clay at the intended location of the second brickyard. The project IO will have to investigate further for a suitable site.

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[11] Ibid.

A member of ATI's Evaluation and Technology Development Group visited the project in July 1985, and he noted that many of the problems and delays in progress are due to poor management and the absence of a technical advisor. The Evaluation Team found the situation little changed during its visit in November 1985.

(5) Commercial viability

Three elements need to be present for the brickyard to be viable: (1) There must be demand for the quality bricks produced by the brickyard, (2) the brickyard needs to be able to meet this demand; and, (3) the brickyard must make the bricks at a competitive price.

In preparation for the Project Plan, a former staff member of SRDA examined the local market for bricks and estimated that a potential market "of at least 10 million bricks over the next several years" exists for the Moshenang Brickyard.[12] The Moshenang Brickyard can produce 1.44 million bricks per year at full capacity. Assuming the second brickyard has the same capacity, these two brickyards would produce 2.88 million bricks per year. If "several years" in the analysis is interpreted to mean three to four years, then the two brickyards would meet all the demand.

A number of major assumptions stated in the summary of the

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[12]Project Plan, Appendix 5.

market surveys are questionable, e.g. self-housing starts will purchase bricks instead of the common practice of owner-builder making their own, the price of bricks will remain competitive with concrete blocks, government-sponsored low and middle income housing starts will purchase bricks. Overall, the demand for high quality bricks around the Moshenang area is substantial. Although the Moshenang Brickyard sells all the bricks it presently produces, the volume is not great. If production is quadrupled, according to project's planned targets, will the brickyard be able to sell all the bricks produced? Will the management have someone to focus on marketing? What will be the effect of the reported plans[13] to establish a new brickyard in proximity to Moshenang which will produce five million bricks per year? Will Moshenang still be able to sell its bricks?

One issue which the Evaluation Team examined in greater detail is the profitability of the brickyard, considering its present costs of production and likely future output (see Annex 4). Detailed analysis was undertaken on the current cost of production which estimates that the brickyard just about breaks even, having only a monthly profit of 16 pula (approximately $7) (see Annex Table 4-1). This marginal profit coincides with the marginal profit noted in the financial statement for the brickyard prepared by SRDA's accounting consultant.

With increased output, use of two high pressure presses, the sale

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[13]Interviews with BTC and Ministry of Local Government Mineral Resources experts.

of the bricks at 80 pula/1,000, and production at 100 percent capacity, the brickyard makes a profit of 19 percent of sales, or 1,421 pula per month. The brickyard breaks even at _____ capacity utilization (see Annex 4, Table 4-2). This high level of production, relative to past performance will require substantial management changes at the brickyard.

(6) Impact on target population

The project was intended to have three impacts: (1) provide low income housing materials, (2) increase local value added of P70,000, and (3) produce foreign exchange savings to exceed P 90,000 per year.

At the time of the evaluation, the project had just produced its first load of high quality bricks. A price had not been established for the bricks. The bricks would go into government-supported low income housing only if the price was competitive with concrete. Considering the cost of production, it is likely that the brickyard will need to sell the bricks above the present P 60 per 1000, a price which competes favorably with concrete bricks for construction.

Using the Evaluation Team's estimated production cost and sales volume of total sales from both the improved Mosheneng and new brickyards would not exceed 35,000 pula annually. Thus the value added is less than half of the originally estimated project benefit of

P 70,000 and the projected foreign exchange savings would not be realized.

b. Local lime production, project no. 84-680

Local Lime Production is the second project with SRDA as the IO, production and with the MHT carrying out the productive activity. Table 5 summarizes the project.

(1) Project purpose

The project purpose is to create a lime producing sector in Botswana using three steps. First to create one lime yard, then provide technical, financial and marketing assistance to establish other lime yards, as well as to create lime products which would stir greater demand for lime production activities.

(2) Description of organizations implementing the productive activity

SRDA/MHT has recently stopped producing lime at its lime yard near Moshenang, which was the only source of quicklime and hydrated lime in the country.[14] The lime was third rate, and produced from a kiln with a two ton per day capacity.

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[14]Project Plan. pg. 6.

Technical expertise for the ATI project has largely consisted of the SRDA Technical Advisor's reference to books on lime kiln construction.[15] Additional assistance has been received from a UNIDO Technical Expert who suggested using stones for the kiln lining.

(3) Description of technologies used in the Local Lime Project

The project design includes both "hard" and soft" technologies. Six basic steps are involved in the planned lime production at Segeng:

- Collecting limestone by villagers using baskets, donkey carts, bicycles, etc.;
- Crushing limestone in a ball mill;
- Charging the kiln by hoisting the limestone with a pulley system located on an adjacent tower with a walkway to the kiln chimney opening;
- Burning the limestone in the coal fired kiln;
- Slaking the lime in a water tight basin; and

[15]Discussions with Mr. Boehmer.

- Screening and bagging the lime.

The major hard technology of the ATI project is a new design of a lime kiln which is expected to double the capacity of the existing kiln at Mosheneng. Technology changes in the design include an increased diameter which theoretically doubles the kiln's output, and a simple pulley system to raise lime stone into the kiln, due to the flat terrain at the project site.[16]

As the kiln was being constructed, other changes were made rather arbitrarily, e.g., increasing the height, lining the inside of the kiln with stones instead of firebricks, and erecting a large tower-storehouse to provide a structure for raising ground level to the top of the kiln. The design of the kiln and lime yard had not been established prior to construction, and it was altered as SRDA's Technical Advisor obtained new information and advice.

"Soft technologies" in this project are:

- The development of a package of services to be offered to individuals to start lime yards; and

- The institutional development of SRDA in the process to "disseminate technologies and production processes used in

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[16]The existing kiln is built into a hill, providing a natural ramp for loading the kiln.

the manufacturing of lime and lime-based products so that small-scale lime industries ... can be established.

(4) Progress to plan

The project was approved in February 1985. By December 1985, the project was to have prepared the Segeng lime yard site, constructed an office/store room, constructed two kilns and a slaking platform. By November 1985, all of this has been accomplished except only one kiln was constructed. The second phase of developing limestone products is to start in 1986, and the third phase of disseminating the production technologies to other sites is scheduled for the last two quarters of the project in 1987.

(5) Commercial viability

The ATI Project Officer undertook a commercial analysis of the existing lime yard, projections for the new lime yard, and the cost of replicating the project at another site under two different scenarios. Detailed calculations were made for cost of production, variable and fixed costs, gross margin, break even point in production units, and as a percentage of capacity. The enterprises financial rate of return, and net present value were also estimated.

The Evaluation Team did not recalculate these analyses, but examined the major assumptions. A major assumption is that the lime

production technology is set and ready for replication. MHT operated a kiln built into a hill, the new kiln will require a substantial change in work organization to hoist the limestone on the pulley system. The kiln has been located and built without first drilling a water well at the remote site[17], which as of November 1985, still did not have an access road. The commercial analysis did not consider these factors adequately, if at all, though anyone may effect cost of production and economic sustainability.[18]

Underlying these concerns is a basic question about the technical operation of the kiln. The diameter and height and lining material have all been changed from previous designs, yet SRDA management is not skilled in lime production, and MHT technical management is missing altogether. The firing performance and organization for continuous production are untested. The project plan notes "the low break even point and high profitability projected at conservative levels of production for Segeng indicate that the risk of project failure is low" yet there are no conditions placed on the statement, reflecting a commercial analysis based on the ideal situation, with inadequate consideration of contingencies.

An assumption which directly concerns the replicability of this

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[17]However, a spring and abandoned basehole are several hundred yards away.

[18]Expense for labor and management in charging the kiln, expense of hauling water, if necessary, expense of transport over unimproved track or road inthe desert.

type of project is that "finance and technical know-how are available to potential lime yard operators to help them get started." At the same time, one of the project's objectives is to provide such a package, including finance and technology to potential lime yard operators. Why then is a component of the project, listed as an assumed condition?

Other questions effecting the commercial viability remain with the evaluation team, if the Moshenang lime yard was breaking even at half capacity, why did it close? If the demand is great for all grades of lime including low quality, why was it operating at half capacity?

(6) Impact on Target Population

It is to early in the project's history to note actual impact on the targeted population, or to evaluate the expected impact on the basis of performance. The project's planned impacts are job creation: 33 full-time, 44 part-time positions; capital formation in the range of P 26,000 to P48,000 annually, and foreign exchange savings of about P 163,000.

3. Analysis and conclusion on SRDA and its ATI projects

The conclusions on both ATI projects are discussed together since the same implementing organization manages the Brickyard and Lime Kiln projects.

a. Source of ideas

Ideas for these projects came from SRDA. The concept was developed into projects after the Project Officer had identified SRDA as an institution which "had a proven track record".[19]

The lime kiln project was the second project ATI developed with SRDA. The project was developed at the request of SRDA as the Association wanted to relocate its kiln operations to a site with good quality limestone in order to produce a quality product.

b. Capabilities of SRDA and MHT staff

The capability of SRDA to implement both the brick and lime kiln projects is presently very limited. It has neither the management capability to direct operations nor the technical expertise on board to oversee the implementation of new technologies. The technical manager for the brickyard, an Indian National Mr. Raj Shrestha, is not currently with the project due to a serious accident in January 1985. Although there were hopes he would return much sooner, it is anticipated he will return to the project in January 1986. Significant delays have occurred due to his absence. The individual in charge of the brickyard presently has no prior experience with bricks, but is an expatriate electrical engineer with experience

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[19]Discussion with ATI Project Officer, Cathy Fort.

in a mining company.

Without on-the-site technical assistance, the projects are bound to make start-up errors and miscalculations. There is a marked tendency on the part of SRDA staff to scale designs up, e.g., building capacity far beyond what is planned. The Evaluation Team relied on opinions of local experts at BTC and the visiting UNIDO Chief of Construction and Construction Materials. No one predicted failure. Nor was there any confidence that the project would proceed as ambitiously as the FEF Technical Advisor at SRDA has now planned.

The Evaluation Team believes that SRDA staff lacks the technical expertise to successfully implement the two projects and SRDA Management has been negligent to allow the projects to proceed without qualified technical guidance.

SRDA Management lacks a keen business sense. For example, SRDA has applied for a brick manufacturing license, but an official at the Ministry of Natural Resources indicated that he did not believe that SRDA had applied for an exploration permit on the clay sites in Labotse. As the clay site identified for the project proved to be unsuitable, SRDA/MHT might well have grabbed the opportunity to use the rich clay site at Labotse. The site is reported to be rich and extensive,[20] but not securing this clay site allows other potential brick manufacturers access to it. This is a very real possibility as

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[20]Rob _____, Botswana Development Corporation.

Botswana Development Corporation (BDC) is actively searching for a partner to explore these clay fields. Failure to move quickly when a "window of opportunity" such as this opens up may speak as well to SRDA's overall management orientation, which has various unprofitable enterprises (See Chapter IIB1b).

Managerial capability is also lacking in financial matters. ATI offered technical assistance to the project to establish better financial records and procedures. It was during the ATI Business Development Specialist's examination, that the misallocation of funds between accounts was discovered. As a result, ATI immediately cut off funds to the project until the books are put in order.

The Evaluation Team found the newly retained consultant to be qualified, experienced and capable of establishing a financial system which should meet the data needs of managing the brickyard as well as the financial reporting to ATI, provided there is a serious commitment by the management to use the system and run the activities on a financially remunerative basis.

c. Commitment to the ATI Project

SRDA receives over half of their funds from one secure source, the FEF, and reportedly the Technical Advisor has full discretion over their disbursement.[21] Thus SRDA has access to

[21]Conversation with FEF Technical Advisor at SRDA.

sufficient funds and is financially supporting the projects, even while the ATI funding has been suspended.

Staff time allocated to the project raises questions about commitment. The FEF Technical Advisor indicated that he devotes about 10 percent of his time, and the absent Indian Technical expert reportedly devoted about 15 percent of his time before his accident. The ATI Project Officer questioned their low estimate for the latter's contribution, because the levels of effort are too low for an undertaking requiring a great deal of management and technical guidance.

SRDA is willing to sustain the ATI projects by drawing on FEF resources, but the Evaluation Team saw little to indicate the necessary commitment to make the brickyard and lime kiln projects commercially viable and economically sustainable. Furthermore, SRDA has a history of implementing projects, with welfare and political objectives foremost, and thus routinely subsidizes project activities to achieve those objectives.

d. Risk

The project to improve the brickyard has risks associated with the marketability of the bricks (see following section). The lime kiln project is a promising but risky venture. If the kiln can produce high quality lime, then it should be profitable if

three areas of uncertainty are resolved: limestone collection, transport, and water supply. Transport and water supply uncertainties were raised in the Evaluation Team's assessment of commercial viability (Chapter IIB2c(5)). As for limestone collection, the project relies on villagers collecting surface stones and transporting it to the kiln. The Team has no evidence that this process will be sustained in the long term, although several piles of stones had already been collected by locals in anticipation of the kiln's operations. The doubled output of the kiln, i.e., four tons per day, suggests that other means of limestone supply will have to be used, if the limeyard runs near its capacity.

For ATI, the brick and lime kiln projects have become more risky because of the management deficiencies within SRDA and the lack of technical advisers. The challenge remains to obtain qualified staff to manage and provide technical assistance to the project.

e. Marketability

The demand for high quality bricks is strong in Botswana, which now has to import from South Africa. The questions are: Will SRDA be able to supply sufficient bricks to meet the market, will others capture the local market by first exploiting the Labotse clay yard? Can Moshenang Brickyard produce a brick profitably? General contractors order bricks in bulk and want an assured and reliable supplier to fill their orders.

There is a good chance that a significant proportion of the market could be captured within a few years by a large brick manufacturer located at nearby Labotse. Financial analysis of the brickyard operations indicate that a profit is possible, but only if there is much improved management resulting in (1) a significant change in labor productivity, (2) financial control with a profit orientation, and (3) development of a marketing strategy.

The Local Lime Project is sited in an area of quality limestone which should produce a saleable lime. The level and quality of production depends on the kiln's actual operation, which was untested as of November 1985. The demand for lime products in the past was reportedly strong. Although cement competes as a construction material, price relative to lime was not assessed. SRDA hopes to use some of the lime in its own small Portalana cement factory.

SRDA/MHT will need to adjust to changing market conditions. The lack of a marketing strategy for product sales and the comment by SRDA management that one is not needed, raises doubts that SRDA will be able to adjust its price and sales efforts to run financially viable concerns.

f. Information flow

The SRDA management was receptive to suggestions in

operating the kiln offered by ATI's East Africa Project Officer on a visit to the brickyard in November 85. The ability of SRDA to implement suggestions on the organization of work production units, incentive pay or other management tools to increase labor productivity is yet to be proven.

It is too early in the lime project to assess the information flows and other potential linkages between concerned organizations. Replicability of the limeyard in other areas is promising, provided quality lime deposits can be located and accessed easily. The team received conflicting information regarding the quality of a study carried out on the existing lime site.

4. Rural Industries Promotions/Rural Industries Innovation Center: Description and findings

The second ATI project evaluated in Botswana--the Animal Driven Pump (ADP)--falls under the category of farm equipment. The project is described in Table 9. Because it was started before the ATI Cooperative Agreement was amended to include this category in December 1984, it was initially approved as a "unique and special opportunity" project. The implementing organization is Rural Industries Promotions/Rural Industries Innovation Center (RIP/RIIC) which acts both as the IO and producer of the technology.

Because RIIC's experience with sorghum dehullers provides some

Table 9: Animal Driven Pump Project Summary

Region: Africa

Project No.: 84-02

Country:	Botswana
Location of Project:	Kanye
Name of Project:	Animal Driven Pumps
Implementing Organization (IO):	Rural Industries Promotions (RIP)
Productive Activity:	Rural Industries Innovation Center
Starting Date of Project:	October 1, 1983
Number of Months Elapsed at Time of Evaluation:	25 Months
Scheduled End of Project Date:	September 30, 1986
Total Funding:	$108,000
Purpose of Project:	To lower the cost of providing water to rural families in Botswana through the use of animal-driven pumps.
Description of Technologies:	The project will install simple, locally designed animal driven pumps, consisting of a gear-box with metal sprockets powered by donkeys or mules, that can run either a shallow lift centrifugal pump or a high lift pump.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

informative parallels to the ADP project, the team comments on this after first describing our findings on the ADP. While ATI has had no input to the sorghum dehuller experience in Botswana, it is promoting a scaled-down version of the agro-processing technology in at least one other African country.

a. History and funding of the implementing organization

The RIP is a quasi public body generally under the Ministry of Commerce and Industry. ATI has contracted with RIP to establish a program at its subsidiary, the RIIC, to test and disseminate animal driven pumping systems.

The RIP is a not-for-profit company with the Board appointed by the Minister for Commerce and Industry. According to the Managing Director, RIP operates on a day-to-day basis like a private company. RIP has two subsidiaries, RIIC and the Pioneer Rural Industries Centre (PRICE). RIIC has no legal existence except through RIP. RIP headquarters are in the Capital, Gaborone, and RIIC is located about 140 km away in the Southern District headquarters of Kanye. PRICE operates in Palapye and is involved in disseminating technologies developed by RIIC in the Northern part of the country, and in providing extension services.

The Managing Director of RIP is located in Gaborone. He is a prominent member of a network of Directors in Botswana, sitting on some

28 different Boards. The Evaluation Team found him to be a valuable informant, not only on the ADP Project, but the general situation in technology development and transfer in his homeland. The RIP Director sits on the Board of the BTC whose managing director reciprocates as a board member of RIP. The BTC is described in more detail in Chapter IIC. BTC is often contrasted with the RIIC in its concern with coordinating the software of technology, while RIIC is intended to be the hardware development institution in Botswana.[22]

The ATI African Regional Manager first heard about RIIC in a familiarization visit to Botswana in 1981. At that time, the Institute suffered from management shortcomings, and the pressure to find new sources of support with the decline in the FEF funding. The ATI Regional Manager chose not to work with RIIC as a potential implementing organization until 1983 after a return trip introduced her to new personnel both in RIP and RIIC. The contract for the ADP was signed in October 1983.

RIP's annual budget is around P 600,000, of which 80 percent goes to RIIC. RIIC was set up in 1974, and received funding from the Frederick Ebert Foundation (FEF) of West Germany until 1984. Thereafter, the GOB contribution to RIIC's support increased substantially. Meanwhile, RIIC augmented its gradually decreasing FEF support through other donor contributions, and profits from commercial activities, e.g., woodworking, renting conference facilities, sorghum

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[22]Carr, 1985; Aarsse, 1985.

milling, and manufacture of sorghum dehullers.

According to RIP's Managing Director, RIIC had lost its local staff by January 1982. The appointment of a local citizen-- a Botswana General Manager at that time was the beginning of the transition period away from heavy dependence on FEF for funding and toward rebuilding RIIC. According to a RIIC Project Memorandum, minor contributions from GOB started with P 170,000 in 1982-83, P 210,000 in 1983-84 and P 600,000 in 1984-85. According to the Director, the GOB has allocated P 4.7 million through 1990/91 to RIP. This rapid increase was in part because of RIIC's success in developing and disseminating the sorghum dehuller.

b. Management and overview of current activities

The current activities of RIIC are diverse, yet in some ways reinforcing. For instance, RIIC operates a sorghum dehuller and hammer mill processing unit for profit. The dehuller was developed in its R&D section and manufactured in its production workshop. The RIIC is actively involved in R&D and is testing three alternative power sources for water lifting:

- The animal drawn pump;
- The RIIC windmill; and

o The biogas driven diesel engine pump.

Furthermore, an array of photovoltaic cells has been installed on site, but is no longer being operated or tested. None of these technologies has taken off, though considerable effort has gone into the windmill technology.[23]

Management at RIIC is along project matrix lines. RIIC is organized into three sections: Research and Development under the Technical Manager, Commercial under the Financial Officer, and Extension. RIIC is organized as shown in Figure 1, with a village artisan program training local people in such activities as tanneries, blacksmithing, under-the-tree woodworking, construction and operation of baking ovens, etc.

Each of the commercial activities has a manager, and the design and workshops in R&D have managers. Specific projects have managers, such as the ADP project manager who is also the current workshop manager. Three members of this management team are local Botswana and the rest are expatriates, including two supplied under the Rural Sector Grant of USAID.

c. Resources committed to ATI project

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[23]Note that RIIC is not developing the actual pumping mechanism, but working on the power source and transmission of power to the pump. The ADP hardware is the above ground power transmission system.

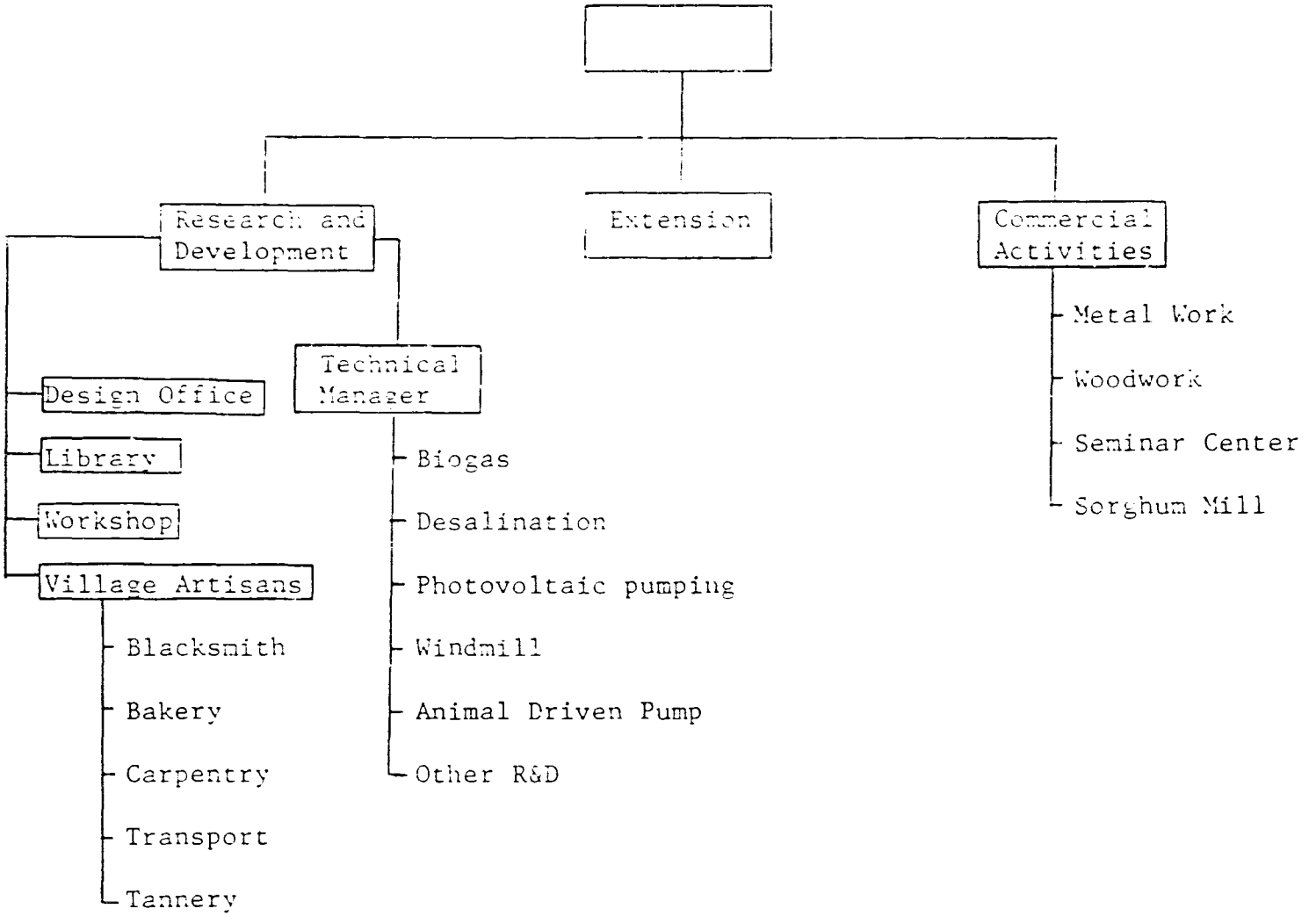

Figure 1: Organization of Rural Industries Innovations Center

The ATI Project Plan provides for ATI funding to RIIC through RIP of $108,000, commencing October 1, 1983 and covering three years. As of October 1985, RIIC proposed a two year extension of the project in order to complete production of 16 machines to the specifications of the new prototype. Because of the government support to RIIC, ATI's contributions enable RIIC to reserve GOB funds for other purposes. Table 10 describes the level of funding and sources for the last three fiscal years. In the first year of the ADP development, ATI was not yet a donor. The initial prototype was developed using funds from GOB, FEF, and the Botswana Christian Council. In the past two years the only contribution other than ATI's P 44,156 in 1983/84 and P 58,061 in 1984-85 was P 5357 from the Botswana Renewable Energies Project in the third year. ADP expenditures (see Table 11) average around 10 percent of the total R&D expenditures over the three years, and the R&D budget is the main share of the total RIIC expenditures.

The human resources committed to the ATI project have been the most problematic. RIIC has a significant turnover in expatriate personnel and this has led to a lack of continuity in the ADP development. Table 12 lists the changes in RIIC staff with the effect on the project noted. This issue is discussed in the following sections and conclusions.

5. <u>Description and findings of RIP/RIIC projects</u>

Table 10: RIIC Funding and Sources
(US$)

a) Period: January 7, 1982 to June 30, 1983

Donor	Total Funding	R&D Budget	ADP Budget	Extension Budget
GOB	74,243	14,005	3,000	18,137
FEF	75,564	49,131	3,000	26,433
IDRC	11,118	11,118	0	0
USAID	69,055	69,055	0	0
BTC	19,030	19,030	0	0
OTHERS	80,373	80,373	2,300[a]	0
TOTAL	329,383	242,712	8,300	44,570

b) Period: January 7, 1983 to June 30, 1984

Donor	Total Funding	R&D Budget	ADP Budget	Extension Budget
ATI	44,156	44,156	44,156	0
BREAD FOR WORLD	94,876	94,876	0	0
BRET	17,000	17,000	0	0
FEF	8,250	0	0	8,250
GOB	374,436	121,543	0	39,347
IDRC	10,351	10,351	0	0
USAID	0	0	0	0
OTHER	5,573	5,573	0	0
TOTAL	554,642	293,499	44,156	47,597

Table 10: RIIC Funding and Sources (cont.)
(US$)

c) Period: January 7, 1984 to June 30, 1985

Donor	Total Funding	R&D Budget	ADP Budget	Extension Budget
ATI	58,061	58,061	58,061	0
BREAD FOR WORLD	9,948	9,948	0	0
BRET	5,357	5,357	5,357	0
FEF	0	0	0	0
GOB	788,626	445,882	0	104,220
IDRC	110,869	102,269	0	8,600
OTHER	134,802	134,802	0	0
TOTAL	1,107,663	654,050	63,418	112,820

d) Period: January 7, 1985 to June 30, 1986

Donor	Total Funding	R&D Budget	ADP Budget	Extension Budget
ATI	20,470	20,471	20,471	0
IDRC	36,010[b]	26,810	0	9,200
GOB	343,551[b]	257,729	0	85,822
IDRC	9,819	9,819	0	0
OTHER	111,535	111,535	0	0
TOTAL	521,385	426,364	20,471	92,022

[a]Church group that paid for prototype; Bot-Christian Council

[b]Funding as per signed project contracts money or part of not received in full.

Table 11: RIIC Expenditures on ADP
(US$)

a) Period: January 7, 1982 to June 30, 1983

	RIIC Total Expenditure	R&D Expenditure	ADP Expenses	Extension Expenses	OTHER
Capital	100,678	100,678	0	0	0
Recurrent	432,176	328,013	21,575	43,874	
Indirect	0	0	0	0	15,000[ab]
TOTAL	532,854	428,691	21,575	43,874	15,000[ab]

b) Period: January 7, 1983 to June 30, 1984

	RIIC Total Expenditure	R&D Expenditure	ADP Expenses	Extension Expenses	OTHER
Capital	125,492	125,492	0	900[c]	0
Recurrent	302,572	292,721	54,738	42,639	0
Indirect	0	0	0	0	16,000[bc]
TOTAL	428,064	418,213	54,738	43,539	16,000[bc]

c) Period: January 7, 1984 to June 30, 1985

	RIIC Total Expenditure	R&D Expenditure	ADP Expenses	Extension Expenses	OTHER
Capital	286,583	286,583	0	0	0
Recurrent	370,309	348,685	56,158	54,254	0
Indirect	0	0	0	18,000[b]	18,000[b]
TOTAL	656,892	635,268	56,158	72,254	18,000[b]

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[a]Difficult to itemize. All R&D expenditures are written off at the end of the financial year.

[b]Estimates.

[c]All fixed assets purchased are for R&D only.

Table 12: RIIC Staff Changes Since Start of ATI Project

1. ADP Project Manager

Eise De Vries	Pre July 1983
Einar Anderson	July 1983 to March 1984
Phillip Motshoge	March 1984 to December 1984
Bernard O'Donnell	December 1984 to March 1985
Warren Jones	March 1985 to present[a]

2. Workshop Production Team Leader

Petrus Mokgalo Tomane	February 1984 to present

3. Design Engineer

Eise De Vries	Pre July 1983 to March 1984
Paul Elkington	May 1984 to present[b]
Arthur Swain	May 1985 to June 1985
Fred Pelotona	May 1985 to present

4. Installation Supervisor

Alfred Thapa	February 1984 to July 1985
Hermann Hoffman	August 1985 to present

5. Workshop Manager

Eise De Vries/Jan Von Uder	Pre July 1983 to March 1984
Farhang Nekakhtar	March 1984 to present

6. Technical Director

Ken Allen	July 1982 to July 1984
John Bruta	July 1984 to present

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[a]N.B. recuperating from Hepatitis June 1985 to November 1985.

[b]N.B. in U.K. recuperating from accident October 1984 to March 1985.

a. The Animal-Driven Pump, Project No. 84-02

(1) Project purpose

The project purpose is to introduce the animal-driven pump (ADP) as an alternative water supply power source in order to lower the cost of supplying water to low income families in the rural areas of Botswana. The objective is to enhance economic growth in rural areas.

The project also aims to foster the development of a commercially-viable organization which can manufacture the ADP. This objective is to be realized by providing ADPs to 36 communities over three years.

(2) Description of the ADP project actors and intermediaries

RIIC has designed and developed the ADP, and by June 1985 had manufactured six pump transmissions according to the original prototype. In November 1985, manufacture of a new design prototype, and laboratory and field site tests were in process. RIIC plans to transfer the manufacturing to local machine shops on a specific order basis, following the experience with the sorghum dehuller development. After a survey of Botswana machine shops by a Senior Production Engineer working on contract with BTC at RIIC, two

machine shops were engaged to manufacture the dehuller. In the Engineer's view, there are very few shops in Botswana with the capability to produce a precision engineering product, and those few need to have careful monitoring to ensure the product's quality.

Manufacture in the machine shop at RIIC appears to be well organized with good plant layout and stock handling. Jigs are used in production, with a very large jig used to fabricate the RIIC windmill tower. Use of jigs to machine the ADP original design were crucial to careful assembly and appear to have been production engineered. When the dehuller was contracted out, the RIIC supplied a model, jigs, and engineering drawings, as well as technical assistance and monitoring of quality. Still there were reportedly some problems with one of the firms meeting specifications. When, and if, the ADP manufacture moves outside RIIC, this aspect will require careful attention, if the ADP's machinery life and durability is not to be effected.

(3) <u>The technologies under the ADP project</u>

The ATI project with RIIC involves more than providing a machine powered by animals to supply water. The technologies developed, transferred, and utilized in the RIP/RIIC project are equipment, processes, and knowledge. Technology, as the Evaluation Team defines it, is embodied in all three forms. The equipment technologies are the animal drawn pump system including the above and below ground machinery, the animal harnesses, the maintenance

and repair tools, spares, transport, and the testing instruments. The process technologies are prototype development, on site and field testing, production engineering (e.g., making detail drawings, jigs and fixtures) and manufacture of the above ground pumping equipment. Technological knowledge, i.e., skills and technical know-how are manifested in the design, development and engineering of the equipment and process described above, as well as in the documents prepared under the project such as operator manuals, monitoring and evaluation reports and studies to assess the potential installation site and end-user organizations.

An operating ADP installation includes the physical hardware of pump and transmission unit, pipes and water storage tanks, as well as the draft animals and handlers, pump operator, and soft technologies such as the organization and procedures for use, and water lifting and utilization practices. It is a sociotechnical system of machinery, men, and animals.

The Evaluation Team visited a installed ADP system at Gamoratswama, about 40 km from RIIC (200 km SW of Gaborone). Arrangements had to be made in advance so that donkeys (the preferred draft animal) could be rounded up from about 15 km away where they had drifted off to areas when it had recently rained. The visit was delayed until some water was run off from the storage tank, which had been kept filled by the diesel engine normally used to power the

mono pump[24] at this site. When we arrived, the operator switched the drive belt from the diesel to the ADP transmission while the donkeys were hitched with new leather harness to three rotors using an assortment of ropes and chains. The operator had not yet been able to undergo the ADP operator's training as the user Syndicate which pays his annual salary would not let him go. The nine donkeys, hitched three to a rotor arm, had raw sores from draft work, presumably with inappropriate harnesses, and were underfed, and no doubt tired from the morning's roundup. The ten-minute demonstration of the pump for the visiting Evaluation Team clearly showed the technical performance of the machinery was adequate to the task of lifting water at the site. The overall sociotechnical system performance was not impressive.

The manufacturing program at RIIC brings together many technological processes. The Evaluation Team was fortunate to be visiting at a time when a new prototype for the ADP was being fabricated, and could still observe the various technologies used in designing the first model, and in testing the prototype's performance. Assembly and detail drawings had also been prepared for the new model which gave a sense of the steps of going from (1) concept, to (2) preliminary drawings, to (3) prototype, to (4) on-site testing, to (5) production engineering of jigs for manufacture, to (6) installation and operations in the field. The Evaluation Team was unable to observe several other important process technologies, such as field testing,

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[24]Mono pumps are the most common pumping equipment installed in Batswana, mainly because they are less likely to clog from sandy water than alternatives such as centrifugal or reciprocating pumps.

and end-use monitoring and evaluation activities, except evidence from documents, which was sketchy, at best.

An ADP is installed into what industrial engineers call a "socio-technical system" with hardware performance dependent on soft technologies. Similarly the ATI-funded ADP program for testing, manufacture, and evaluation has technical, economic, and social components.

(4) Progress to plan for the ADP project

Approved in October 1983, the ADP project was to run for three years and manufacture and install 36 animal-driven pumps. This ambitious target was based on a set of assumptions, such as the readiness of the technology, the acceptability of the "appropriate technology for water lifting", and the capabilities of RIIC machinery designers and extension services.

The Project Plan assumed that the technology development was essentially finalized. RIIC was to complete a set of final drawings of the ADP as well as a service manual during the first quarter of the project (October to December 1983). As of November 1985, the design of the pump transmission was still being developed. A service manual had been prepared on the earlier design. The pump transmission underwent a design review in the Spring/Summer of 1985 and a new "prototype" is under development.

The project timetable phased the "assembly" of the ADP units and installation and monitoring of the units over the three years of the project. Six units were to be installed and monitored during the first year, ten the second year, ten the first quarter of the third year, and ten the second quarter of the third year. It is now the beginning of the third year and a total of only three pumps have been installed. No community now relies solely on the ADP for its water supply, although a remote desert installation at Khawa has several inoperable diesel engines at the borchole.

Other elements of the project are also behind schedule. The criteria for selection of ADP recipients and the RIIC contract format for the ADP were to be completed during the first quarter of the project, but were finalized two years later. Although six pumps have been assembled,[25] only three have been installed:

- At Gamortswana, the pump has been on site since March 1985, but is only used irregularly when the diesel engine is out of order. The problem with pump usage is the lack of draft animals to pull the drive mechanism, as well as a perceived problem of the community to understand what is needed for the operation of the pump;[26]

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[25]Project Report, August 1, 1985.

[26]Joyce Coange, Memo: Animal-Driven Pump Project Status on Each Site.

- The Tlhatswe pump was installed in November 1984, but has mechanical problems. Although encouraged to send an individual to RIIC for training, none from Tlhatswe have been trained. Other problems have been identified including the lack of organization of the Tlhatswe community, lack of support from the agricultural officers for the ADP pump, and lack of facilities at the site; and

- In April 1985, a pump was installed at Khawa, a very isolated site, two days travel from RIIC. A number of problems remain at this site, including (1) the unwillingness of draft animal owners to provide their animals--and strong healthy animals are needed for water pumping, (2) the use of the well by outsiders--who would use their animals to pump water and pump the well dry, and (3) a worn animal track around the pump which unbalances the pump's rotor arm and workloads.

A number of other sites have been identified, many with their own set of issues to be resolved:

- The Tlanege syndicate ordered an ADP, but it was not installed as the reciprocating pump needed to be changed to mono pump and the council has not agreed to this expense;

- The Ministry of Agriculture, through the ALDEP project, decided to purchase an ADP for the Mahalaopy Syndicate to use

as a demonstration program for the area;

- The Matlalo syndicate is interested, as two members visited RIIC, but their syndicate is not as yet organized to receive a pump;

- The Hukuntsi Nursery, in Tsabong has shown interest, but with the change of nursery planning officers, they presently want a hand pump now;

- An individual near Hukuntsi is interested, but he has not returned the required information to RIIC; and

- The Popagano Syndicate at Lehututu is interested but they lack funds.

The project is essentially in the second quarter of its timetable, although over two years have elapsed. A new project manager, an American expatriate, actually looks at the project as starting its first year since he just recently arrived. A revised plan for the next two years, submitted to the ATI Project Officer in November 1985, is similar to what was to have been accomplished in the first two years of the project. It has the same assumptions about how quickly the new prototype can be production engineered and pumps installed in the field.

(5) Commercial viability

The commercial viability of the ADP depends on demand, and demand depends on the overall requirements for water lifting power sources, the alternatives available to fill the requirements, and the ability to fund that requirement. The Evaluation Team focused on two aspects of the commercial viability: the market share for the ADP technology and the costs of supplying the ADP technology to meet requirements. The issue of whether or not people are willing to accept the technology, which means accepting the socio-technical system requirements to utilize it was not addressed directly by the Evaluation Team. Time and logistical problems foreclosed any sort of rapid rural reconnaissance on this important issue, to which we return in the conclusions section (see Chapter IIB6.

The Evaluation Team interviewed a number of informed people on the question of the place the ADP might fit into the choice of water lifting power sources in the future. These included the Senior Water Engineer at the Ministry of Local Government, an expatriate with long experience in Botswana who now advises District and Town councils on the choice of technology for boreholes development and rehabilitation. Interviews were held at the Ministry of Water Affairs with engineers engaged in borehole development, and in repair and maintenance for district councils, local governments, and private syndicates. Botswana staff at the Botswana Renewable Energy Project were interviewed, as was

the head of the Botswana Technology Center (BTC). From these various sources, the Evaluation Team concludes: While the ADP may be a great idea in principle (e.g., eliminating the dependence on imported diesel fuel, utilizing the abundant supply of draft animals, and the low population density), its acceptability to the target population is not self-evident. Support for this conclusion is born out by the low rate of implementation by RIIC of the existing ADP stock.

For 30 years, diesel engines have been the preferred power source for pumping water. There is some debate about maintenance difficulties, raised especially in the ADP project plan. It may not be a question of technical bottlenecks to maintenance as much as ability of user groups to pay for available services. The Borehole Repair Service (BRS) of the Minister of Water Affairs has depots located strategically around the country, stocked with replacement diesel engines. The staff assert that the response time is less than two days; however, not allowing for the down time while a user notifies the BRS of the breakdown, which for remote desert sites may be two to three weeks. The Evaluation Team sees some discrepancy in the rationale for the ADP which cites the poor maintenance of diesels.

Operating costs comparisons favor the ADP, and RIIC's extension officer and the ADP project manager have prepared cost figures which emphasize the savings of ADP over diesel powered water lifting, even allowing for feeding and veterinary services for the draft animals. Annex 5 presents the analysis (see Table 5-1). This analysis does not,

however, include the opportunity costs for using the draft animals for pumping water instead of plowing, which at certain times of the year may be a significant factor in any comparison with alternative power sources. Other more intangible factors, such as the increased socio-cultural tensions, animal management and pump operator attitudes are not treated in the comparison, but are clearly important factors.

The Evaluation Team would like to have seen in the Project Plan, a comparison of several "appropriate" pumping technologies on the basis of investment and operating cost plan. The Water Engineers speak highly of the attractiveness of photovoltaic power sources, especially in remote sites, but acknowledge its present impracticality because of the high initial costs. BRET's prototype human traction pump should be considered in this analysis as well.

The cost of production of the ADP and the selling price are also at issue. Plans to subsidize the price of the pump in the first two years of the ATI project were debated within ATI. The Evaluation Team did not get into this matter, as it seems tied up with RIIC's overall strategy for promoting its technologies. For example, the substantial markup on the Sorghum dehuller is an attempt to support future R&D at RIIC. A substantial burdened rate for machine shop time is used in costing the ADP manufacturing costs. The issue of recovering product development costs in the selling margin needs to be explored in greater detail. The Evaluation Team concentrated instead on determining the

minimum production costs, as shown in Annex 5, Table 5-2.

The missing ingredient in this commercial analysis is a realistic assessment of the installation and after-sales service costs for the ADP, while this cost factor would be difficult to estimate because of widely varying logistical factors. Nevertheless, its inclusion is desirable, as any new product should have some guarantee of after sales service at the installation site. If the ADP proves to be the most acceptable technology at relatively remote desert sites, then logistics will be a major cost factor in after-sales service.

Finally, the Evaluation Team proposes that any further commercial analysis include a proposed 0.5 kw pump as well as the 1.5 kw pump now being built. The Production Engineer proposed this scaled-down pump to serve boreholes with a low or intermittent water supply. The economics for this installation (provided a prototype can be successfully scaled down and developed) may well favor the ADP because most diesel pump sets would pump these boreholes dry in a few minutes. Hence, choice of smaller ADP power source, requiring less material for manufacture, and fewer animals to power it may well gain a market share. The Evaluation Team is not aware of plans by RIIC to pursue this line of action.

(6) Impact on target population

The project's intended impact is provision of a

water supply system to rural populations which is more reliable and less costly than the diesel engine powered pump. As only three of the expected 36 ADP pumps have been installed, the impact as of November 1985 has been minimal. Many problems have arisen at the three sites where the pump has been installed, preventing the pumps from successful field operation and consequently no community is depending on the ADP for its water.

A major reason for limited impact, besides the mechanical problems with the pump, is that the community receiving the pump must be well prepared and understand the requirements of the overall ADP system. More extension work is required, a fact which has been recently appreciated by RIIC, and it is making efforts in this direction.

b. Comparisons with the RIIC sorghum dehuller

The experience of RIP/RIIC with the Sorghum dehuller is indicative of the progress and problems facing the ADP project. RIP/RIIC is reportedly enjoying much success with the manufacturing and dissemination of its sorghum dehuller, which is a scaled-down version of a Canadian design. Some 50 dehullers have been produced over the last six years and the technology has been transferred to other countries in Africa. RIIC produced ten for Swedish SIDA to be distributed by the Ministry of Commerce and Industry in Tanzania. Some

dehullers are being supplied to a IDRC program in Zimbabwe.[27]

These last orders have been filled by the two privately owned workshops in Botswana, but neither enterprise have shown any desire to produce for inventory, or to handle marketing directly preferring to leave the latter to RIIC. The dehuller costs about P 2,400 to produce by RIIC estimates. The local manufacturers have been paid about P 2,700 for each. RIIC has sold ten dehullers to the SIDA program for P 3,500. The margins are 12 percent, 30 percent, respectively and 35 percent overall.

Two points are important. First, RIIC has used the Dehuller sales as a money earner to support its R&D program. As the immediate market is becoming saturated,[28] further sales will depend on export. Continued earnings for the machine shop at RIIC will depend on successfully bringing the ADP or some other machine to market. Hence, there should be an incentive for progress on the ADP project, but not necessarily to expedite local manufacture of the ADP outside RIIC.

The second point is the total time that the dehuller has taken. The R&D program began in the mid 70s. Nearly ten years elapsed before the product was released for local manufacture. Discussions with the

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[27]ATI had been peripherally involved in each of these development efforts, through consultation (Tanzania) and a small grant (Zimbabwe).

[28]Marketing of the dehuller in Botswana has been successful, but the total number required in Botswana is estimated at around 40 dehullers. Thus, continued production earnings for RIIC will require export development.

agro-processing specialist at IDRC/Nairobi, who has a long experience with the process going on at RIIC, indicate that the time might have been shortened if RIIC had more incentive to move on to another experimental technology and release its money earner to the private sector. There is a lesson here for the ambitious schedule of production and dissemination for the ADP.

6. Analysis and Conclusions on RIP/RIIC and the ATI Project

a. Source of the ADP project idea

The Animal Drawn Pump technology was developed by RIIC. The Director of BTC claims credit for stimulating the development of the first prototypes by RIIC. His initial studies of costs of operation and required technical performance, while in his own view are too crude, paved the way for the design and development effort. The idea for a project to disseminate the technology came from discussions between the Regional Manager and RIIC staff in early 1983, i.e., while the Cooperative Agreement with AID was still being negotiated.

b. Capability

RIIC has the facilities and machinery to develop prototypes and manufacture the transmission systems for the ADP. The development and manufacture of the Sorghum dehuller may be taken as evidence of RIIC's ability to produce a commercially-viable machine and

to market it. As the plan is to transfer manufacture to local machine shops, the producing entities are intended ultimately to be outside RIIC. A study by a British consultant was not optimistic about the capability of local workshops to fabricate the ADP without some technical assistance (providing jigs) and without special attention to quality control. The consensus at RIIC was that none of the prospective firms were likely to take on a successful marketing program. RIIC would handle marketing, as it has with the sorghum dehuller technology.

The management of projects at RIIC has been weak. The technical assistance which staffs the RIIC has not been consistent, nor always highly regarded. Too short of tours by American consultants, illness and departures of staff, including the departure of the ADP design engineer, have hampered a timely development and testing process. In the Evaluation Team's view, there is a lack of reality in project planning, and perhaps the management and organization of RIIC, particularly the role of Technical Manager filled by an expatriate, needs to be looked at more closely.

c. Commitment

The team found a strong commitment to the ADP project, but one not yet translated into successful project efforts. This is on three levels. First, there is a belated recognition that the design could be improved and further tested, and a prototype was nearing

completion in November 1985. RIIC sees the need to institute accelerated life testing and is acquiring the testing capabilities to do it. Secondly, the commitment to extending the technology is now fairly strong, but based on acceptance of the ADP, has not been that successful. A key informant, no longer with RIIC but having kept close contact with them, and quite familiar with the dehuller experience, emphasized that it has taken a continuing lobbying effort to get RIIC to devote the necessary resources to the extension efforts. An additional extension officer is to be hired.

Finally, the commitment to transfer the technology to local manufacturers must be looked at closely. The Evaluation Team is skeptical of the view that little capability existed in the light engineering sector of Botswana outside of a few European run workshops. Part of this divergence of views stems from RIIC's perception that high quality production is required, and when RIIC should "freeze" the design. Experience in other regions of the developing world argue for a continued process of local adaptation for farm machinery once it is manufactured outside a research and development facility. Production engineering necessarily follows prototype development and testing, and in the Evaluation Team's view, those best able to economize on manufacture are the workshops who want to produce it commercially. This may prove to be a significant point of dispute for the evaluation of ATI projects overall, and thus will be discussed in the main report. It was noted however, that even within RIIC, there was a (healthy) dispute about which components to

use and their source of supply in the redesigned ADP prototype.

d. Risk

There is little risk for RIIC to engage in ADP research and development because of their now substantial Government support. Several years ago, this was not the situation, and if the ADP had been developed then, the lost of a potential money earner for the Institute would have been more critical to the research program.

Risks for the ADP user groups are high. Because the ADP operates as a socio-technical system, it requires social organization to derive the full benefits of the technology. A question unanswered by the Evaluation Team is how much of a cultural fit or misfit is involved. As a Water Affairs Engineer indicated, many people in the villages switched to diesel-driven boreholes in the 1950s. Are there strong enough incentives to switch from an admittedly risky technology (the supply of diesel fuel, downtime for engine repairs, etc.) to an alternative with a different set of risks which are managerial, social, and cultural adjustments.

The risk for local machinery workshops is directly related to the ADP's marketability.

e. Marketability

RIIC has calculated the capital and running cost comparisons between the ADP and the diesel driven borehole. Groups interested in the technology are reportedly impressed by the overall and annual projected savings. There is a list of "interested syndicates". Yet the ADP has been available for several years now, and to date three are installed. The project had proposed to have 16 manufactured by the end of the second year of the project. A total of six had been produced as of November 1985 because of the changes to the design and the unexpected delays in getting groups to take up the technology.

The Evaluation Team did some independent checking on the potential demand for the ADP. The BTC Director's estimates that there are: Boreholes Nationwide, 12,000, of these: Operating with Diesel Engines, 3,000; of these: Boreholes able to supply water, 6,000; therefore, remaining potentially functional boreholes, 3,000.

Thus, there may be some 3,000 boreholes where ADPs could be installed. However, many of the boreholes have insufficient water recharging rates which do not warrant a diesel driven pump. In the view of one Government engineer, there may be a need for alternative water lifting devices such as photovoltaics or even human traction pumps. The former is too expensive at present, and the latter may not generate sufficient power to lift water from deep boreholes. For remote sites where transport of diesel fuel is a factor, then such alternative technologies are more attractive. The willingness of

groups with borehole rights to organize themselves to provide draft power for the ADP pump is uncertain. It seems surprising that two years into the project, this issue has not been satisfactorily assessed.

f. Information flows

The technology development and transfer process is two-way. Feedback is essential to the process. The ADP project has been hampered by a lack of continuity in the project team staffing. (See Table 13.) Furthermore, we question the advisability of locating the first real test of the technology under the ATI project at such a remote site in the Kalahari desert. Communications with the site are essential during a prototype testing process and the remoteness clearly was a hindrance.

7. Thusana Lefatsheng: Description and findings

The fourth and final project in Botswana examined by the African Evaluation Team is the Grapple Processing project, no 85-0001. Table 13 summarizes the projects funding, timing, and purpose.

a. History and funding

Thusano Lefatsheng (T-L) Terre Aide Botswana, is a private, nonprofit organization interested in developing local natural

Table 13: Grapple Processing Project Summary

Region: Africa

Project No.: 85-0001

Country:	Botswana
Location of Project:	Gaborone
Name of Project:	Grapple Processing
Implementing Organization (IO):	Thusano Lefatsheng
Productive Activity:	Same as IO
Starting Date of Project:	April 1, 1985
Number of Months Elapsed at Time of Evaluation:	7 Months
Scheduled End of Project Date:	March 31, 1988
Total Funding:	$37,000
Purpose of Project:	To demonstrate commercial opportunities in wild and cultivated plant processing by establishing a profitable enterprise which produces high quality grapple products for export and employs inexpensive and simple production technologies.
Description of Technologies:	The project will test a low cost, labor intensive production process that includes manual cleaning and crushing of the grapple root, a small scale motor driven mill, and a hand-operated capsule loading machine.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

resources, particularly aromatic and medicinal plants, to provide employment opportunities and contribute to local development in Botswana. Other objectives of the organization include: cultivation and processing of wild and cultivated aromatic and medicinal plants, introduction of semi-arid agricultural methods, agricultural extension programmes, essential oil production, protection and cultivation of endangered plant species, food processing and improved rural nutrition.

T-L was registered in 1984, and since then has received a no-interest loan of P38,000 from the Botswana Development Corporation for a two-year pilot project to identify and study indigenous plants with the potential for commercial production. The BDC-funded project has succeeded in identifying a number of plants, including grapple.

Grapple (Harpagophytom procumbens) is a desert plant whose roots are used to make medicinal teas and capsules. ATI started the Grapple Processing Project with T-L in 1985. Other donors contributing to T-L include IRDC (Canada) which will be funding some equipment purchases for T-L.

b. Management and overview of current activities

As described in the Project Plan, T-L has three full-time technical staff, four farm laborers and part-time administrative, and accounting staff. The staff includes a French horticulturist, specializing in medicinal and aromatic plants; a

British expatriate research horticulturist/garden farmer and a Dutch volunteer working with the administrative and accounting staff.

The French horticulturist is the force behind the grapple project and is a dynamic, highly motivated individual who devotes the majority of her time to pursuing activities related to this project. These include testing the grapple processing technique in her home, exploring markets throughout Europe and interacting with the research horticulturist/farmer regarding the grapple experimental plots.

8. Description and findings of the Grapple Project, No. 85-0001

a. Project purpose

The objective of the project, as noted in the Project Paper, is to "demonstrate commercial opportunities in wild and cultivated plant processing by establishing a profitable enterprise which produces high quality grapple products for export and employs inexpensive and simple production technologies."[29]

b. Organizations involved in implementing the project

T-L is the central pivotal organization, working with the research horticulturists garden farming enterprise and selected village councils. SRDA (see Chapter IIB1) has been paid to collect,

[29]Page ___.

store, and transport grapple roots at their remote desert enterprises.

c. Description of technologies

The technologies to be used in the project are simple, high labor and low capital input processes. The root is collected from the field by gatherers, dried, sliced into chunks and delivered to the project storage area. At this location, the grapple is scraped by brushes to remove dirt particles, crushed in wooden mortar and pestles, sorted, and sifted. Small chunks are bagged for tea, while a proportion is pulverized by a motor-driven mill. From there, it will be encapsulated by a hand-operated capsule loading machine.

The "soft-technologies" which were not treated in the project paper, but were recognized by the T-L project manager in Botswana, are the encouragement and training required for the harvesters. Although a substantial amount of grapple is grown in Botswana, it is not grown in the area around the processing location. Also, the harvesters need to be trained to remove only part of the grapple plant, and allow the principal root to remain.

d. Progress to plan

At the time of the evaluation, the project was eight months old and had made substantial progress. Equipment had been received, a storage hut constructed, some grapple purchased and trial

production undertaken. European markets had also been explored. The project is on schedule, and will start commercial production in early 1986, after the next grapple harvesting season.

e. Commercial viability

The commercial viability of the project depends on a number of factors, none of which will be known with any degree of certainty until production and sales are under way. These unknowns make it a risky project. Some factors affecting the commercial viability are the ability of the project to get sufficient grapple production in the region, working out the remaining technical bugs in encapsulating the grapple, and establishing the market in Europe. Demand for grapple exists, but presently grapple is purchased in chunks and processed in Europe. As the project will be processing in Botswana, the task will be to establish a marketing channel for export of the processed grapple.

f. Impact on target population

The target population is primarily the harvesting community, as well as the community where the processing will take place. If the elements discussed above regarding commercial viability can be worked out, the project has a good chance of having a significant impact on the rural poor.

9. Analysis and conclusions on T-L and the grapple project

a. Source of idea

The idea was worked out with the French horticulturist and ATI project officers over the last two years. The former proposed the idea, and was introduced to the ATI Project Officer by the Managing Director of RIP (see Section 4), who sets on the Board of T-L. It provides a good example of the Project Officer's network of contacts in Botswana as a source of project ideas.

b. Capability and commitment

The capability of T-L to succeed in this endeavor lies with the project manager: the French expatriate is the force with the energy, devotion and entrepreneurial talent to make the project succeed. In this sense, she is the "technology champion". She is devoted to the project and has arranged for the necessary resources through ATI funding to put her ideas to test. She has past experience with fruit tree businesses in Southern Africa, and has a realistic grasp of the business requirements of the project, including heading off competition.

c. Risk

As indicated in the discussion of commercial viability,

this is indeed a risky project, but it is the type of risk that ATI welcomes. For example, there is really little risk to the harvesting community initially, as the grapple grows wild. Grapple is now being exported, so the project will be successful if it captures some of the "value-added" of processing for the Botswana. There are, however, some unknowns associated with the plans to move to more intensive growing of grapple, e.g., possible risks of grasshopper and root worm attacks in concentrated plots.

d. Marketability

The sale of processed grapple to Europe is a new product. The project manager explored the possibility of sales and the prospects look good. T-L is cognizant of the need to keep a tight control over the processing technology and grapple supply to ensure sufficient markets in Europe for their product. A risk is the change of consumer preference away from grapple, because it is a "health food" item subject to the whims of the consumer.

e. Information flow

It is too early in the project timetable for responses to any market demands. The expatriate project manager's many contacts in Europe provide information channels for use when the time is appropriate. The information flow between ATI/Project Officer and T-L is excellent.

Staff at the USAID mission is informed about the project and enthusiastic about its prospects.

B. ATI Links to Other Intermediary Organizations

1. Donors

ATI's links to foreign assistance donors in Botswana are mainly with USAID. The Mission staff expressed interest in ATI's appropriate technology activities, especially as they involved private sector thrusts, but in general, the Mission resources and time are spent on human resource development. For example, AID funds the two Americans now working at RIIC in positions directly effecting the RIIC project.

The ATI Regional Manager has made a point to keep the Mission informed of her program and contacts, and has facilitated transport for Mission staff to visit sites. There appears, however, to be little opportunity for any collaborative efforts, apart from sharing of information and promising concepts, as in the case of the Grapple Processing project.

ATI is working with PVOs to develop new projects, but coordination with other large-scale donors has been minimal as of November 1985.

2. Botswana Technology Organizations

The Evaluation Team sought out several of ATI's contacts in Botswana with other similar intermediary organizations. We met with the Director of BTC, with the management of Partners for Productivity and staff at the Botswana Renewable Energy Technologies Project (BRET).

a. Botswana Technology Center

The Director of the BTC shared his views on ATI in a frank interview. Contacts with the Regional Manager have led to sharing of project ideas and even a proposed small grant to BTC, in cooperation with ITDG, to test cement manufacturing technology. However, the contract was not signed as of November 1985 in part because the BTC Director objected to the form and covenants of the contract. He was of the opinion that ATI was essentially a funding agency in contrast to ITDG. BTC had the technical competence, ATI has the money, thus any marriage between the two should be undertaken on a more equal basis.

The Director was deeply involved in the Animal-Driven Pump development before ATI came on the scene. He views the project and the technology's potential very highly. BTC also has an interest in the Brickyard and Lime Kiln projects. Unfortunately, the director's views about these ATI projects is colored by clashes with the expatriate

Assistant Manager of SRDA. BTC and ATI have an informal working relationship through personal contacts, and since BTC considers itself the leading technology agency in the country, this linkage is important.

b. Botswana Renewable Energy Project

The interests of ATI and the Botswana Renewable Energy Project (BRET), (see Chapter II5), were joined on the ADP project with RIP/RIIC. The Evaluation Team received conflicting reports about the USAID-funded BRET project and its resulting accomplishments which we cannot comment on here. BRET contracted with BTC to evaluate the ADP and biogas water-lifting technologies. BTC failed to adequately test the ADP, but BRET in turn failed to follow up. It is not known the degree to which ATI involved itself in this testing aspect. In retrospect, it should have been much more involved in testing the ADP before attempting to push an unproven technology to commercial production.

c. Partners for Productivity

Partners for Productivity (PFP) is working in two restricted areas of Botswana to strengthen small enterprises. The entrepreneurial experience is only a recent development in Botswana because the people come from an essentially pastoral background. For instance, any surplus generated by a small store or shop is not

reinvested in the enterprise, but invested instead in cattle. People running small enterprises are the first generation in that business, with little tradition or experience in such activities. PFP has had to scale down training modules developed and tested in other regions of the developing world for effective use in Botswana. A fairly bleak picture was painted for promoting the existing entrepreneurial class into light engineering industries. Workshops are still at a very basic level of crude fabrication with little appreciation of quality control, marketing, etc. It is clear, from discussions the Evaluation Team had with PFP and with a former expatriate Rural Industries Officer, that credit is readily available. GOB has programs which make borrowing relatively easy.

d. Church groups

The ATI Regional Manager acting as the Botswana projects officer is developing new concepts as they are identified and screened, a process which has to be nurtured over a year or more. For example, the Regional Manager is presently considering a groundnut processing proposal from a Botswana Church Group. The regional headquarters for the group is located in Zimbabwe, and the Regional Manager visited there as part of her October-November 1985 field trip.

3. International Technology Organizations

ATI's technical people have visited Botswana and are thus

facilitating the exchange of ideas and technologies across national boundaries. The mineral resource expert reviewed the SRDA/MHT Lime Kiln project design, having worked on a similar type project in Costa Rica. The East Africa Project Officer has brought in ideas from Tanzanian projects, notably the brick press testing, and opened the continuing dialogue with ITDG on which model is the superior technology (see Chapter IIIB2).

Discussions with an economist on ITDG's staff in London, revealed that Botswana was not a priority country in ITDG's emerging strategy of focusing their program on eight countries. The reason given was that the target population (only 700,000 people total in the country) hardly justified concentrated efforts by ITDG. Nonetheless, a staff member was posted in the Botswana Technology Center for several years in the late 1980s.

4. Analysis and Conclusions about ATI linkages in Botswana

The crucial link would appear to be with BTC because of its clearinghouse role, but in the evaluation team's view the ADP project with RIP may be as beneficial because of the cooperation between the ATI Project Officer and RIP's Managing Director. For instance, this association has lead to the grapple project. His participation on several dozen Boards of Directors (including BTC's and T-L's) provides an excellent opportunity for new ideas to be shared and a two-way exchange of communication.

In conclusion, the Evaluation Team found the ATI Regional Manager held in favorable regard, both in her political savvy and her motivation and drive. When the news circulates that ATI has stopped disbursements and called an IO into account, it will send strong signals to Government and PVOs alike in future dealings with ATI. While no one was particularly impressed with the Regional Manager's technical hardware credentials, it has not seemed to diminish her image as a planning, funding and implementation specialist.

III. FIELD OPERATIONS IN TANZANIA

A. ATI's Planning and Field Operations in Tanzania

1. History

Tanzania was not one of the countries covered by ATI under the Grant. The program in Tanzania has been initiated since the signing of the Cooperative Agreement, and started when a new Africa Project Officer joined the staff and was assigned to East Africa in January 1984. The Project Officer brought to ATI considerable experience working in Tanzania, which enabled him to develop four projects in a very short time.

ATI involvement in Tanzania is clouded by the impact of the Brooke Amendment on the US bilateral assistance to Tanzania, which bars further development assistance to Tanzania until the Government resolves its debt payments to US creditors. However, continuing programs, such as emergency and food aid provide funds which permit a certain latitude in ATI activities. Details of the workings of ATI in Tanzania in light of the Brooke Amendment are outlined, as the Evaluation Team understands them, in Appendix 6 to this regional report.

2. Projects in Tanzania

ATI has been involved in four projects in Tanzania since the inception of the Cooperative Agreement, executed through contracts with two implementing organizations (IOs):

- The Center for Agricultural Machinery and Rural Technology (CAMARTEC) located in Arusha:

  -- Rural potteries, project no. 84-0103;

  -- Improved Bricks, project no. 84-0513;

  -- Oil Press Production, project no. 84-0102; and

- Lutheran World Relief (LWR):

  -- Village oil production, project no. 84-0035.

These projects cover two priority technology areas of ATI's program, the development of local mineral resources, and agricultural products processing.

B. Description and Findings About IOs and Projects in Tanzania

CAMARTEC has contracted to implement three separate projects, which we will describe in detail, after first giving the background on the Center. The fourth project, though contracted through a different implementing organization is clearly a follow-on to the Oil Press Production Project. In the next sections we present the findings and conclusions, following the format of the other country descriptions,

i.e., grouping projects under each IO and describing our findings on a common set of characteristics (purpose, technology, progress, commercial viability, and impact). The Village Oil Production Project is covered under its implementing organization, LWR, at the end of Section B.

1. CAMARTEC: Description and findings

a. History and funding

CAMARTEC started officially in 1982 as a merger of the Tanzania Agricultural Machinery Testing Unit (TAMTU) and the Arusha Appropriate Technology Project (AATP). TAMTU had been testing and adapting farm equipment and machinery since the mid 1950s; AATP started in 1977 with SIDA (Swedish) development assistance as a project under the Small Industries Development Organization. With the merger, SIDA assistance has declined and the Government of Republic of Tanzania (GPOT) funding has increased. Approximate budgetary allocations are shown in Table 14.

The Development Budget has provided for a significant expansion of office space through a construction program which is not yet complete, but fully obligated, hence the sharp decline in funding after 1984-85. During the years 1982 to 1985, the recurrent budget has enabled a staff increase from 85 to 140 people, 15 of whom have professional degrees.

Swedish aid provides one million kronas over the first two years for development of CAMARTEC. Other donors to the Center include GTZ funding of experts in biogas, African Regional Center for Technology in Senegal ($10,000 for biogas), and returns from PL 480 commodities programs of T sh 1.95 million (US Food for Peace local currency reflows). No direct funding for the Center has been received from AID. However, the Tanzania Rural Development Bank (TRDB) now the Cooperative Development Bank (CBD), which was set up through AID projects in the early 1980s, has provided US$ 100,000 for the purchase of material stocks for the workshops. In addition to GROT funding, the Center has earnings from commercial activities (mainly the fabrication of an ox-cart, described below) which totaled T sh 393,823 in 1982-83, T sh 3.5 million last year, and T sh 4.5 million this year. These earnings are retained directly by the Center, and hence are not included in the Budget estimates above.

CAMARTEC was created by an act of the National Assembly and is a "corporate body", i.e., a government parastatal, with staff coming under the Scheme of Service, but relative autonomy from the regional government of Arusha. The intent was:

> "to improve the quality of rural life through development, adaptation and implementation of appropriate technologies in the fields of agricultural mechanization, water supply, building construction and sanitation, rural transport and

training and field training as well as consultancy ser for the production and use of farm implements, rural transportation, low-cost-house construction, water, and energy. . .CAMARTEC also accepts orders for the manufactur of the listed items which can be acquired at reasonable prices."[1]

b. Management and overview of current activities

CAMARTEC is organized into three directorates: Production and Testing, Extension and Training, and Technology Development. The staffing is 40, 10, and 17, respectively. Finance and adminstration staff total 58, but this includes unskilled workers. The Centre has a branch at Nzega, 400 kms southwest of Arusha, with a staff of 16. There are six other workshops located around the country which were established under the TAMTU organization. CAMARTEC is establishing four more for a total of ten branches. CAMARTEC is experimenting with a revolving fund set for one such workshop, the Nzega branch, with the idea that after one year of material and salary support, the workshop would convert to a private ownership.

The CAMARTEC production workshop, with a staff of 21 people generated T sh 3 million in sales last year, primarily from the production of the ox-cart. The wooden cart with steel axle and

[1]CAMARTEC brochure, n.d.

oil-soaked wooden bearings sells for T.sh. 8,000 with steel wheels, and for 15 percent more with pneumatic tires. The carts are fabricated, assembled, then disassembled for distribution around the country. The Director General indicated to the Evaluation Team that he "plans to move ox-cart (production) out of CAMARTEC". Several years before, CAMARTEC assisted a local engineering firm, Themi Engineering Ltd., by giving them plans, prototypes and jigs for the fabrication of the steel axles and wheels. Themi is the firm undertaking the Oil Press Production Process described in Section B.2.c. below. The ox-carts went through some 15 model changes in the course of development, hence, CAMARTEC, and its predecessor organization bore the R&D expense for this successful product.

CAMARTEC also claims considerable success with biogas plants designed for on farm renewable energy generation and utilization. Reportedly, 30 to 40 have been installed in the area, and CAMARTEC is currently training 16 people for six weeks in biogas development.

CAMARTEC has also designed a simple hand pump, and a local group manufactured 300 units on a commercial basis, although production is not active now. A moldboard plow was tested and Themi Engineering started manufacturing it when a Dar es Salaam based factory changed managers and flooded the market.

c. <u>Resources committed to ATI-funded activities</u>

Because CAMARTEC is the implementing organization for three ATI projects, the resources committed to each are described under each project. Management had positive views on the relationship with the ATI Project Officer, and on the mode of ATI operations citing the promptness in getting commitments filled, funding, and quality of project supervision. CAMARTEC has assigned a young engineer as a full-time ATI project coordinator and given administrative support to the relationship.

The reflow of funds to CAMARTEC from the projects provides an opportunity to bring forth new technologies. Presently being considered is a hermetically sealed grain storage bin, which the ATI Project Officer introduced over from ATI's contacts in Costa Rica.

The ATI Project Officer first came in contact with the newly created CAMARTEC while in Arusha working on an AID project, the Regional Development and Planning project (RDAP). His work with rural industrialization led him to CAMARTEC. Where the Centre is lacking in specific skills, e.g., brick making, the Project Officer has provided direct technical assistance over the years, and through the ATI-funded brick making project, he has worked closely with the newly recruited Civil Engineering Project Manager when in Tanzania.

2. <u>Description and findings of CAMARTEC projects</u>

CAMARTEC's three projects are Rural Potteries, Improved

Bricks, and Oil Press Production which are presented in this order followed by the Evaluation Team's overall conclusions on CAMARTEC and the project enterprises which ATI funding and technical assistance is supporting.

a. Rural Potteries Project, Project No. 84-0103

The ATI Rural Potteries Project is summarized in Table 15.

(1) Project purpose and objectives

The project aims to support the development of rural potteries, by (1) strengthening Sheriff Dewji and Sons, Ltd. to make available needed pottery supplies to produce glazed ceramics (including the necessary ingredient, borax frit), and by (2) providing technical assistance and training to rural potteries on kiln design, construction and glaze preparation. The objective is to ultimately raise incomes for rural potteries through their sales of higher value (glazed) products.

(2) Description of organizations involved in implementing the productive activities

Sheriff Dewji and Sons, Ltd., is owned and run by the Sheriff family. Sheriff Dewji's other operations include paper

Table 15: Rural Potteries Project Summary

Region: Africa

Project No.: 84-0103

Country:	Tanzania
Location of Project:	Arusha
Name of Project:	Rural Potteries
Implementing Organization (IO):	Center for Agricultural Mechanization and Rural Technology (CAMARTEC)
Productive Activity:	Sheriff Dewji and Sons, Ltd. and rural potters
Starting Date of Project:	September 1, 1984
Number of Months Elapsed at Time of Evaluation:	14 Months
Scheduled End of Project Date:	August 31, 1987
Total Funding:	$97,512
Purpose of Project:	To produce firebricks, kiln furniture, and glaze materials for sale to small village potteries in Tanzania, as well as provide technical assistance to rural potters.
Description of Technologies:	Firebricks will be produced by repressing crushed bricks in a hand-operated press and then drying and firing them. The glaze will be produced by mixing boric acid with ball clay, feldspar, silica and dolomite, and then heating the mixture in a kiln. Technical assistance to be offered include training potters on kiln design, construction, and glaze preparation.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

production and related products, napkins, greeting cards, and stationary. There are fourteen members of the family, many of them involved with the various businesses. There are 53 individuals employed in all operations: paper production (6), pottery production (25), and in firebrick production (22).

The family's interest started in pottery as a hobby, and expanded into a business when the conditions of the seed bean and coffee bean business became unprofitable. Although the family has been producing ceramic goods for over eight years, they are still in the learning stage and are experimenting with various techniques. The family member in charge of pottery operations is studying ceramics via a correspondence course from England. He expects to be operating this section of the family business for quite some time, although his original plans had been to study engineering in the US.

Very little information was available from the Dewji family on the potteries to be assisted by this project. The Evaluation Team was referred to Sister Jean in Dar es Salaam for information on the number of potteries and specifics of their production. Subsequently, the Evaluation Team visited three pottery shops, one near Arusha and two in Dar es Salaam. All three were producing pottery products, but only one potter was experimenting with glaze, and this was the enterprise nearest to Sheriff Dewji's facilities.

(3) Description of the project technologies

Firebricks are produced by repressing crushed bricks in a hard-operated press, drying and firing in a new high temperature kiln. The glaze will be produced by mixing boric acid with ball clay, field spar, silica and dolomite, and then heating the mixture in a kiln. Technical assistance includes training village potters in glaze preparation, in the application and firing of glazed pots, and in the design and construction of suitable kilns.

(4) Progress to plan

The three major activities of the project as indicated in the project timetable are (1) firebrick production, (2) borax frit manufacture, and (3) sale of ceramic supplies. With regards to the first activity, the progress reports by ATI indicate that this activity is ahead of schedule: the mill and presses had been ordered, cleared from customs, installed and operating ahead of schedule. The kiln had been built, undergone trial manufacture, and redesigned, ahead of schedule. Sheriff Dewji has recorded sales of 1,646 pieces, and 208 used within the company. All of these, with the exception of brick to two local pottery shops were provided to the industrial sector.

With regard to the borax frit manufacture, full production, scheduled for the third quarter 1985 had begun in the fourth quarter 1985. Cost of production of frit was provided to the Evaluation Team, including details for labor, raw materials, fuel, electricity, and

depreciation. No data on sales was provided, and it was explained that the sale of ceramic supplies has just recently begun. A store for the sale of ceramic supplies had been established. This was an office used by pottery production management for both production purposes and for sales of items produced.

An additional activity added to the project agreement was the training of selected village potters in glaze preparation; also in application and firing of glazed pots. The project was also to assist village potteries in the design and construction of suitable kilns. A workshop was held in March 1985 entitled "Requirements and Supplies of Tanzania Rural Pottery Projects". The objectives of the workshop were to identify village pottery material needs, to make aware the sources of supplies, and to demonstrate the use of the pottery materials. Approximately 15 individuals attended the workshop, representing the dispersed rural pottery shops which should be customers for both firebricks and glaze.

The primary responsibility in this project for the assistance to village potteries rests with CAMARTEC, and the type of technical assistance to be offered is to assist in the completion of loan applications. However, CAMARTEC's project coordinator for the three ATI projects was not familiar with any activities along this line of work, or any monitoring or evaluation work that had been undertaken by CAMARTEC for this project.

(5) Commercial viability

The sale of firebricks to pottery shops may not bring in much revenue to Sheriff Dewji, but the excess production capacity is being used to provide firebricks for industrial concerns, which is a lucrative activity. Firebrick sales are providing approximately 50 percent of the sales of the Sheriff Dewji ceramic concern.

Commercial production of frit had begun recently, but no sales figures were available. It is very likely that a good percentage of the frit production will be used within Sheriff Dewji for its own production, as little marketing work has been undertaken to examine the market for the frit sale at pottery shops throughout Tanzania.

The commercial viability of rural potters using glaze is not clear. The production of glazed items is a new line of work which requires substantial investment. It necessitates an additional 100 thousand shilling investment in machinery (a new kiln and potters wheels), and in comparison to terra cotta requires about 2.7 times the investment in raw materials and about 1.7 times the amount of labor. The unit cost works out to be only 50 percent more as a month of terra cotta production can provide 2,500 items, compared to 1,500 items in a month of a glazed production cycle.[2] At a selling price of 2.5 times higher for the glazed item, the analysis completed by ATI

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[2]Rural Potters Project, Commercial Analysis, ATI.

indicates that the firm will be doing better with glazed items versus terra cotta. An analysis indicating the minimum price ratio (glazed/terra cotta) was not provided, but estimates on individual items ranged from 50 to 150 percent mark-up for glazed ware.

Commercial viability of a glazed production operation needs both increased technical and managerial talent. The production process requires numerous and substantial changes, including the addition of eight materials to the production process (frit, zircon, kaolin, field spar, whiting, silica, dolomite, and wax), changes in how the kiln is stacked, how the kiln is fired, and changes in the marketing strategy as it will be aimed at a different, higher priced market.

(6) Impact on target population

The Evaluation Team observed that the project has already been very successful in increasing the technological capacity of Sheriff Dewji and Sons, Ltd., and its viability. The impact on rural potteries is another matter as the findings raise doubts. Inadequate attention has been given to marketing the products to village potteries. Although a workshop was held prior to the availability of the goods, and samples of glaze was sent to a number of potteries, one potter noted that no instructions were enclosed on how to use the glaze or how much it would cost. To the Evaluation Team's knowledge, very little follow-up work has taken place since the pottery workshop was held in the Spring of 1985.

The Sheriff Dewji management expresses a very high level of interest in rural potteries, and has contributed in many ways to the development of the various pottery activities with free training and technical assistance. This work is seen as a willing sacrifice,[3] and not as a part of their responsibilities under the project. Because the project does not have a mechanism to support the pottery shops, except in the completion of loan applications, the Evaluation Team doubts that there will be any significant impact on rural potters from this project, without explicit attention by the IO to providing extension activities beyond the immediate Arusha area.

b. Improved Brick Making, Project No. 84-0513

The second project visited by the Evaluation Team, for which CAMARTEC is the implementing organization, is "Improved Brick Making." Table 16 summarizes the project's elements and funding.

(1) Objective of the project

The purpose of the Improved Bricks Project, according to the project plan of 28 September 1984, is "to introduce new technology to make it possible for villages and rural entrepreneurs

[3]Comments in a letter from the manager of Sherif Dewji's ceramic operation to the Evaluation Team: "Presently there are several promotional organizations, e.g., SIDO, CAMARTEC, for such projects (support village potters) but we feel if we do not sacrifice time and effort for these small potteries, they might not survive."

Table 16: Improved Bricks Project Summary

Region: Africa

Project No.: 84-0513

Country:	Tanzania
Location of Project:	Arusha
Name of Project:	Improved Bricks
Implementing Organization (IO):	Center for Agricultural Mechanization and Rural Technology
Productive Activity:	
Starting Date of Project:	January 1, 1985
Number of Months Elapsed at Time of Evaluation:	10 Months
Scheduled End of Project Date:	December 31, 1988
Total Funding:	$156,451
Purpose of Project:	To establish a rural brickyard that manufactures high quality bricks for the urban market.
Description of Technologies:	The project will test several alternative hand-operated brick presses that use low moisture clay to produce bricks of high strength and regular size.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

to manufacture bricks of high strength and regular size, leading to penetration of the urban market for high quality building material."[4]

The effects of the project are summarized as:

- Creating jobs directly for 40 to 50 people;
- Providing a multiplier effect for jobs in housing construction from an increased supply of improved bricks;
- Capital formation on the order of T.sh. 280,000 annually, assuming that the brickyard operates at no better than 55 percent capacity; and
- Bricks for construction of 200 low-cost, two-bedroom houses annually, thus sheltering "between 540 and 1,200 people."[5]

The project is designed with two distinct phases. The first is to import and test different brick-making technologies, to experiment with different clays found within 30 km of Arusha town, and hence to determine essential technology and plant location factors in order to proceed to the next phase. The second phase is to construct and operate a pilot plant at the most suitable site employing the selected machinery and raw material mix for quality bricks.

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[4]Project Plan, p. 1.

[5]Project Plan, p. 20.

Successful implementation of the second phase will demonstrate that a brickyard equipped with capital saving "appropriate" technology will "create profitable small industries able to cover financing costs, create new capital and attract local investment", thus leading to "dissemination of the technology to other peri-urban locations in Tanzania."[6]

(2) Organizations involved in implementing the project and its productive activities

The implementing organization for the Improved Bricks project is CAMARTEC, which is also the grantee. The Center is also an on-lending agency for sub-projects jointly selected with the ATI Project Officer, in this way recycling loan repayments. One of the Center's predecessor organizations, AATP, had experimented with building materials technologies, e.g., soil-cement, low-cost structure. The Director General of CAMARTEC is from an area of Tanzania where brick making is well established and thus has a special interest in the project. CAMARTEC intends to "use the demonstrated success of this project as a means by which it can seek to expand its range of marketable technologies."[7] It may opt to produce the machinery directly, or gain its profit from consultancies in setting up new brickyards taking advantage of the new technologies.

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[6]Project Paper, p. 17.

[7]Project Paper, p. 8.

The productive activity for the second phase of the project, establishing and operating a commercially successful brickyard is to be in the hands of a private partnership, Meru Earthworks Ltd. The firm's interest in this venture started well before the project was conceived as they had been actively seeking to begin brick manufacture in the area but had rejected outmoded technology which the Regional Government had imported and was planning to sell. Currently a technician from the firm is working with the CAMARTEC Civil Engineer in testing the brick making machinery and has undergone three months of training with him in the United Kingdom in a working in a brickyard at the IT-Workshops. The other partners are technologists trained at the Mbeya Ceramics Institute in southwest Tanzania and local businessmen.

The Small Industries Development Organization (SIDO) has cooperated in the project by providing a Danish ceramic technician and transport and facilities to carry out tests on clays. This four month effort proved inconclusive, and thus the site for the factory has not yet been determined.

The firm of Sheriff Dewji and Sons, Ltd., which is carrying out the Rural Potteries Project under the implementing organization, CAMARTEC, has cooperated by providing free facilities for the test firing of bricks.

(3) <u>Description of the technologies under test</u>

As with probably all ATI projects, there are hard and soft technologies involved in brick making. The brick making machinery for mixing clay, molding bricks, and firing them must be organized into an operating brickyard with materials flows, stockpiling, quality control and, above all, production and financial management leading to a marketing strategy. As the project is some time from initiating Phase 2, the Evaluation Team concentrated on the technology selection under the first phase. The technologies employed have implications for the quality of the bricks produced, and hence for the ability of the firm to capture a share of the urban construction materials market.

The Evaluation Team visited two existing brickyards in the Arusha area which provide a significant contrast to the proposed brickyard under this project. Korean money and engineers have built a high technology brickyard for the SARUJI Corporation, which is designed to produce 5 million bricks per year. This large-scale factory has been equipped with mixer-extruder technology and oil-fired kilns. The construction has been limping along for several years but appeared to be complete, except for office buildings.

Nearby is an old brickyard now being operated under Tanzanian army control and producing bricks by a much older vintage extrusion process. Two new extruding machines sit rusting in the brickyard, with no apparent plans to install them. The brickyard only operates

intermittently; but no production information or plans were available under the circumstances of its current operation.

In contrast to these two plants, the ATI project aims to equip a brickyard with brick presses, which because of the low moisture content, require a clay crusher in order to finely granulate the material. This technology[8] will produce a high strength, well formed brick, which can be immediately fired, or stacked to dry. The stacking is important because it saves on shed space for drying. The technology proposed represents not just an intermediate step between backyard village brick makers who use slop molding of bricks and the high technology extruded brick factories, but in many respects a more appropriate technology because of the technical and commercial advantages.[9] The Evaluation Team saw the contrasts between slop molded bricks and pressed bricks in the Botswana Brickyard Expansion project. (See Chapter II.)

The technologies being tested in Phase I are three types of hand operated presses--the Terstaram Press, manufactured in Belgium by Fernand Platbrood; the Ceraman H Press, also of Belgium manufacture; and the Type E Press, manufactured by IT Workshops in the UK--and three clay crushers, two of which are also products of the IT Workshops. So far, the IT Workshops machinery seems to be the last choice, either for the crusher or the press. While the latter comes

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[8]"Improved Bricks" Project Plan, pp. 9-13.

[9]Project Plan, p. 12.

with a materials handling and green brick drying and handling package, it is nonetheless viewed by all whom the Evaluation Team interviewed as an inappropriate choice. This is doubly ironic since the manufacturer and disseminator of this technology is associated with the ITDG and the two testers were trained at the IT Workshops under project auspices and British Council Funds.[10]

The Evaluation Team had access only to verbal and preliminary written reports on the testing, and thus reporting of conclusive results awaits completion of the first phase. However, even the preferred machinery is being modified under the Project Officer's technical advice, e.g., drilling holes in the Terstaram press to vent clay in pressing and thus facilitating the determination of the appropriate moisture content.

Testing of the bricks for strength has been made more difficult by the local vocational institutes lack of capacity, but again, with the ATI Project Officer's technical advice, this unforeseen development should not be a significant bottleneck.

(4) Progress to plan

The Project is five to six months behind schedule. Presses were sent from Belgium to the wrong airport and held for

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[10]Note this was a change from the plan's proposed training in Kenya.

payment of taxes and duty, leading to a series of procurement delays. CAMARTEC appears to have handled these as best they could.

(5) Commercial viability and impact on target population

Because of delays in the implementation of the project, it is far too early to assess the commercial viability of the brick making enterprise. The Evaluation Team does have conclusions on the market and impact of the project which are treated in Section II.B.3. It is noteworthy that detailed commercial analysis was carried out by the ATI Project Officer. However, due to the inflation rate in Tanzania and development of possible competition, the analysis is out-of-date, and certain assumptions may prove faulty.

c. Oil Press Production, Project No. 84-0102

The third project visited by the Evaluation Team for which CAMARTEC is the implementing organization was the oil press production, described in Table 17.

(1) Project purposes

The purpose of the Oil Press Production Project is to provide a means to increase small-scale oilseed pressing capability in rural areas. Sunflower seeds are grown in marginal agricultural

Table 17: Oil Press Production Project Summary

Region: Africa

Project No.: 84-0102

Country:	Tanzania
Location of Project:	Arusha
Name of Project:	Oil Press Production
Implementing Organization (IO):	Center for Agricultural Mechanization and Rural Technology (CAMARTEC)
Productive Activity:	
Starting Date of Project:	September 1, 1984
Number of Months Elapsed at Time of Evaluation:	14 Months
Scheduled End of Project Date:	August 31, 1987
Total Funding:	$112,276
Purpose of Project:	To manufacture hand-operated sunflower oil presses for use in Tanzania villages.
Description of Technologies:	The project will manufacture two and possibly three types of oil presses developed in Tanzania. Two presses, which extract oil at a higher rate than existing presses, operate on the principle of a scissor jack. They exert 20 and 80 tons pressure, producing 1/2 and 2 gallons of oil per hour respectively. A Third press design has been developed based on a continuous feeding process.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

areas and offer a potential cash income to poorer farmers while supplying an essential cooking staple, edible oils. The project aims to provide a manually operated press through local manufacture in the town of Arusha of a design developed at the Institute of Production Innovation (IPI) at the University of Dar es Salaam. The objective is to bring this design to the commercial market place, setting up oil pressing enterprises in rural areas. A follow on to this project, the Village Oil Processing Project, (Section III.B.5.) has the objective of enabling villages to adopt and operate the oil presses manufactured through ATI support.

(2) Organizations involved in implementing the project

The project implementing organization is CAMARTEC on the outskirts of Arusha. However, the main productive activity is to be carried out by Themi Engineering, Ltd. This was formed through the efforts of the Regional Government in 1981 from a group of African engineers and machinists, selected through a competition. The firm is the result of a joint effort by three intermediaries: an AID-funded regional development project--the Arusha Village Development Project (AVDP), the Small Industries Development Organization, and the Regional Government. The aim was to establish an African-owned and operated engineering workshop. The Arusha area has many small machine shops, owned by the Asian community. Through an initial loan[11]

[11]Approximately US$ 136,100 at current official exchange rate of T.sh. 16 = US$ 1.00.

of Tanzania Shillings 2,177,500 for building and machines, and a loan to allow the purchase of critical raw materials (mainly soft steel),[12] Themi Engineering Ltd. was able to gain a foothold into the light engineering business in the area. The credit was provided through the Tanzanian Rural Development Bank, now the Cooperative Development Bank. The ATI Project Officer worked for this Bank after leaving the AVDP.

The USAID Mission, Dar es Salaam has been involved in setting up Themi Engineering, both indirectly through the Arusha Area Regional Development Project and support of the TRDB, and directly through assistance in overcoming procurement problems for a large milling machine.

CAMARTEC acts not only as the implementing organization for the ATI project, but has provided Themi Engineering with its main money earning enterprise, the manufacture of iron oxcart wheels and axles. Assistance was also given to set up production of an improved animal-drawn plow and accessories, but sales of this technology have been sabotaged by GROT support of a large-scale farm machinery factory in Dar es Salaam.[13]

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[12]T.sh. 900,000 or approximately US$ 56,000 for raw material stocks.

[13]This is a curious story of centralized planning and disjointed decision making. One arm of the Government spends money to establish local manufacturing capability to meet farm equipment demands and another arm works at cross purposes, overcoming managerial bottlenecks at a factory which assembles plows, whose components are manufactured outside the country.

The IPI at the University of Dar es Salaam is the source of the manually operated scissor-jack oil press technology. This Institute has been developing, modifying, testing, and selling theses presses since 1982. Under the ATI project, they were to provide Themi Engineering with engineering drawings, and technical assistance, e.g., in the fabrication of jigs and quality control for the manufacture of the press.

(3) Description of the technologies

The ATI supported technologies are especially appropriate to the Arusha region because of the characteristics of the existing technology. The IPI designed oil press, which uses a scissor jack principle to produce 80 tons of pressure, can be operated and powered by two men, and can be easily located in rural villages or small towns. Modern oilseed expellers powered by diesel or electric motor, have other drawbacks besides the dependence on expensive fuels or electricity supply, which many villages do not yet have. The expeller shaft quickly wears out and must be replaced, at present by importing a new shaft because it is difficult to machine.

At the time of the Evaluation Team's visit, a new pressing technology had been designed, built, and a prototype tested mainly through the efforts of the ATI Evaluation and Technology Development Groups' farm equipment specialist. The Evaluation Team refers to it in this report as the Bielinburg press. The specialist felt the IPI

design was excessive, and that a smaller scale continuously fed press was potentially viable. The prototype was functioning, and comparison testing side by side with the 80-ton press produced similar extraction percentages from the seed, but at a much slower rate (due to the smaller capacity).

The 80-ton press and an IPI scaled-down version which produces 20-tons pressure are only part of the sunflower seed processing system. Testing at IPI has shown the necessity to dehull the seeds and winnow out about 70 percent of the shells. IPI has developed a hand operated decorticator for these steps which must be done separately. Then the mixture of seeds and shells are crushed in a hand operated roller and scorched in a saw-dust fired heat exchanger. After pressing, the oil is separated from the residue using a clarifying chamber. From experimentation at IPI and Themi Engineering, it is clear that failure to carry out these separate steps leads to a much lower output and productivity.

One apparent attraction of the Bielinburg press is that the simpler design appears only to need heated seeds and clarification of the oil. Decorticators, roller-crushers and the IPI scorcher are not necessary to get the same extraction percentage. The seeds heated in the sun, or over an open fire is the only preparation necessary. However, the pressing effect on oil purity and taste has not yet been tested, and some degree of decortication of hulls may prove

necessary.[14] The technologies to manufacture the presses are typically those found in an engineering workshop, lathes, metal cutting saws, drill presses, cutting and welding torches. Themi Engineering Ltd is equipped with this level of workshop technology from its initial capitalization, and has been using it for general engineering repair work, to manufacture the iron wheels and axles of the ox-cart and to carry out special orders, e.g. for a corn thresher. The Bielinburg press prototype is being built with this machinery to demonstrate that no special equipment is needed.

The ATI project has introduced a new level of machine shop technology to Themi Engineering, Ltd., including a two-meter lathe, a radial arm drill press, and an electronically controlled precision flame cutter. To differentiate the precision engineering required of the IPI design presses from the cruder repair and ox-cart fabrication, the new equipment has been installed in a separate building. The machines were selected on the recommendations of IPI staff, procured through ATI channels to avoid the delays of getting foreign exchange allocations from the GOT, and set up specifically to produce the IPI designed presses.

Thus the evaluation team found an interesting contrast brought about through two parallel ATI efforts. The Oil Press Production Project, conceived with the IPI technology and its manufacturing requirements in mind, has created an impressive engineering capacity at

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[14]Discussion with IPI staff, Dar es Salaam, November 1985.

the African owned and operated Themi Engineering firm. The ATI technical assistance provided through their farm equipment advisor, who was hired and brought into the picture only in June of 1985 has provided an alternative technology with much less stringent manufacturing requirements.

(4) Progress according to the plan

The project has made substantial progress, despite some equipment procurement difficulties which the ATI Project Officer and CAMARTEC project manager have been resourceful in overcoming. Themi Engineering has produced three of the 80-ton presses and two of the scaled down 20-ton presses, and ten prototypes of the Bielinburg press were being manufactured. Testing of the models has been much slower, as one 20-ton press had been in a village setting for only three weeks. It had failed (at the end of the screw thread, which was suspected to be a weak point in the design) the day the Evaluation Team visited it. The 20-ton press is likely to be supplanted by the Bielinburg design if the latter tests out in a field site installation.

The 80-ton press was only reaching its productive potential at the time of the Evaluation Team's visit because of a recent injection of technical assistance from IPI. The roller crusher and scorchers were added to the processing steps which reduced the number of pressings on one 25 kg batch of seeds from three to one. One of the Themi partners made the long trip to IPI at Dar es Salaam, spent a week studying the

newly designed equipment and then returned to Arusha to manufacture the items.

A continuing problem for the manufacturing process has been difficulties with the electronically controlled flame-cutter, which is the state-of-the-art technology for shaping large steel plate as required for the cage of the 80-ton press and the frame. An alternative technology, e.g. a profile cutter would have been perhaps a better choice, but was not the IPI recommendation.

(5) Commercial viability

The ATI project officer carried out a detailed and comprehensive analysis of the commercial aspects of the oil press production and utilization. The Evaluation Team examined this assessment and identified several areas which are of concern. Annex 7 presents the analysis.

First, there is the level of capitalization of the Themi Engineering, Ltd. and the debt they have taken on. Loans from the regional government got them started. loans from the Cooperative Development Bank have provided both machinery and raw materials. Loans made available through CAMARTEC from the ATI project have encouraged a high level of machinery investment. This expenditure is questionable if the machines are to be utilized only to manufacture oil presses, i.e., it is difficult to see how the two-meter lathe, or the flame

cutter will pay for themselves if their capacity is restricted to oil press manufacture.

Second, a close examination of Themi's debt-equity ratio, debt servicing, and inventory turnover reveals some risks which must be closely monitored and eventually managed. Themi has acquired an enviable stock of hard to procure raw materials, mainly steel bar, plate, and sheets. The inventory turnover rate would be unacceptably low were it not recognized that this is an insurance against procurement problems in a climate of severe shortage of foreign exchange.

The debt-equity ratio is unacceptably high when all loans are considered lumped together, but if loans for raw materials are excluded, then the picture is more favorable. One concern is that the fixed assets, mainly in expensive workshop machinery are not being properly maintained[15] and because of duplicated equipment purchases, this situation is not likely to turn around.[16] As for debt servicing, Themi Engineering has repaid approximately T.sh. 900,000 borrowed initially from the CDB and has reportedly set aside funds to repay the

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[15]Bielinburg memo, July 1985.

[16]The Evaluation Team has an unclear picture of the source of machinery and what machinery is being used. A loan from CDB for steel reportedly resulted in machinery being delivery to Themi which duplicated some of that purchased under the ATI project loan with CAMARTEC, i.e., two flame cutters were delivered. According to Themi staff, one has been sold; according to ATI staff both are still with Themi. The Evaluation Team saw only one installed and it was down for repairs.

Regional Government start-up loan. The loan terms are unclear to the Evaluation Team. Themi appears to enjoy favorable terms from the Government and CBD, at least with regard to repayment of the initial capitalization loan. Themi's repayment of the balance of the debt, T.sh. 6 million depends on successful returns on the machinery and raw material investments. These returns may be jeopardized by unexpected competition, possibly from two organizations who were to have assisted Themi.

- CAMARTEC is back in the business of producing ox-carts which they presumably had passed on to Themi Engineering. This has been the main money earner for the latter, but CAMARTEC seeks to supplant its government and donor funded budget as well; and

- IPI, despite an understanding that Themi would have the responsibility for national sales of the 80-ton press has taken up full scale manufacture in their Dar es Salaam workshops. Some 25 presses were in various stages of assembly when the evaluation team visited. This is a definite threat to Themi's market share as IPI is clearly better equipped to refine the design, cut manufacturing costs as they move to production engineering of the design, and provide after-sale service to a wide region because of their more central location.

None of these points may be a major concern, if, as suspected, a significant demand for the press develops. Just in the week that the team was in Arusha, several interested purchasers approached the ATI project officer and at least one came for a demonstration. Should demand grow, it is a possibility that the Asian-owned engineering workshops in the Arusha area would provide significant competition to supply the manually operated presses.

(6) Impact on target population

The project has the potential to have a significant and sustained impact on the lives of farmers in rural areas where sunflower seeds can be grown and processed locally for cooking oil. The latter is much in demand as noted in the Evaluation Team's review of the Village Oil Production Project (see Section II.5.). The press technologies, 80-ton and Bielinburg, offer the possibility of the seed producer capturing the value added. As for the manufacture of the press itself, this will have limited direct impact, as Themi Engineering will only increase its number of workers marginally to take up production. There is a potential multiplier effect leading from Themi's increased capability to serve as a engineering workshop, keeping new machinery technologies flowing to commercial use.

3. Analysis and conclusions on productive activities and CAMARTEC

The descriptions and findings have treated each project according to the informal evaluation checklist, e.g., purpose, technologies, commercial viability, etc. This section draws together the Evaluation Team's conclusions, first, for the productive activities supported under the projects, and then for CAMARTEC as an implementing organization, over all the ATI projects.

a. Analysis and conclusions regarding the productive activities

(1) Source of ideas

The ideas for the rural pottery project, the improved bricks project and the oil press project stem from the Project Officer's past work in Arusha for an AID-funded project and the Tanzania Rural Development Bank. The Project Officer has had experience working with the productive enterprises, Themi Engineering and Sheriff Dewji and Sons, Ltd., from earlier work in Tanzania. His relationship with the regional representative of the Small Industries Development Organization (SIDO) led directly to the manual brick press technology being tested for the Improved Bricks Project.

Project ideas were developed in Washington, proposed via mail to the entrepreneurs in Tanzania, and then further developed by field visits. There is no question that the ATI Project Officer could not have been able to move so rapidly to initiate three projects in the

first 12 months of his employment without building on his established contacts and prior experience. This was perhaps ATI's thinking in hiring him and makes sense when there is organizational pressure to fund projects.

(2) Productive activity capabilities and commitment

The Sheriff Dewji and Sons, Ltd. is owned and managed by quite capable businessmen. The Rural Potteries Project Plan reports that all divisions of the business are profitable. The management is interested in further refinement of the technology and process and allocates time for research. One family member's sole job is the operation of ceramic production. The head of the family has a very keen interest in the rural potteries project, and works well with the Project Officer in any suggested changes or alternations in the project.

Themi Engineering has the capabilities to carry out the oil press production. The project has supplied them with a seeming abundance of hardware technology; and prior loans have enabled them to build up a substantial raw materials stock, which in present day Tanzania gives them a significant advantage over other workshops. They are running a successful ox-cart fabrication business and general machinery repair. The partners include capable management and business expertise. The firm has the required capacity to manufacture both prototypes and production machines.

While Themi has a strong commitment to the production of the 80-ton equipment, having acquired the machinery and tools necessary to produce it, commitment to manufacturing the Bielinburg press is less easy to assess. For one thing, it doesn't require the use of the new machinery such as flamecutter or a 2 meter lathe.

The Meru Earthworks firm has devoted the time of an employee who studied with the CAMARTEC Civil Engineer in the UK and is working alongside him in testing the equipment planned for the improved brickyard. While the Evaluation Team did not have the time to talk directly with the management of the enterprises, the provision of employee time to essential training and R&D is indicative of commitment to the project, and realization that their capabilities with regard at least to the brick press technology need upgrading.

(3) Risk to productive activities

The rural pottery project poses little risk for Sheriff Dewji and Sons, Ltd. The project has strengthened their enterprise and allowed them to make materials they were previously required to import. It is uncertain that there will be impact on rural potteries. The project was originally designed to build up Sheriff Dewji's capabilities, i.e., an institution-building project, and the objective of assisting the rural potteries was added after the project was reviewed within ATI. Although the project agreement notes one of

the objectives is to provide technical assistance to the potteries, there was very little redesign of the project to reach this end.

On the other hand, the risk taken by a potter to move into glazed production is substantial. With the large capital investment required, the production process requires more attention to productivity, and marketing to insure sufficient output and sale of output, to cover loan charges, and higher operating expenses.

The Evaluation Team sees considerable uncertainty and risk in the improved brick project. Initial assumptions about the availability of suitable clays elsewhere were not borne out. The project site and product quality-price uncertainties to be faced by the new brickyard are related to the two existing brickyard facilities, whose future operations, output, and market competition are yet to be determined. One might wish that these inherent risk factors could be foreclosed by an altogether different project site, serving a different market, and thus having significantly different raw material and product transport cost factors.[17]

(4) Marketability

Orders are being made for the oil presses, and a number have been sold. The Evaluation Team sees no problem with

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[17]The SIDO Regional Manager suggested moving the site to his home town of Iringa in Central Tanzania, if a suitable site did not soon develop.

marketing the large press, given the favorable return on investment resulting from the high price of cooking oil. There may be a reduced market share for the 80-ton press because of IPI's decision to retail the technology. Themi Engineering may not devote its resources as enthusiastically to the production of the Bielinburg press, although the Evaluation Team believes there will be great demand for it.

As for the marketability of the brick making technologies being tested at CAMARTEC, only the Meru Earthworks is a known customer at this time.

The original design of the rural potteries project focuses on the production of firebricks, frit and other materials. The marketability of firebricks has already been proven by the sales experience of Dewji. The production outputs of frit and other materials have a ready consumer--Sheriff Dewji and Sons, Ltd. can consume it for their internal use. The firm's market orientation seems not to be directed toward selling to the potters, and thus it is uncertain whether this market will compose a significant percent of their sales in the short term.

(5) Information flow

Themi Engineering receives significant attention from the ATI Project Officer. He visits the site frequently on his trips to Tanzania. Communication between the Themi and the Arusha

Synod representative regarding the production of presses for the ATI supported follow-on activity has been poor (see Section III.B.6.).

The information flow between ATI and Sheriff Dewji and Sons, Ltd. is very good. Recommendations to adjust the technology, e.g., relocate flame throwers within the kiln were readily accepted. Information flow between Sheriff Dewji and the potters is minimal. Efforts have been made, but two potters complained about the lack of dedication to activities with which Sheriff Dewji has been involved and the lack of follow up on promised assistance.[18]

b. Analysis and conclusions regarding the implementing organization CAMARTEC

(1) CAMARTEC's capability

CAMARTEC has an active technical role in only one of the three projects, the Improved Brick Project. All apparent capability rests with the civil engineer they recruited for the position, as any experience gained from their previous work with earth-block presses was lost. There is no brick testing capability, other than simple density calculations, and material must be sent to test facilities in Dar es Salaam.

CAMARTEC's participation in other projects is largely limited to

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[18]Sister Jean, Dar Es Salaam and Pottery, Dar es Salaam.

monitoring and evaluation. In the Rural Pottery project, they have the role of assisting village potters to complete loan applications. The CAMARTEC representative assigned to this project had little information on the activities of the operations he was to monitor, and knew very little about the village potters he was to assist.

(2) CAMARTEC's commitment

CAMARTEC has assigned one individual to work with the three projects that it monitors, but the amount of time allocated to the projects (about half) and the design of the projects gives CAMARTEC very little room to contribute to the projects. CAMARTEC is being used as a convenient organization through which to pass funds.

The Improved Brick Project is different from the other two ATI projects because it gives to CAMARTEC a substantive research and development role. The other two projects do not substantially involve CAMARTEC in research, testing, or demonstration activities, and thus we suspect a different level of commitment on the Center's part.

The Evaluation Team noted that CAMARTEC's resumed ox-cart production may undermine Themi Engineering's overall commercial viability. CAMARTEC passed the ox-cart production technology to Themi, pursuant to CAMARTEC's commitment to fostering organizations based on technology developed from its organization. This commitment may be limited as it continues to produce the ox-carts in lieu of moving to

other machinery development and prototype testing.

(3) Risk to CAMARTEC

CAMARTEC's role is largely limited to being an information broker. It has little investment in the projects; consequently it has little risk. The organization should gain from the projects through the loan repayments by the productive enterprises. These funds can be used by CAMARTEC to develop other projects, such as new grain storage technology shared with them by the ATI Project Officer.

(4) Information flow

Information flow between ATI and CAMARTEC appears to be good. There is a lack of monitoring of projects on the part of CAMARTEC, indicating there is not sufficient communication between CAMARTEC and the productive activities.

4. Lutheran World Relief, The Arusha Synod, and Village Oil Production

The fourth and final project in Tanzania follows on the oil press production project. It is an effort by ATI to ensure dissemination of the oil presses to village groups through innovative

technical assistance and financing arrangements. Table 18 summarizes the project.

a. History and funding

The Lutheran World Relief is the implementing organization for the Village Oilseed Project. The Arusha Synod, a conglomeration of parishes under the Evangelical Lutheran Church in Tanzania (ELCT), is the sub-grantee implementing the project. Both organizations are discussed below, with greater emphasis on the Synod as it has the day-to-day management responsibility of the project.

The Synod's orientation is evangelical and development work. It is composed of 15 community congregations, each with an annual budget of 1 to 1.5 thousand shillings. In most cases, the budget is entirely from contributions from members of the congregation.

The Synod receives funding from a number of international organizations including Bread for the World, ICCO (Dutch), and GTZ, (the German Overseas Service). Their current heifer project supported by the European Community for forty thousand dollars will be increased to one million dollars. A long-term pastor working in the Arusha Synod, informed the Evaluation Team that obtaining money is not a problem. He notes that there is more of a problem to find donors willing to fund small projects.

Table 18: Village Oil Processing Project Summary

Region: Africa

Project No.: 84-0035

Country:	Tanzania
Location of Project:	Arusha
Name of Project:	Village Oil Processing
Implementing Organization (IO):	Lutheran World Relief/Lutheran Synod in Arusha
Productive Activity:	Village Groups
Starting Date of Project:	March 1, 1985
Number of Months Elapsed at Time of Evaluation:	8 Months
Scheduled End of Project Date:	February 28, 1989
Total Funding:	$142,676
Purpose of Project:	To disseminate hand-operated oil pressing technology to villages and to start a self-financing development entity to help Tanzanian village groups establish small scale sunflower oil extraction industries.
Description of Technologies:	The "soft technologies" include assistance in extension research to identify high potential sunflower growing areas, financial assistance to purchase the oil press and most important, assistance in developing organization to operate the oil presses. The oil presses manufactured by the oil press production project (84-0102) will be used in this project.
Strengthening Grants to IO:	None

Expended thru September 30, 1985:

The financing body behind the Arusha Synod supporting this project is the Lutheran World Relief (LWR). The headquarters of LWR are based in New York, with regional headquarters in Nairobi. ATI directs its funds for the project via this organization. LWF funds a number of projects in East Africa, and has four in Tanzania with budgets totalling over $3 million. LWF has worked jointly with USAID, UNHCR and ELCT, which indicated to the Project Officer that LWF could work well with other donors. In relation to this project, LWF has provided input to shape the project, but does not deal with the project on a regular basis, except to process reports from the field. It has no management responsibilities in the field.

A major impact that LWR had on the project was reshaping the project at the last minute. Project development did not proceed smoothly. After initial commitment from LWR to fund two vehicles and two expatriates, LWR withdrew almost half of their resources. The decision to change LWR's support was made at the top of the organization after a change of leadership. The ATI Project Officer doubts that he will work with LWF again. His reasons are that 1) he does not consider LWR a reliable partner due to the unexpected withdrawal of substantial funding at the last minute, and a perception that the LWR top leadership is not sensitive to African development needs. However, the disenchantment appears to be mutual: LWR is disappointed with ATI's development of the project plan. It requested

that the recipients of the press be communities, not individuals, an issue which has not been resolved as of November 1985.

b. Overview of current Synod activities--management and resources devoted to the project

The Synod is presently involved in a number of projects including heifer, pottery, fish farming, and health clinics. The objective of the heifer project is to upgrade local cattle breeding stocks largely through the supply of improved heifers. Most of the project activities of the Synod are managed by people in individual congregations. There is little centrally-funded activity.

Major contributions from the Synod are supporting the Governing Council and the network of congregations in the Synod. These are valuable contributions which will affect both the direction of the project as well as its replicability between villages.

5. Description and findings of LWR project

a. Objective of project

The objective of the project is to disseminate hand-operated oil pressing technology to villages. Through this dissemination villages will have access to lower priced oil, and the establishment of oil pressing concerns will create employment. Another

objective is the enrichment of the community due to retention of the value added by processing in the village, rather than paying an oilseed pressing enterprise based in the town.

The relative emphasis between making oil available at lower prices and the enrichment of the village community is under debate between ATI and the Synod. The ATI Project Officer feels that the oil press should be disseminated not only to community concerns, but to individuals as well. The availability of the oil at a lower price should be a primary concern, and dissemination will be quicker and have a greater chance of success if individuals are also involved.

The Synod believes that the benefits from the technology should not be captured by an individual proprietor, but shared by collective or group ownership.

A second project objective is to establish a self-financing development entity to help Tanzanian village groups establish small-scale sunflower oil extraction industries.

b. Description of producing entities

As of November 1985, the LWR technical advisor of the project states that the producing entities of the project will be groups of villages. The ATI Project Officer hopes to convince the advisor that the press should also be made available to individuals as

well. How this will work out in practice is yet to be seen, but it may be that assistance will be offered to individuals to help set up an oil press concern, but individuals will not be eligible for financial assistance.

During the first phase of the project, the LWR advisor notes that the press will be received by villages within the Synod district. At present, identification of villages has proceeded along Synod organization networks. It is probable that the first few groups will be members of the Synod.

c. Description of "soft technology"

This project is taking the technology developed under the oil press production project (i.e., oil presses) and providing assistance to villages to be able to use the press. Assistance includes extension and research to identify high potential sunflower growing areas, financial assistance to purchase the press and most important of all, assistance to developing organizations to operate the oil presses.

d. Progress to plan

The project was recently funded in March 1985, and consequently is only eight months old, but the project is already ahead of schedule. Seven villages have been identified, instead of the

three, and one press has been installed in a village. Progress has been made on developing a process for the dissemination of the technology. The process involves substantial Tanzanian community involvement, as well as substantial press recipient involvement.

e. Commercial viability

(1) Type of analysis performed in Project Plan

The commercial analysis in the project plan was completed with a good deal of thought and examination of issues. Many factors were considered, including all the components of fixed, variable, capital and start-up costs for the productive sub-project activity. Two components of the project were analyzed: oil producing enterprises and the development company. A break-even analysis on the productive sub-projects (independent oil production operations) and then a cash flow analysis on the development company was undertaken. The Project Plan noted a break-even point at 17 percent of capacity, and a development company cash flow sufficient to fund the projected number of sub-projects. An aggregated cash flow analysis was calculated for all the sub-projects, and it was estimated at T sh 26,000.

(2) Revised commercial analysis by the Evaluation Team

A commercial analysis of the independent oil

production activities was recalculated by the Evaluation Team and is presented in Annex 8. The analysis considered the changes due to the technology development and price and cost data as of November 1985.

No major assumptions of the original analysis were challenged, but prices had changed considerably, and the development of the technology required more capital equipment than previously envisioned (see Section II.B.2.c.). The capacity of the oil press is calculated at 50 percent more than previously estimated. Considering these major changes (more capital equipment, greater productive capacity and price changes), as well as changes in cost of raw material and price of oil to be sold, the recalculated commercial analysis indicates that the project will break even at 15 percent. (See Annex Table 8-1.) When financial costs are included (which were not in the Project Plan), the break-even price increases to 21 percent of capacity.

Sensitivity analysis was performed on three factors: price of raw material, cost of output, and the capital investment (cost of major equipment) required for the project (see Annex Table 8-2). The cost of raw material inputs and price of output (oil) was varied by 10 percent, where as the cost of the capital equipment was varied by 20 percent. The cost of equipment was varied by 20 percent as information on these costs is more tentative. The analysis indicated that the success of the project is not very sensitive to the cost of the raw materials, but is very sensitive to the changes in price of the equipment required to start an operation as well as the price of the

output.

The probable return to investment in the technology package promoted by the project, as calculated by the Evaluation Team, is likely to be about 22 percent. The change in the internal rate of return according to price changes in these factors are displayed in Annex Table 8-3.

(3) Sensitivity analysis to various price changes

Commercial analysis of the new Bielinburg oil press developed under the project indicates that it has similar break-even points to the 80-ton press described above (see Annex Table 8-4). Capital costs are about one-third, production is one-third, but productivity measured in terms of extraction rate are similar between the two machines.

6. Analysis and conclusions about LWR and Village Oil Production

a. Source of the project idea

A pastor in the Arusha Synod along with the ATI East African Project Officer developed the project idea in response to the perceived need to have access to locally produced edible oil in the villages. The project is a follow on project to the oil press production project which ATI funded the previous year.

Villages must depend on the market and market prices for their oil. The official price of sunflower seed oil has increased from T sh 120 per imperial gallon ($13.33 in 1980 dollars) to T sh 450 in 1985.[19] Oil is usually purchased on the black market at an even higher rate of T sh 560, as it is not frequently available in the stores at the official price. Due to low producer incentives, decrease in oil press capacity, and the government mandate to cultivate crops other than oil seed crops, there is little edible oil available for village consumption.

The pastor sought assistance from ATI and subsequently from Lutheran World Relief to make the oil presses available, so villagers could extract edible oil from their own seed production and capture the value added for themselves.

b. Capability and commitment

The Technical Advisor to the project is a very capable American with extensive experience in Tanzania. He has worked previously in the region and is familiar with the customs and relationships in the village. The Advisor has a history of village-level participation and the Evaluation Team believes these attributes will be major factors in the project's success. As his time is fully committed to the project, any problems arising in the project

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[19]Project Plan, p. 5.

and can be dealt with quickly.

The commitment of the Synod is demonstrated by their active participation in an advisory council, and their interest in learning about developments of the project such as a demonstration of new developments in oil press production.

c. Risk

The financial risk to the Synod is very small, but their personal stake is high, as they are devoting energy to the project in terms of time and program review. The risk to the villagers is dependent on the terms given to them for the purchase of the oil press. The Advisor hopes to reduce the risks by educating them on the requirements of an oil press operation and by staging the entry of the press into the village, e.g., first introducing sunflower seed varieties with high oil yields and increased plantings.

d. Marketability

There will be no problem in selling the oil, as it is in great demand and the low production costs should insure complete use or sale of all oil produced, even if the prevailing retail price were to level off or decline marginally.

e. Information flow

The dissemination process developed by the advisor is one in which the introduction of a press will be dependent on the receptivity of the village to the press and the necessary requirements of operating it. The arrangements for dissemination are tailored to the individual needs of the community receiving the press.

During project development, feedback from LWR was not incorporated into the Project Plan. The ATI Project Officer reasons that it was necessary to get the project started, leaving the details to be worked out subsequently. This has resulted in some discontent between him and the advisor hired by LRW, as the advisor is following the original LWF proposed plan, which was not incorporated into the ATI project plan.

C. ATI Links to Other Organizations in Tanzania

1. Donors

a. USAID/Dar es Salaam

ATI has been operating in Tanzania since the Project Officer joined the organization in 1984, but he was well known to Mission staff from his prior work on AID-funded projects. In a debriefing with the Evaluation Team, the Mission Director expressed his respect for the ATI Program Officer based on past associations and his interest in ATI's current activities. Because of the Brook Amendment's

structures, he considered ATI's program to be wrapping up ongoing programs as the Mission phases down (see Annex 6). Bilateral aid to the GOT is scheduled to end in 1987, though funds may be expended on disaster relief and Food for Peace (Public Law 480) beyond that date. The ATI Project Officer has made use of the Mission's administrative assistance in procurement and in utilizing the reflow of PL 480 funds.

b. Other donors

ATI has not worked with other direct bilateral assistance programs in Tanzania, but its projects have relied on the services of a Dutch volunteers in both the Rural Potteries project (to provide technical assistance to one of the Arusha cited potters) and in the Brickyard Project to help select sites for the Improved Brickyard.

2. Tanzania technology organizations

ATI has selected CAMARTEC as the implementing organization for three of its four Tanzania Projects. The Center may not be a strong institution, but it has the Government's trust and support to deliver appropriate technology in the Arusha region and its expanding network of workshops (refer to Section III.B.1.).

The ATI Program Officer has strong links to the Regional Manager for SIDO, based on the Project Officer's prior work experience in Arusha. The Evaluation Team met with the SIDO Regional Manager and was

impressed by his stated approach and interests. He was involved with the ATI Project Officer in setting up Themi Engineering, and he has considerable interest in the Improved Brickyard project.

The links between ATI and IPI are not well forged, though IPI provides the source of the 80-ton oil press technology. Various aspects of the Oil Press Production Project could have been improved if close ties, more frequent exchanges, and better agreement had been reached on the development of the technology, the granting of exclusive rights of production (to Themi), the frequency and quality of technical assistance, and the apparent competitive situation which has now developed. (See Section III.B.3.a.)

3. <u>International technology development and transfer organizations</u>

ATI's improved brickyard project is testing alternative brick press and clay crushing technologies, one of which is supplied by the Intermediate Technology Group in the United Kingdom. The test is likely to generate controversy between ATI and ITDG on the merits of IT-Workshops promoted technologies. (See Section III.B.2.b.)

The Rural Potteries Project funded enterprise, Sheriff Dewji and Sons, Ltd., has ties to VITA, and the kiln firing technology using waste oil has been featured in the latter's worldwide publications. The evaluation team is not aware of any follow-up links between ATI and

VITA, which is based in Washington, DC and AID funded. Areas of cooperation may be limited to knowledge dissemination, but could be important to the replication objectives of ATI projects.

4. Analysis and conclusions about ATI linkages and operations in Tanzania

ATI has staffed the East African region with an experienced personable project officer. He has cultivated various links with agencies and Government over the years, knows the principal actors well and is respected by those the Evaluation Team met. It is not coincidental that the projects are concentrated in the Arusha area where the Project Officer worked for many years, and which provides easy communication to Kenya.

The ATI program in Tanzania is significantly biased toward working closely with and supporting for-profit enterprises. The types of projects chosen, the particular actors selected to work with, and the relative inattention to and impatience with bureaucratic niceties reflects the interests and experience of the Project Officer. The immediate result is that the program got off to a quick start in a situation where other programs were in jeopardy because of the Congressional Amendment effecting bilateral aid to debtor countries. As the evaluation team has indicated in the conclusions about the specific projects and Implementing Organizations in the preceding sections, this approach raises some questions of leveraging and

spreading the benefits. The report returns to this point in the concluding chapter.

Table 14: CAMARTEC[a] Budget, 1982-86
(Millions of Tanzanian Shillings)

Year	Development Budget	Recurrent Budget
1982-83	14	2.6
1983-84	29	3.9
1984-85	30	5.2
1985-86	7.5	NA

[a]CAMARTEC = Center for Agricultural Machinery and Appropriate Rural Technology.

Source: Estimates from Director General, CAMARTEC, November 1985.

IV. FIELD OPERATIONS IN KENYA

A. ATI's Planning and Field Operations

1. History and staff

ATI has a long history in Kenya commencing with ATI's establishment under the Grant. The program has not always been successful, in particular with regard to a number of institutional-strengthening grants. Nine of the 11 projects begun under the ATI Grant were completed by October 1983. The remaining two were closed down in 1984.

A project in the local mineral resources technical field is the first initiated under the Cooperative Agreement, and represents a shift in emphasis for the Kenya program. A more direct route to working with the private sector enterprises is being pursued. The shift coincides with the preferences and interests of the ATI project officer assigned to East Africa. He served in the Peace Corps in Kenya, and stayed on to help set up a pottery business some years later which is still in operation. He knows the country and people well and is fluent in Swahili.

2. Project portfolio

ATI has only one Kenya project as of November 1985, the Ceramic-Lined Jiko Project (No. 85-0009), which was studied by the Evaluation Team. The implementing organization for this project, Kenya Energy Nongovernmental Organizations (KENGO), and the prime contractor,

Maiki Jikos, Ltd., are described in the following sections.

The Jiko Project is for a total of $248,973 K sh and is summarized in Table 19. It was of special interest to the Evaluation Team because of its replication potential. ATI is actively involved in dissemination of the technology outside of Kenya, and the East Africa project officer has traveled to Haiti to test the Kenya Ceramic-Lined Jiko (KCJ) and assess demand.

Other ATI projects in the concept stage include a portable brick press which would travel to various brickyard sites, and a compressed saw-dust burner. Both technologies are employed in other Africa ATI projects, and fall in the priority areas of mineral resource development and agro-processing, according to the Project Officer. The Evaluation Team is not aware of any other agro-processing projects, or any farm equipment projects under consideration.

B. Description and Findings About IOs and Projects in Kenya

1. Kenya Energy Nongovernmental Organizations: description and findings

a. History and funding

The Kenya Energy Nongovernmental Organizations (KENGO) was established in 1981 to coordinate the participation of

organizations and associations in the United Nations Renewable Energy Conference, held in Nairobi that year. It continued the coordinating role after the conference, registering as a nonprofit organization, and now has some 60 member organizations subscribing at 200 K.sh. per year.

KENGO's funding source, apart from the nominal amount raised by subscriptions, is through donor organizations, and is reported to be K sh 10 million., and K sh 1 million from NORAD.[1]

KENGO was a subcontractor on the Renewable Energy Development Project (REDP) under the Ministry of Energy and Regional Development. The project was to run from 1980 to 1984 with funding of about US 6 million. The cookstove portion of this project was terminated in 1984, mainly because the principal actor, Maxwell Kinyangui departed at the completion of his two-year contract.

KENGO carried out some cookstove dissemination activities on this project and was involved in a test program for the KCJ. It is a natural implementing organization for the ATI cookstove project because of its widespread variety of contacts throughout the country.

b. Management and overview of current activities

KENGO is an umbrella organization for all the

[1]Walubengo, 1985.

non-governmental organizations working in the field of renewable energy. It provides for (1) direct material assistance, e.g., seedlings and fencing materials, (2) training in agro-forestry, (3) technical assistance to its member organizations, and (4) coordination/information transfer.

KENGO is organized into two main program areas, Agro-Forestry and Wood Energy. Its total staff is approximately 26 with about eight people in the Wood Energy section. The woodstove project has the ATI project manager and three other extension officers.

KENGO's management is reportedly over extended. The Evaluation Team was unable to meet with the Director, and instead interviewed the Head of the Wood Energy Section.

KENGO's main activity at present is promotion of energy conservation through a series of traveling workshops. At these workshops agro-forestry and improved cookstove technology are explained to local leaders and interested citizens.

c. Resources committed to the ATI project

The ATI project with KENGO did not get started smoothly, partly because of a misunderstanding (and perhaps miscalculation by KENGO) on roles and in-kind resources to be contributed by KENGO. The original plan called for KENGO to supply two staff full time, and a

vehicle. The vehicle and second staff member were not made available. At the time of the Evaluation Team's visit, November 1985, this seemed to have been resolved, but not without some mutual disenchantment. This matter is treated in the conclusions.

2. Description and findings of KENGO's Ceramic-Lined Jiko Project

a. Project purpose and objectives

The objective of the project is to "assist in bringing about the widespread use of fuel-efficient charcoal and wood-burning stoves (jikos) in Kenya..." in order to reduce the pressure on fuel wood resources and to decrease both the labor allocated to cooking and fuel expenditures of low and middle income families.[2]

The project aims to facilitate the spread of this improved cookstove technology (KCJ) throughout Kenya by promoting 20 dispersed projects to create a demonstration effect for the manufacture of the KCJ, and especially the production of the ceramic liners. Specifically it will:

- "Introduce...manufacturers to improved jiko design, and train them in the process...;

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[2]Project Plan, p. 2.

Table 19. Ceramic-Lined Jikos Project Summary

Region: Africa	Project No.: 85-0009
Country:	Kenya
Location of Project:	Countrywide
Name of Project:	Ceramic-Lined Jikos
Implementing Organization (IO):	Kenya Energy Non-Government Organizations (KENGO)
Productive Activity:	
Starting Date of Project:*	August 1, 1985
Number of Months Elapsed at Time of Evaluation:	3 Months
Scheduled End of Project Date:	July 30, 1988
Total Funding:	$248,973
Purpose of Project:	To promote the manufacture and dissemination of fuel efficient cook stoves (jikos) in Kenya.
Description of Technologies:	The project will offer existing jiko manufacturers training in the production of metal cladding and ceramic liners for charcoal burning stoves. The project will also field test a ceramic-lined portable wood burning stove.
Strengthening Grants to IO:	None
Expended thru September 30, 1985:	

*Grant dated May 16, 1985.

- Locate and train local potters in the process of manufacturing ceramic liners;

- Re-capitalize these producers to jointly make improved jikos on a commercial scale..."[3]

An overriding objective of the project is to shorten the time required for widespread adoption of the technology, especially in areas outside Nairobi and Mombasa, the two largest cities. The Project Plan envisions that the project may shorten the time period in half, from 20 to 10 years. Thus, it falls into the category of replication efforts under ATI's amended Cooperative Agreement.

A secondary aim of the project is to test an improved ceramic-lined wood burning stove with further development of this technology contingent on successful pilot and field tests.

b. Description of the organizations involved in implementing the project

The funding for this project is channeled through KENGO, which subcontracts the work to Miaki Jikos, Ltd. The latter is a partnership formed by a man who has been most instrumental in the development of the KCJ, Maxwell Kinyanjui. KENGO's role as implementing organization is primarily to subcontract with Miaki Jikos, and then test the products. Other activities are accorded to KENGO,

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[3]Concept Paper, p. 3.

but the primary responsibility for the thrust of the ATI project lies with Maxwell Kinyanjui.

"Originally conceived to provide a training and testing site for research into improved jikos, it (Miaki Jikos) is now a full-scale production unit in which the metal and ceramic components of jikos are manufactured...Miaki Jikos was originally operated as a self-financing technical development unit, and has evolved into a profit-making company making money from supply of technical assistance, and manufacture of jikos."[4]

Mr. Kinyanjui is known as the African expert on ceramic-lined stoves.[5] He has been involved with cookstove improvement and production since 1977.[6] He has direct experience of the specified tasks assigned him in the ATI project as he was recently involved with the Kenya Renewable Energy Development Project for which he "designed, planned and implemented a strategy for...(USAID) establishing ten small-scale enterprises producing improved woodstoves." He has had experience in Sudan, Lesotho and Rwanda on consultancies with USAID, CARE and UN/FAO on the design of programs, implementing projects and in the design of stoves. His entrepreneurial talents are easily recognized in his numerous occupations: a pottery shop, a consulting firm, a past investment in a beef feedlot business, and the

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[4]Project Plan, p. 10.

[5]Source: Conversation with H. Allen.

[6]Project Plan, p. 8.

organization of a profitable study/tour of East Africa for US students.

Kinyanjui's ability to manage an operation in a commercially-viable mode is exemplified by the production operations of his jiko business, Miaki Jikos. Each line of the production process is paid by the piece, allowing a profit margin at each step of production. There are "profit centers" built into the operations--Kinyanjui buys ceramic liners from his pottery man, who in turn has hired workers to make the liners, the workers being paid on a per piece basis.

c. Description of the technologies

Both hard and soft technologies are involved in this project. The hard technologies are the production of the metal stove cladding, the ceramic liner and the assembly of the pieces for the charcoal burning jikos.

The major differences between the stove promoted by this project, usually referred to as the bell-bottomed jiko or the Kenyan ceramic-lined jiko and the traditional Kenyan stove are (1) the presence of a ceramic liner instead of an all metal stove, (2) the waisted-metal casing, (3) the need to use vermiculite to seal the liner and the metal claddings together, and (4) a 30 percent greater fuel efficiency.

The soft technologies in this project involve training and marketing assistance as well as business management. The project will offer existing jiko manufacturers training in the production of metal cladding, training in the manufacture of ceramic liners, help in penetration of the local markets, and (provide) capital both to consolidate their existing operations and to provide security and additional storage for expanded production of the new stove.[7]

The "soft technology" is especially important as the project is premised on the need for technical assistance in order to produce a good quality liner. The liner must be constructed of a suitable mixture of clay, sand and cow dung, and fired in a permanent kiln at a controlled and constant temperature. The liner must also be properly installed in the cladding with sufficient vermiculite to ensure sufficient insulation.

The project includes technical assistance in the form of training on the technical side of the manufacture of both the cladding, the liner and their assembly, but also in developing a local market for the stove and in developing a market strategy. Financial assistance is offered in terms of loans and credit for material.

d. Progress to plan

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[7]Project Plan, p. 2.

The plan for the Jiko Project calls for a staged expansion of the program on a geographical basis, starting with sub-projects in Central Province and more heavily populated areas of Eastern and Northeastern Provinces.[8] After the first year, the efforts will concentrate in two other regions, western Kenya and the central portion of the Rift Valley, and the corridor from Nairobi to the Coast (Machakos, Voi, and Mombasa).

The strategy is to start the project in a region where the improved cookstove technology will be most readily accepted and build up the manufacturing capability in that area to meet the demand. The Evaluation Team saw evidence to support this strategy, with the informal sector in Nairobi actively engaged in manufacturing the KCJ, and retailers carrying the cookstove. In November 1985, the project was only in the second quarter, but extension training activities were well underway and at least two arrangements made with KCJ assemblers. Part of the strategy is to promote local market development through established retailers and then pass the supply source from Miaki Jikos Ltd. to a local assembler. The Evaluation Team's site visit to Thika confirmed that this market development was underway, and apparently successful.

The progress over the life of the project hinges on establishing the manufacturing process outside central and eastern Kenya to the other two areas of concentration. A corollary development is to

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[8]Project Plan, p. 24.

establish alternative suppliers for the ceramic lining. While this was not underway in November 1985, the Evaluation Team visited a kiln set up in nearby Limuru with the direct assistance of the ATI Project Officer. Production of the first batch of 300 liners was underway but quality and sales were not yet established. Getting the ceramic liner manufacture dispersed around the country will be a critical test for Miaki Jikos and the project. In the ATI Project Officer's view, the move to western Kenya as an area of concentration will be a test of KENGO's dissemination and promotion abilities.

e. Commercial viability

There are three different phases of jiko production: ceramic-liner production, metal cladding production, and assembly of the two components to make a cookstove. The viability of each of these phases in an urban setting has been demonstrated. However, the Evaluation Team has some concerns, especially with regard to dispersed production.

The viability of commercial production of the metal claddings and the assembly of the jikos is proven by the existing production in Shauri Moyo, an artisan community of metal workers on the outskirts of Nairobi.[9] The Evaluation Team, on their visit to the market, noted that the ceramic-lined jiko stove had taken over the market from the

[9]The "informal sector" described in a 1972 ILO report and emphasized in the 1979-1983 National Plan.

traditional stove. Out of the 32 artisans observed, 78 percent (25) of them were making the ceramic-lined jikos only, while 16 percent (five) were making both the traditional and ceramic-lined jikos, and only six percent (two) were making the traditional jiko only. This depth of market penetration clearly indicates the commercial viability of the technology lines in the urban setting (see Table 20).

The major factor to prevent this technology from having an equal success in other regions is the availability of the raw materials. The artisans are using scrap drums in which they use the inexpensive top portion to make the claddings. The profitability of cladding production will depend on the availability of the cheap metal and the price of the jiko. However, the former may pose the major constraint to dispersed manufacture of the KCJ, as the main source of scrap is the Nairobi industrial area. The Thiki project participant visited by the Evaluation Team complained about the availability of scrap metal and that town is only 30 km from Nairobi. Ironically, Kenya's poor dispersion of medium- and large-scale manufacturing plants outside the Capital assures that Nairobi's informal scrap fabricators will have a comparative advantage over other jiko makers.

Commercial viability of liner manufacturing enterprises depends on the demand for the liner, and the ability of the potter to produce a good quality product. Liner production is a more complicated process than cladding production requiring a significant amount of capital investment in a kiln and in acquiring the skills to work with

Table 20: Market Penetration of Jikos, Nairobi, November 1985

	Number of Artisans	Distribution (Percent)
Traditional stoves only	2	6
Traditional and ceramic lined jikos	5	16
Ceramic lined jikos only	25	78
TOTAL	32	100

Source: Evaluation year survey at Shavri mayo artisans, November 25, 1985

ceramics. For example, the clay composition must be just right, and the molded liners must be made of an appropriate thickness, with sufficient and well-placed holes for the grate, and must be fired properly. The construction and firing of the kiln alone are two areas which require expert knowledge.

At the time of the Evaluation Team's visit in November 1985, there were two major manufacturers of liners: Miaki Jikos and Mwangaza Pride International. KENGO's progress report to ATI notes that

> "they [Mwangaza] are selling fire boxes to Shauri Moyo at K sh 5.00 below the normal prices. Their liner quality is at present poor. The clay/sand ratio is wrong, poor firing, rough finish, unstandardized sizes, and excessive cracking inhibit sales of the Mwangaza Jiko liners."

Yet, the ATI project technical assistance trained eight of Mwangaza's potters.

The Evaluation Team also visited Jerri International, another liner producer. They noted that production was greatly reduced from prior levels. The Evaluation Team learned from another source that they had lost their trained staff and were likely to be out of the liner production business soon.

Annex 9 presents the cost of production (Table 9-1) and profit

margins (Table 9-2) on liner production, based on figures provided by Miaki Jikos. The profit margin is 13 percent (on wholesales) and 49 percent on retail sales, but the enterprise, which is the ATI project's prime contractor under KENGO, has the benefit of superior management and quality control. We return to this issue under our conclusions on capabilities (see Section IV.B.3.b).

f. Impact on target population

The project promises to have a significant impact on the target population in terms of household savings for those purchasing charcoal for cooking and heating purposes. However, the target population is both rural and urban consumers[10] and informal sector workers. The Evaluation Team feels that this will be mostly urban dwellers because of location of informal sector workers and prevailing patterns of charcoal use acknowledged in the Project Plan.

As discussed in the section above on commercial viability, one problem with the impact of the project on direct participants is the capture of the producer surplus from the introduction of the new technology. In November 1985, we found most of the margin going to the assemblers of the KCJ, with a price war reducing the ceramic liner manufacturers margins to insignificance. Widespread adoption argues for low prices (and hence low margins at each stage from raw material procurement to retail markups.) There is some danger that if the

[10]Project Plan, P. 25.

technology continues to take off as it has, large producers will try to squeeze out smaller participants in the production chain and exploit the powerless informal sector fabricators of the cladding. Most vulnerable will be dispersed small-scale liner manufacturers because of their greater capital and human investment (kilns, training). This process is something to be watched closely, especially in the generally laissez-faire entrepreneurial climate for this segment of the Kenyan economy.

3. Analysis and conclusions on KENGO and ceramic-lined jiko project

a. Source of ideas

The idea for the Ceramic-Lined Jikos Project stems from the dissatisfaction of the AID staff in Kenya with dissemination efforts under the Renewable Energy Development Project (REDP). The REDP planned to promote the technology through the Ministry of Energy and Regional Planning, a relatively new organization with no extension capability. The main vehicle was to have been an Economic Development Fund but after three years of the project, a long list of PVOs were still waiting to receive any sort of financial support from this Fund. The REDSO office and Mission removed the cookstove component from the REDP and were looking for alternative approaches.

ATI's Project Officer, through contacts with the Energy specialist

at REDSO, conceived of the project and developed the project plan. At the same time the Evaluation Economist from ATI's Evaluation and Technology Development Group was carrying out a study of the KCJ as an example of highly successful appropriate technologies, and his study[11] is heavily referenced in the project plan. Perhaps the key to the overall project conception was Maxwell Kinyanjui, the central figure in the KCJ development, who left the REDP contractor in March 1984 and returned to manufacturing KCJs. Securing this "technology champion" to act as the prime contractor for the ATI project was a major coup for the Project Officer as other donors competed (and continue to compete) for his professional and entrepreneurial talents. His full participation appears to the Evaluation Team to be crucial to the project.

b. Capabilities and commitment

The capabilities of Kinyanjui, sole proprietor of Miaki Jikos Ltd., have been amply demonstrated in his successful operation of a ceramic liner manufacturing enterprise, in his past business experience, and his marketing orientation. The Thailand study mission reinforced his views on both technical and business possibilities of cookstove manufacture.

The question of capability is less clear for the contractor, KENGO. The Evaluation Team was not able to meet with the Director,

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[11] Hyman, Eric. _____, 1985.

but was accompanied on field trips by KENGO's ATI project manager. He has the qualifications to carry out the extension effort, having worked on CARE's cookstove program for several years. He described the testing program for the improved woodstove, and seemed to have a realistic grasp of the problems of both testing and dissemination. He gave a critical assessment of past efforts to promote liner manufacture through church groups. As he told the Evaluation Team, a church group's expectations were geared to reserving free technical assistance and grants for kiln construction, rather than a businesslike approach.

A lingering problem with KENGO which significantly affects both its capability and commitment is the question of budgetary support for extension and administrative activities. This possible area of resource deficiency may be addressed by funds available from an increase in the exchange rate and about $5,000 more added to the total project cost. It is too early to tell whether this initial under-allocation will pose a continuing constraint. The ATI Project Officer has been responsive, after some initial misunderstandings. The project plan and budget might have better ensured that KENGO would have contingent resources available "to move in the field" and pay extension staff devoted solely to the project, despite KENGO's belief that other donor support would be available.

The other actors in this project are the entrepreneurs involved in cookstove manufacture. The "informal sector" survives quite well in

Nairobi and larger towns despite sporadic harassment by city and town councils. They produce a simple product cheaply, whether it is the small paraffin lamp made from used oil cans, or the traditional jiko made from used oil drums. Their capability to produce the casing for the KCJ is not questioned, provided sheet metal scrap is available, as it is an incremental change to the current jiko fabrication technology.

The capability of enterprises to take up manufacture of the ceramic liners is again a matter of scale. Clayworks, the large brick and pottery manufacturer on the perimeter of Nairobi, has the capacity, though the quality was not sufficiently controlled. A government decision has excluded their participation in any event. It remains to be seen whether small-scale kiln operations can supply a quality liner without timely and sustained technical assistance. The operation the Evaluation Team saw in Limuru had obviously benefited from the close personal interest of the ATI Project Officer with his special technical skills in pottery and kiln construction and operations. That model of assistance may be expanded to other regions, but cost effectiveness and sustainability are at issue.

c. Risk

The risks in the ATI project are well known. The technology of improved cookstoves will spread because all evidence indicates that the demand for the product, at the current low price,

exceeds the supply. But this is not the project's central thrust. Risks to the ATI project success are that manufacture will stay concentrated in only one or two areas, e.g., Nairobi and Mombasa, and that one or two large producers of liners will capture most of the market, to the detriment of informal and small-scale enterprise development and employment. The manufacture of the assembled KCJ and its components should be small-scale and dispersed throughout the charcoal using regions of Kenya, not concentrated in a few large cities and towns. The risks for liner manufacturers are the greatest, because of the investment in the kiln. The plan to upgrade existing pottery making operations to include the ceramic liner as an additional source of income makes sense.

As ceramic liner manufacturers emerge spontaneously, the likelihood of reduced quality control may lead to a negative demonstration effect. Too many cracked liners may retard the spread of the technology of improved cookstoves. This risk was part of the rationale for the project, i.e., to ensure that customers have the choice of quality locally made product by spreading the ceramic liner technology. The Evaluation Team recommends more effort and resources be put into ways to ensure a self-correcting quality control system, e.g., through explicit efforts at consumer education (see Information Flows section). Advertising could serve this objective, at the same time developing the market, but was not budgeted in the Project Plan.

d. <u>Marketability</u>

The marketability of the KCJ has been proven in Nairobi with the great increase of jiko assemblers producing the improved jiko over the traditional jiko (see Table 20). The ability of the project as designed to establish production and distribution centers out of Nairobi is a concern. An 1983 report[12] prepared for the Renewable Energy Development Project noted that nine jiko producers existed in Kenya, three of which were liner producers. These three liner producers were all located in Nairobi. Since then, Clayworks has dropped out of the market. However, Miaki Jikos was not counted in the list and is one of the substantial market producers. Thus, the current three liner producers are all located in Nairobi.

As for the assembly of jikos, the report noted five locations out of Nairobi which were producing jikos, two on the Coast, and three in the Western Province. (See Table 21.) It was also reported at the time of the Evaluation Team's visit that a rural pottery in Western Kenya was producing liners. The project plans to build on this production base.

The Evaluation Team believes that the production and sale of the jiko outside of Nairobi may be hindered by a number of factors. These include the heavy constraints of technical assistance to train potters in the art of liner production at long distances from Nairobi. Project

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[12]Opoli, Monica, "A Review of the Production and Sales of Improved Cookstoves in Kenya," p. 7.

Table 21: Production, Distribution, Extension and Training Activities for Jikos by Region, 1983

	KCJ Producers	Distribution and Sales Outlets	Extension and Training Activities
Coast	2	2	2
Eastern Prov.	-	-	1
Western Prov.	3	2	3
Nairobi	4	19	7
TOTAL	9	23	13

Source: Opoli, Monica, "A Review of the Production and Sales of Improved Cookstoves in Kenya," Renewable Energy Development Project, Nairobi, Kenya, 1983.

management did not seem to be overly concerned about this aspect. The ability to manage quality production at diffused centers of production will remain a problem, as the incentive for the producer to keep quality control high is not always apparent.

The incentive to produce quality liners may be provided by fostering public recognition using labels now stamped on the liner with the producer's name, so that poor quality products will be associated with the source. Quality control of hidden defects such as using sufficient vermiculite to seal the liner to the cladding will be more difficult to achieve except through an educated consumer. It is unlikely in the near future that government regulation will be a factor, but large-scale institutional procurements may contribute to setting a quality standard for producers.

Other factors affecting marketability include the difficulty that cladding producers have in obtaining metal in Western Kenya (as noted in Chapter II) as well as the prohibitive price of a metal stove there.[13]

Thus, the marketability of the jiko stove will be dependent on the ability of the project to effectively provide technical assistance to producers outside of Nairobi, and the ability to introduce incentives into the production system to insure quality production.

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[13]Ibid.

The Project Plan[14] calls for "continuing quality control testing" by KENGO. It is too early to tell how effective such inspection will be. However, the ATI Project Officer recognized the problem. The marketability of the stove is likely to be limited to the population which presently uses a charcoal stove: 17 percent of rural households and 83 percent of urban households.[15]

e. Information flows

In the Evaluation Team's view, the best mode of feedback in the technology transfer process is from customer to manufacturer either directly, or through responsible retailers. Customer complaints, returned stoves, replacement of inferior products, guarantees, etc., will all play some part in such a system. It is too early to tell how this will develop, but the project should encourage the manufacturers to clearly identify their product, so that an educated consumer can apply the principles of the marketplace to weed out inferior products, stimulate modifications in product or process, and promote the further development of the cookstove technology and its dissemination.

C. ATI Links to Other Organizations in Kenya

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[14]Project Plan, p.22

[15]Hyman, "The Strategy of Decentralized Production and Distribution of Improved Charcoal Stoves in Kenya," p. 3.

1. REDSO and USAID

The ATI Project Officer has cultivated strong links with the REDSO (Regional Economic Development Support Office) through the Energy specialist. His views on ATI have changed since he perceives a stronger private sector emphasis of the organization under the AID Cooperative Agreement. One criticism noted was an impatience with bureaucratic constraints (specifically, those of KENGO) in developing and implementing projects in Kenya. The general sense, however, was that ATI had come along with funding at an opportune time, and was to be envied for its rapid progress from concept to operating project. Securing Kinyanjui for the KCJ was considered a major coup as his services are sought by other donors.

The Evaluation Team received little feedback from the USAID Mission, having only a short meeting with the Chief of the Projects Office. The turnover in Mission staff works against continuity in following ATI's activities in-country. AID in Kenya happens to be a special case because of the close proximity of the REDSO headquarters and the liaison role played by the Energy Specialist. There is interest in the Mission on the dissemination of the improved cookstove, partly because the Mission's own renewable energy project was only partially successful.

2. Kenyan appropriate technology organizations

ATI's links to formal NGO appropriate technology organizations is tied to its past activities under the grant and will not be dwelled on here. New links are clearly associated with the Cooperative Agreement project. For example, Kenyatta University's Appropriate Technology Center is cooperating on the cookstove testing program.

3. International Appropriate Technology organizations

The Intermediate Technology Development Group (ITDG) has been involved in design modifications to the improved woodburning stove which is being tested under the ATI project with KENGO. The reported experience illustrates a view heard several times by the evaluation team from participants and interested bystanders. ITDG is often seen as pushing a particular technology, which through their technical assistance efforts and laboratory modifications in England, is given an IT logo. One staff member at KENGO was especially annoyed at ITDG involvement in the woodburning stove for this reason since he felt the technical assistance was perfunctory.

ATI is not seen in the same light. Their role is perceived more as that of funding source and project stimulus. Nonetheless, ATI and ITDG have common interests, typified by ATI examination and testing of ITDG technology. The brickyard project in Tanzania called for staff to be trained for three months at an ITDG equipped factory in Kenya. (They instead went directly to IT Workshops in the UK. See

Section II.)

ATI and International Research and Development Center (IDRC) have some common interests. The Canadian research organization staff based in Nairobi have expressed some concern over ATI's potential involvement with the sorghum dehullers. Cooperation between the two agencies may be desirable so that they do not step on each others' toes, but the Evaluation Team shares ATI's impatience with the more measured applied research approach to post-harvest processing machine dissemination insisted on by IDRC. (See Section II).

4. Analysis and conclusions about ATI linkages in Kenya

The ATI Project Officer assigned to East Africa has an admitted impatience with NGO/PVO institutional and bureaucratic constraints. His preference is to work directly with the private sector, using agencies such as KENGO for political legitimacy, but not letting them get in the way of the real business of moving technologies to the market place. In the view of several expatriates who are familiar with the Project Officer's working style and with agencies such as KENGO, this is a small shortcoming.

Working directly with a private enterprise has pitfalls for ATI as well, particularly in the cookstove project. KENGO's prime contractor, Miaki Jikos, Ltd., is foremost a profit-driven manufacturer of ceramic liners and improved jikos and it is mainly through ATI-funding that it

is involved in technical assistance and dissemination activities. An agency such as KENGO is essential to give ATI the leverage and coverage for a successful replication project.

V. CONCLUSIONS AND RECOMMENDATIONS FOR ATI FIELD OPERATIONS IN AFRICA

The Evaluation Team visited the sites of nine ATI projects in three African countries, Botswana, Tanzania and Kenya, over a four week period in November 1985. The following conclusions are based on these field trips and interviews with ATI staff in Washington, DC. Conclusions are related to specific ATI projects[1] or field activities, and cited by project title where appropriate.

Recommendations respond to specific conclusions and expand on the implications of a set of findings and conclusions. The issues raised will be addressed in the main report of the mid-term evaluation (Volume I).

A. ATI's Africa Region Program Experiments with Unproven Technologies, and Risky Markets

1. The project portfolio and priority technical fields could be more representative

The portfolio of ATI projects in Africa began under the Cooperative Agreement has a distribution among the priority technology fields which emphasizes agricultural products processing (APP) and

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[1]Refer to Table 1 and the Project Summary Description Tables for project specifics.

agricultural waste utilization.[2] Eight out of the 14 Africa projects as of November 1985 were in the APP field, five were in local mineral resource development (LMR), and one was in Equipment and Support for Small Farms (ESF).

- The Africa portfolio, on a sub-regional basis, lacks a representative coverage of priority technical fields. The West Africa projects are only APP and the East Africa projects favor LMR.

  Recommendation: ATI should strive for a representative set of projects in each sub-region, if not each country, as is now the case for the southern region of Africa.

- The present imbalance in priority technical fields by sub-region correlates to the interests of the ATI project officer more than the opportunities or resource endowments of the countries covered. Funding projects which are representative of all priority technical fields in each sub-region will broaden ATI's technical image and thus its contacts, as well as increase its contribution in each region.

2. The technologies promoted in ATI projects are in various

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[2]See Section I and Table 1, listing of priority technical fields. ATI is required under the Cooperative Agreement as amended to focus on technologies in three areas.

developmental stages

- The Africa region program is taking necessary risks with technologies that are unproven, but promise a high return (oil processing, grapple processing).

- ATI project plans have assumed that several of the promoted technologies are already proven, or have underestimated the amount of time necessary to develop and test prototypes. This leads to unrealistic schedules and implementation targets (ADP, oil presses).

  Recommendation: ATI should cross-check the status of a technology under development before contracts are signed. The Project Officer should not rely only on the source of the technology for this assessment.

- The ATI project plans generally fail to schedule decision points which allow for making "go, no-go" decisions on technologies. A more contingent approach to implementation is warranted when risky technologies and unestablished markets are involved.

  Recommendation: ATI should continue to follow the pattern of project implementation of recent projects which reportedly phase the implementation process, and should emphasize joint

decision reviews with implementing organizations (Grapple processing).

- ATI has generally pushed hard technologies which fit the social, cultural, economic, and ecological settings found in Africa, and Project Officers have shown sensitivity to these requirements.

- ATI's emphasis on the hardware of technology transfer has in some instances slighted the treatment of soft technologies, for example, organizing groups to utilize the Animal Driven Pump, changes to the organization of labor in the brickyard, funding arrangements for village oil processing enterprises.

  Recommendation: Project designs should reflect an appreciation for the socio-technical aspects of change in production technology, perhaps by introducing change in a more incremental way (Botswana Brickyard Project).

3. Markets and assessment of commercial viability

- The Evaluation Team has an overall impression of ATI promoting technologies (e.g., the ADP and lime yard projects in Botswana, glazed potteries and bricks in Tanzania) where the market for the products is not established. Because the technologies themselves are still under development and the

technological product not yet available, it is difficult to estimate demand.

Recommendation: More effort is needed to develop a consistent ATI market assessment methodology and its application to the planning process, including market planning assistance to the IO and Productive Enterprises.

- In every project visited, the Evaluation team found evidence of the attention paid to assessing the commercial viability of the technology, which was generally analyzed adequately. Shortcomings were in the area of market demand analysis (Animal Drive Pump, Rural Potteries), and questionable assumptions in the commercial analysis.

- The commercial viability and economic sustainability of several projects may be in doubt largely because of changed circumstances since the project start-up. (Animal Driven Pump, Botswana Brickyard) The responses of the implementing organizations have been disappointing, despite intensive supervision from ATI staff.

Recommendation: ATI should assess the capability and will of an implementing organization's management to respond to changing circumstances which jeopardize project outcomes. At the very least, a second project with the same IO should not

be contracted until after a testing period has passed. (Botswana Brickyard, local lime yard projects.)

B. <u>ATI Africa Projects Aim at Helping the Rural Poor and Small-Scale Enterprise.</u>

- ATI's Africa project portfolio is targeted to helping the poor and small-scale enterprises through employment generation (Lime Kiln Project), through income increasing activities (Village Oil Processing, Grapple processing), or through improved consumer goods (Ceramic-Lined Jikos).

- The impact on the poor brought about by ATI's Africa projects initiated under the Cooperative Agreement cannot be measured as it is still too early in the implementation process.

- The poor benefiting from ATI projects are not always the rural poor, as projects are located in and draw labor from towns and cities (brickyard projects and ceramic-lined jikos projects). ATI recognizes the difficulty of assisting the rural poor, but that is their own stated challenge, i.e., to put appropriate technology in the hands of the rural poor. Brickyard projects, in particular, seem more geared for urban development, employment, and siting near urban areas in order to reduce transport costs.

- The ATI project portfolio addresses the needs of small-scale enterprises in concept, if not always in practice (rural potters, Animal-Driven Pumps).

  Recommendation: ATI needs to study the extension capabilities of existing IOs and adjust the project design for clearer responsibility for outreach.

C. ATI Africa Field Operations are Understaffed

- The African Project Portfolio is in transition which increases the staff workload and reduces the time available for new project development and supervision.

- Project officers have spent valuable time in closing out projects initiated under the Grant in countries and technical areas, which are no longer part of the more focused Africa portfolio. The Regional Manager has been significantly occupied in this regard with projects in southern Africa, to the detriment of overall project supervision throughout the region.

- The implementing organizations and productive enterprises for ATI Africa projects have various management weaknesses, compounded by turnover of expatriate technical assistance (Botswana Brickyard, Animal-Driven Pump) and by competing

donor interests (Botswana brickyards, mini sorghum dehullers, Ceramic-Lined Jikos). This circumstance makes successful ATI project management much more difficult and is one argument for smaller, more manageable projects in the Africa portfolio.

Recommendation: The projects selected for Africa should be modest in their demands on IO management, which is typically a bottleneck to successful implementation. Smaller scale projects ought to be designed which would then require fewer technological changes, fewer simultaneous adjustments to organization or production, and less intensive monitoring and supervision by both the IO and ATI.

- The tasks of monitoring existing projects, terminating projects, and intervening when problems emerge (e.g. as in the Botswana brickyard project) consume a large proportion of the ATI Project Officer's time, leaving little time for exploring and developing new project ideas.

- The increased Africa program demands on ATI Project Officers have not been matched by staff position increases. The Africa region is understaffed relative to the funding targets.

Recommendation: The funding targets for the Africa region

should be stabilized, or even reduced unless more staff is assigned to project officer field work. It makes no sense to recommend smaller more manageable projects, if more projects are thereby required to fulfill regional funding targets.

- ATI Project Officers work out of ATI headquarters in Washington, DC., a considerable distance from its African project sites, and travel (and planning to travel) consumes too much staff time. This situation puts ATI at a disadvantage with regard both to project supervision, and new project development.

- Recommendation: ATI should explore the idea of hiring locally available, qualified staff for the African region to establish a continuous field presence. A project officer based in Nairobi or Harare could be ATI's agent in the region.

D. ATI Project Officers' Backgrounds, Interests and Working Styles Result in Different Outcomes for ATI's Africa Program

- The Project Officers exhibit differences in approach which may be loosely contrasted as institutional vs. entrepreneurial oriented. The differences have consequent effects on the kinds of programs in their regions and the outcomes of ATI efforts.

- The institutional orientation emphasizes building in-country capability to open up a broad range of productive activities.

- The entrepreneurial orientation emphasizes achieving results directly from productive enterprises.

1. <u>The Institutionally-Oriented Operating Style</u>

- The institutional orientation of one ATI Project Officer leads to working through institutional-bureaucratic channels to identify project concepts and execute projects. Judgment of institutional capabilities, particularly management capacity is therefore crucial to this operating style. Several projects (Botswana Brickyards, Animal Drawn Pumps) have fallen short of ATI's expectations partly because of over optimistic appraisal of the institution's capacity to bring a technology to commercial production.

- The institutional orientation is premised on the concept of leveraging in-country institutional capability to result in a number of productive activities (Botswana Brickyards and Lime Kiln are under the same implementing organization). This institutional orientation more closely follows the evaluation team's concept of technology development, transfer, and resulting productive activities as espoused in ATI documents

and represented in Figure 2, part a.

- An institutional orientation can lead to strengthening research and development capability, but without private sector incentives, (i.e., a market orientation), the technology may stay on a test stand and not reach commercial production.

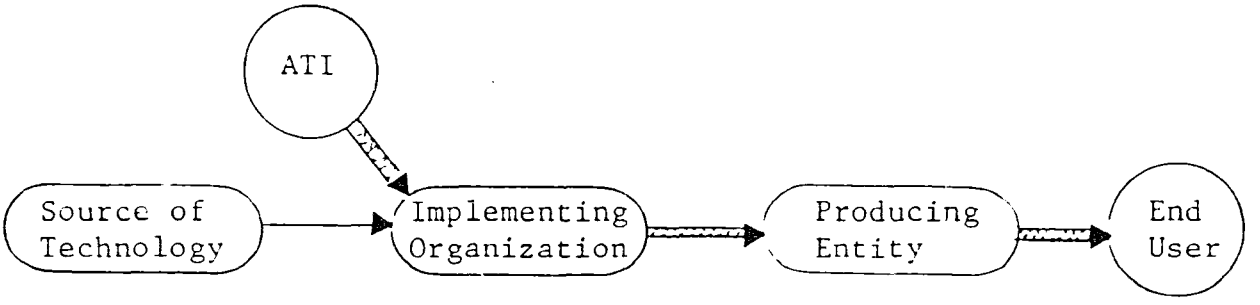
  Recommendation: ATI should promote manufacture outside the R&D institute's workshops by private enterprises as a further development of a commercially-viable technology, adapted to local conditions and input availability (Animal-Driven Pump).

2. The entrepreneur-oriented operating style

- The "entrepreneurial" approach of one ATI project officer works by establishing strong links directly to the productive enterprise, usually an established firm. The officer thereby shortcuts institutional and bureaucratic channels to get on with the job, take advantage of "windows of opportunity," and avoid dependence on weak institutions. The evaluation conceptualizes this approach as shown in Figure 2, part b.

- In the "entrepreneurial " approach, implementing organizations are used to legitimize the project, but not as a fundamental actor in the technology transfer process, and

A. The institutional approach:



B. The entrepreneurial approach:

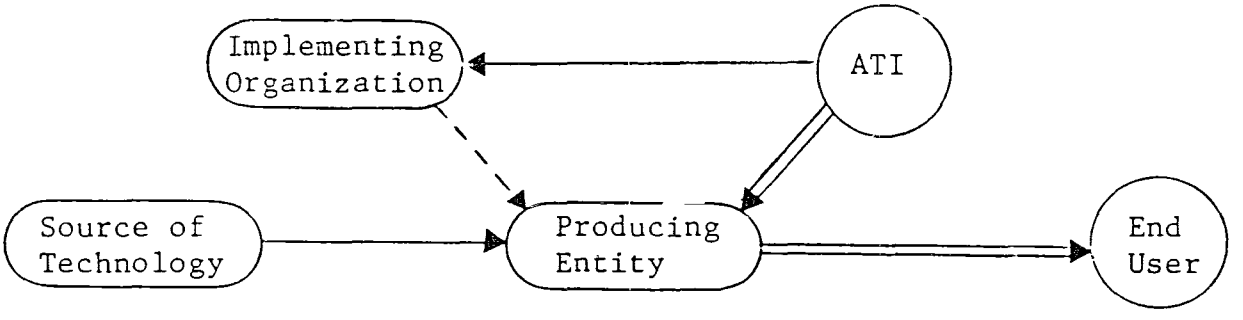


Figure 2: Contrasting Approaches by ATI Project Officers

consequently are not fully integrated into the process (rural potteries, oil press production).

- Working directly with the profit making enterprise and relying on its services to extend the range and diversity of productive activities reduces ATI's potential leverage. (Ceramic-Lined Jikos, Rural Potteries, Oil press production). The situation is complicated when the selected productive enterprise may have conflicting or proprietary interests that can work against the spread of the technology.

  Recommendation: ATI must reconcile the trade-offs in using profit-making incentives to spread a technology with the advantage and disadvantages of using neutral institutions.

- The entrepreneur oriented ATI Project Officer skews projects more toward his personal interests and capabilities, diminishing the development and strengthening of working relationships with institutional networks that can open up a broad range of project possibilities (Rural Potteries Project, Ceramic-Lined Jikos).

- Strengthening institutional capabilities by means of participation in the ATI projects where the productive enterprise is paramount has in general been by chance rather than by design (one exception being the Improved Bricks

project in Tanzania).

- The entrepreneurial approach has led to some projects having been rushed to the contract stage without first having reached agreement among parties on essential details (Ceramic Lined Jikos Project, Village Oil Presses).

- The institutional approach, while necessarily more measured and deliberate than the entrepreneurial orientation, permits the project to evolve from the institution at its own pace, and with its own funding requirements (Grapple Project).

3. <u>The different approaches could complement each other</u>

- The approaches of the two project officers could have complemented each other if staff had had greater opportunity to jointly consult in the field on project development, rather than proceeding more or less alone. Backstopping from ATI headquarters, which could provide more consistency of approach, has not been timely for the Africa region, as staff positions remain unfilled (as of November 1985).

- The ATI Project Officers, regardless of basic orientation, are dedicated professionals, pushing the development process along through imaginative ATI projects which have required both nurturing and tight supervision. They could use more

time, less pressure, and timely support for their individual efforts, which are the heart of ATI's field operations in Africa.

Recommendation: ATI field operations could benefit from blending of styles through more joint work of project officers.

E. Feedback from ATI's Africa Program to Headquarters is Inconsistent and Should be Rationalized

ATI's formal feedback system, which transfers information from the productive activities to implementing organizations to field officers to ATI senior management and eventually to AID, takes the form of (1) Trip reports, (2) Quarterly progress reports, and (3) the Project Monitoring and Evaluation System (PMES) documents.

- Feedback of information from Africa field operations depends heavily on personal communication between individuals. Briefings by project officers returning from the field are not structured around a consistent check list of issues, and trip reports are written at some later date. Essentially, the basis for management decisions and corrective action (e.g., suspension of disbursements to the Botswana Brickyard Project) relies on an ad hoc feedback mode. This reliance increases the vulnerability of ATI field operations in the

Africa region to interpersonal vagaries.

Recommendation: ATI should examine its own management guidelines and information flows, beginning with a common check list of key project implementation concerns, e.g., market assessment, prototype rest results.

- A Quarterly Progress Report is a short period for formal feedback from small enterprises and implementing organizations in Africa. Changes in project progress and status within one quarter can be insignificant because the typical African project develops on a much slower time frame. For example, a three year project would require twelve quarterly progress reports. Most implementing organizations view these as a burdensome but necessary obligation in taking on ATI projects.

  Recommendation: The timing of reports from the field is driven by AID-imposed reporting intervals. The overall monitoring and information feedback system should be rationalized.

- The Evaluation Team looked for evidence in the field that the Project Monitoring and Evaluation System (PMES) developed by the Evaluation and Technical Support Group at ATI is useful for project monitoring. The Evaluation Team found it to be

in various stages of completion, and difficult to access and utilize. Project officers gave no positive feedback on its use for field operations, except as a historical record.

Recommendation: ATI needs a longitudinal evaluation methodology as it moves to implement its replication strategy. The PMES system needs to be reviewed and redesigned. It does not, at present, serve as a project monitoring system, e.g., as a management feedback system.

- The evaluation team found little baseline data of the kind indicated in the Cooperative Agreement for ten designated projects (four of which were in the Africa Region). ATI's efforts to get the IOs to gather such data was often disappointing (Animal-Drawn Pump).

F. Overall Conclusions on the Africa Program

The Africa program as seen by the Evaluation Team has several exciting projects, dedicated hardworking staff with distinctive approaches and operating styles, and room for improvements. ATI is promoting appropriate technologies to help the poor, working with a variety of implementing organizations, and directly and constructively with private enterprises. The progress since the signing of the Cooperative Agreement has been slowed by unfinished business from the Grant period, by inadequate numbers of staff, and by cumbersome

reporting requirements.

ATI is seen by implementing organizations as a responsive and concerned funding mechanism. It is not seen as a strong organization for providing technical assistance. USAID missions in the three countries visited were mildly interested in ATI activities. In Tanzania, there was keen interest and a supportive staff and Mission Director.

ATI cooperates with the activities of ITDG in Africa and offers a healthy competition, especially with ATI's emphasis on commercially-viable activities for the poor and small-scale enterprises and ITDG's growing appreciation of the importance of promoting profit-making technologies.

Has ATI made a difference to the appropriate technology process in Africa? It has changed its operating style in constructive ways from the Grant period mode of assistance, but the significance of the changes and the consequences for the advancement of the appropriate technology on a widespread scale to the benefit of the poor are yet to be determined.