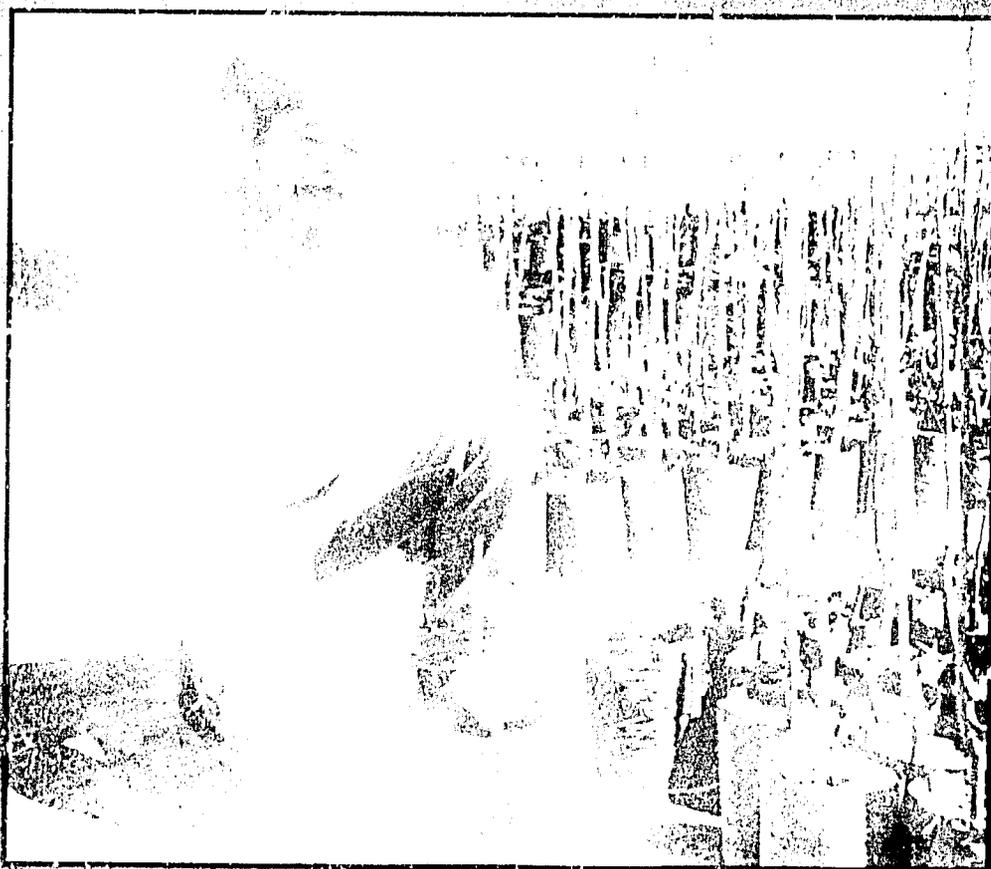


# Appropriate Technology International

## *1987 Annual Report*



*Macro-Policies and Appropriate Technology Stimulate  
Small Enterprise Development*



*FRUIT TREE NURSERY is one of a number of small enterprises established under the Farm Support Enterprise project in Mexico. The grafting skill of the nursery's owner, Don Elias, has been recognized beyond the project area. (Photo by Arleen Richman)*

ATI implements its mission with public funds made available by the U.S. Congress through the Agency for International Development. ATI's program is carried out in cooperation with the Employment and Enterprise Development Division of the Office of Rural and Institutional Development within the Bureau of Science and Technology of A.I.D.

## Letter from the Chair

For more than two decades my major professional concern has been the design, testing and evaluation of viable strategies to increase food production among small farmers.

As an ATI Board member since 1984—a significant distinction which carries serious responsibility—I have helped formulate ATI strategy to get productive technology into the hands of poor people in developing countries. ATI is a “source of experimentation” that strives to “contribute to employment, output and equity objectives, meeting the needs of the poor, and increasing participation by the poor in a number of ways.” Because this process alters the dynamics of human society, ATI’s experiences constitute a source of learning, and stimulate dialogue and creative criticism regarding its development philosophy and practice. ATI itself is continuously learning how to work in harmony with diverse populations, how to overcome obstacles, and how to chart new paths to motivate people to take charge of their own development and that of their countries.

ATI was established in 1976. The years since then can be divided into two definite periods. The first period, from 1977-82, can be characterized as one of experimentation and strengthening of local organizations. From 1983-87, ATI concentrated on promoting and establishing commercially viable small-scale productive enterprises.

ATI has established demonstration and replication projects in 22 countries in Africa, Asia, and Latin America and the Caribbean. These projects have created 63 small scale (less than 25 workers) and 1,219 micro-enterprises (3-4 workers). The core of these projects generally is a hard technology ranging from agricultural and livestock production, to building materials, minerals engineering and equipment for small farms. Projects also incorporate soft technologies, such as accounting systems and financial management and marketing. Support services, including monitoring and evaluation, commercial analysis and social impact assessment, among others, are essential ingredients in project design and implementation.

The varied range of projects demonstrates that ATI’s strategy works. About 90% of the ideas for ATI projects originate in the field and come from ATI’s project partners, the implementing organizations in the developing countries. Recent evaluations indicate that approximately 70% of the projects are likely to be successful, as measured by output, levels of efficiency, and compatibility with the local environment. One of the most relevant indicators is the number of jobs created. The enterprises ATI established have created more than 5,000 direct jobs and have increased the incomes of more than 144,000 people who are involved in economic activities related to project operations. The average total cost per job is \$2,200, which compares favorably with data from other reliable organizations.

This quantitative data is an important indicator of the quality of the projects. What is even more important, however, is that these results have been consistent from country to country, continent to continent, with different types of people who have different cultural and ethnic backgrounds. I believe these results can be attributed to several factors. All ATI projects respond to real local needs and are designed to fit the potentials of the people, their resources, and their national policies. ATI has developed a rigorous process of project design, implementation, monitoring and evaluation which is based upon a permanent dialogue among all participants. All projects receive both technical and financial assistance. Another common denominator is the presence of strong local institutional support and encouragement.

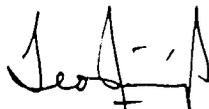
ATI is now launching a third period in its program development, based upon the Long Term Strategy approved by the Board of Trustees on April 14, 1988. This strategy represents a new challenge and provides a unique opportunity to move from a small-scale enterprise approach toward a more comprehensive program. The Long Term Strategy is to establish a cluster of small and micro-enterprises located in an area large enough to favorably influence macro and institutional policies. The area can be either a geographic region (horizontal integration) or a specific sector of the economy (vertical integration) or a combination of both approaches.

This does not mean that ATI will cease designing and implementing demonstration projects. Rather, ATI will continue to experiment with demonstration projects that add to its understanding of external factors that limit the success of individual enterprises. ATI will also concentrate efforts in the policy area in order to make political leaders at top levels of government, as well as private and parastatal organizations, aware of the consequences of technology choice and the effects macro-policies have on economic development. In all its efforts, ATI will continue to place a premium on human interaction, continuing dialogue, and joint undertakings.

ATI’s Long Term Strategy is a concrete response to the expectations of our partners in the field. It will enable us to better understand the potential of a region and to develop strong linkages with regional and national policymakers and their programs. It will provide examples of positive development that can be incorporated into local and national, social, economic, and political systems. The Regional/Sectoral programs are a crucial step in ATI’s evolution as a pioneering, experimental institution.

To launch this approach requires firm support from the U.S. Congress, A.I.D., NGOs and PVOs and the collaboration of international and bilateral organizations that support development programs. The most essential ingredient, however, is the interest and commitment of the local people who will be participating in their own development.

Once more, I call upon each member of the ATI family—the staff in Washington, D. C. and the Philippines, the staff of our project partners, and the people in the field—to be the best they can be and to do the most they are capable of doing. This is our challenge; these are the seeds for a better future. This is the way the development process succeeds, working from the bottom to the top and vice versa, to create new communication linkages.



Leobardo Jiménez Sánchez  
Chair  
Board of Trustees

Dedicated to the memory of Edgar (Ted) Owens, who inspired the creation of ATI. His books, *Development Reconsidered*, *Farmer Cooperatives in Developing Countries*, and *The Future of Freedom in the Developing World*, have contributed to the shaping of the U.S. foreign assistance program. Mr. Owens served ATI as Associate Director of Policy (1977-85) and as a member of the Project Review and Advisory Committee (1987).

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# Macro-Policies and Appropriate Technology Stimulate Small Enterprise Development

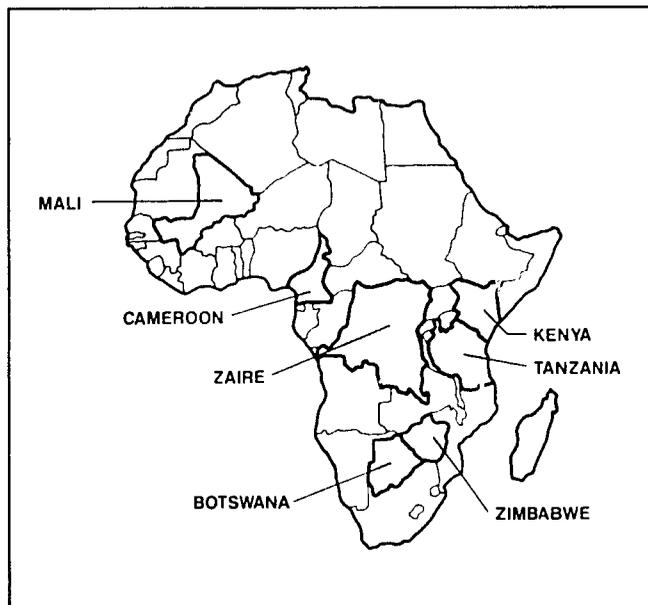
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# AFRICA

## Partners and Projects



### BOTSWANA

#### **Animal Driven Pumps**

RIP/RIIC: David Inger, Managing Director; Kit Morei, General Manager

#### **Brick Production**

SRDA: B.R. Chibana, Managing Director; Manfred Boehmer, Technical Advisor

#### **Grapple Processing**

Thusano Lefaisheng: Tabe Tietema, Board Chairman; Jennifer Inger, Acting General Manager

#### **Lime Production**

SRDA: B.R. Chibana, Managing Director; Manfred Boehmer, Technical Advisor

### CAMEROON

#### **Anguh Maize Mills**

APICA: Evariste Mama Ndima, Secretary General; Joseph Moutsi, Project Coordinator  
CATMI: Barnabus A. Anguh, Director General  
MIDENO: Andrew Ndonyi, Manager

#### **Composite Flour**

ENSIAAC: Dr. Joseph Kayam, Acting Director; Gilles Imbs, Project Coordinator

#### **Dehuller Project**

ENSIAAC: Dr. Joseph Kayam, Acting Director; Gerard Fumey, Project Coordinator  
MANUCYCLE: Alhadji Moussa Issa

#### **Maize Planter**

APICA: Evariste Mama Ndima, Secretary General  
CATMI: Barnabus A. Anguh, Director General  
MIDENO: Andrew Ndonyi, Manager  
PAFSAT: Karl Schleich, Manager

#### **Medium-Scale Hammer Mill**

APICA: Evariste Mama Ndima, Secretary General

#### **Palm Oil Extraction Unit**

APICA: Evariste Mama Ndima, Secretary General

### KENYA

#### **Ceramic-Lined Jikos**

KENGO: Achoka Aworry, Coordinator

### MALI

#### **Mini-Dehullers**

CMDT: Jean Pierre Derlon, Chief of Training

#### **Shea Butter Extraction Units**

CEPAZE: Bernard Clamagirand, Representative

### TANZANIA

#### **Improved Brick**

CAMARTEC: Edward Ngaiza, Director General

#### **Oil Press Production**

CAMARTEC: Edward Ngaiza, Director General; William Ngange, Managing Director

#### **Rural Potteries**

CAMARTEC: Edward Ngaiza, Director General; Aliasghar Sherif, Project Manager

#### **Village Oil Processing**

LWR/ELCT: Lynn Schlueter, Project Manager

### ZAIRE

#### **Hydro-Powered Grain Mills**

SODERZA: Soheyl Mottahedeh, Director General

### ZIMBABWE

#### **Agro-Industries**

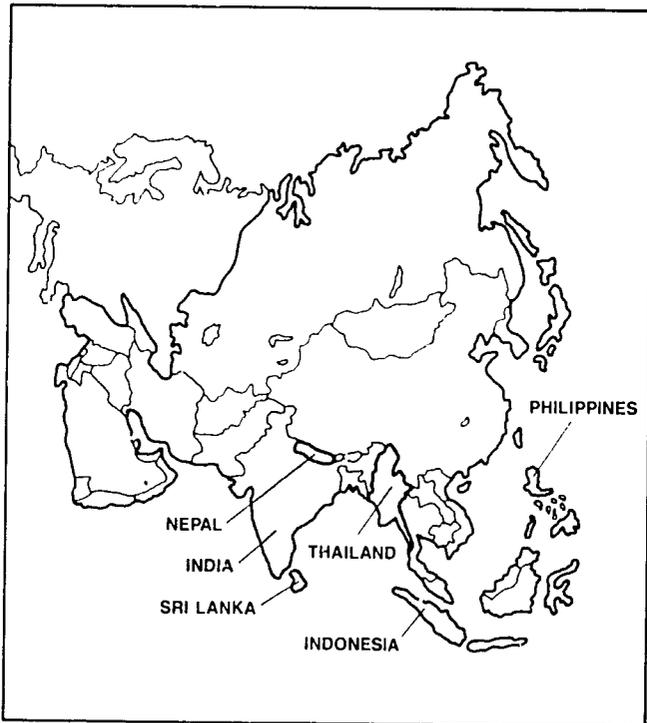
FEP: John Conradie, Project Manager; Patrick Van Rensburg, Director of FEP

#### **Zimbabwe Oil Presses**

G. NORTH & SCN: Ed Berry, General Manager

# ASIA

## Partners and Projects



### INDIA

#### VCAT

IDBI: S.S. Nadkarni, Chairman

#### Potato Processing

SOTEC: Robert Nave, Project Coordinator

### INDONESIA

#### Venture Capital Company, Indonesia

YDD: Anton Soedjarwo, Director

### NEPAL

#### Turbine Driven Agro-Processing

New Era: Shree Krishna Baidya, Field Coordinator; Bhim Bahadur Durra, Vice Chair, R.K. Watershed Conservation Comm.

### PHILIPPINES

#### Organic Fertilizer

FFI: Melo Cabrera, Manager, Science and Technology Research Center

#### Rural Small-Scale Industries Development

FFI: Margarito B. Teves, Executive Director; Marita Guevara Cuño, Manager VCD

### SRI LANKA

#### Cinnamon Processing

ATC: Calayanatissa Gunawardene, Executive Director

#### Computer-Video Training

PIDA: S. Tilakaratne, Chairman

#### Mahaweli Rural Industries

Mahaweli: K. Gunatilaka, Director General; Lalit Godamunne, Secretary General

### THAILAND

#### Rural Small-Scale Industries

PDA: Mechai Viravaidya, Secretary General; Tavatchai Traitongyoo, Deputy Executive Director; Tanotai Sookdhis, RSSI Managing Director

#### Rhizobium Inoculant

SVITA: Malee Suwana-adth, Executive Director; Karnitha Karnchanachari, Managing Director

# LATIN AMERICA/ CARIBBEAN

## Partners and Projects



### REGIONAL

#### *Linares Pump*

SCF: Jairo Arboleda, LA/C Regional Director; Jesús Linares, Inventor and Project Coordinator

#### *Wheelchair Production*

(Various project partners in Colombia, Peru, Honduras, Guatemala, Dominican Republic plus Ralf Hotchkiss & Associates, USA)

### COSTA RICA

#### *Lime Kiln Technology*

FUNDATEC/ITCR: Francisco Pacheco, Academic Research Director and Lime Project Coordinator; COONAPROCAL: Juan Bautista Monge, Manager

### DOMINICAN REPUBLIC

#### *Swine Feed*

#### *Poultry Improvement*

CIMPA: Raul Osvaldo Hernandez, Director; Pedro Azcona, Project Manager

### GUATEMALA

#### *Wool Production and Processing*

FUNDAP: Roberto Gutierrez, Project Director; Jorge A. Gandara, Asst. Project Director

### MEXICO

#### *Farm Support Enterprises*

Colegio de Postgraduados: José Cortés Flores, Project Director; Antonio Turrent, National Director of Research, Ministry of Agriculture

### PERU

#### *Annatto Production*

CADER-Pachacutec: José Palomino, Project Coordinator

#### *Placer Mining Equipment*

PIAT: Ricardo Chavez, Director; Roberto Zegarra, Project Coordinator

#### *Potato-Based Foods*

Centro-IDEAS: Alfredo Stecher, Director; Maria Alvarez, Project Coordinator

# Introduction

## ATI Mandate

Appropriate Technology International (ATI) is a private, not-for-profit development assistance corporation based in Washington, D.C. It works with organizations and local businesses in Africa, Asia, and Latin America to identify, assess, adapt, disseminate and transfer technologies, and establish commercially viable small-scale enterprises appropriate to the needs and resources of the poor in rural and semi-urban areas of the Third World.

ATI was created in 1976 in response to an initiative by the U.S. Congress to provide "access to tools and machines that are suited to labor-intensive production methods and fit small farms, small businesses, and small incomes." ATI implements its program mainly with funds made available through the Agency for International Development (A.I.D.) under an agreement with the Bureau of Science and Technology, Division of Employment and Enterprise Development, in the Office of Rural and Institutional Development. ATI also receives funds from other sources and has carried out projects for international organizations and bilateral development agencies.

ATI works through non-governmental organizations and private institutions to improve the capabilities of small businesses and entrepreneurs. ATI trains local people in the technical aspects of operating equipment, as well as in project planning, financial analysis, management, and administration. ATI places a high priority on an enterprise's commercial viability, its ability to create employment and generate income, the project's socio-economic impact on the rural poor, and the potential of the technology for replication elsewhere.

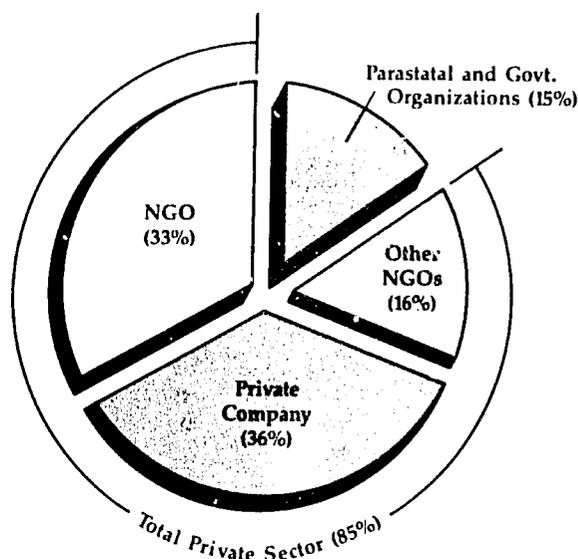
## Products and Services

ATI is changing its activities to reflect its Long Term Strategy. ATI's current products and services are:

- Establishing technology-based small and micro-enterprises in collaboration with local project partners. In the past four years, more than 1,280 small and micro-enterprises have

## ATI's PROJECT PARTNERS

Private vs. Public Sector



Figures based on Project Partners, 1987-1988

been established creating more than 5,000 jobs. Through backward and forward linkages, 144,000 people have increased their incomes. Direct capital investment per workplace averages \$US 1,500;

- Market assessments for appropriate technologies (end products as well as production processes);
- Design of marketing strategies (including credit programs facilitating the purchase of products) for products of small-scale enterprises;
- Technology assessments for technologies to be utilized in rural areas and market towns;
- Identification of the most efficient technology and provision of technical assistance for processing local resources in rural areas and market towns;
- Commercialization of laboratory-tested technologies intended for use by poor people in rural areas and/or market towns;

- Identification of macro-policies in the areas of monetary, fiscal, trade, and science and technology policies that hinder the application of appropriate technology;
- Replication (transfer) of successful innovations tested in commercially viable, small-scale enterprises from original site to other locations;
- Documentation, publication and communication of ATI's experiences.

## Products and Services Provided as Part of ATI's Long Term Strategy

- Implementation of programs in collaboration with local project partners which establish clusters of small and micro-enterprises in sectors of the economy or small geographic regions, introduce micro-credit and savings programs and interact with local government authorities to change macro-policies to favor appropriate technology;

- Assessment of small-scale industry sectors and subsectors;
- Evaluations of appropriate technology strategies which focus on economic development in small geographic areas or sectors or subsectors of the economy;
- Definition of specific country and regional macro-policies that will enhance the impact of technology-based small and micro-enterprises;
- Design, implementation, and/or evaluation of training programs to establish and manage technology-based small and micro-enterprises.

### The Project Approval Process

All ATI projects must provide direct returns to ATI's target group — the poor in rural and semi-urban areas. Project ideas usually originate in the field, a result of ATI staff discussions with private businesses, NGOs, local banks, and other development organizations. ATI's rigorous selection process begins formally with a Concept Review Meeting. Here ATI screens the idea and alerts the Project Officer to issues and assumptions that would affect the proposed project's success. If the concept

is approved, members of the Technical Resources Group and the Business Development Group—ATI's two support wings—meet with the Project Officer in a Technical Review Meeting to review and assess the scope of work for the project's commercial analysis, technology assessment, and social impact analysis. The Project Officer then returns to the field and, in collaboration with local project partners, formulates a detailed project plan. This plan includes technical and financial appraisals, market analyses, social impact analysis, and a thorough assessment of the assumptions underlying the expectation of project success.

Following ATI scrutiny, the project plan is then presented to the Project Review and Advisory Committee (PRAC), composed of outside experts from the international development and scientific communities. Based on the PRAC's advice, plans are submitted to ATI's Board of Trustees prior to receiving final approval by the President. The entire process, from idea to approval, takes between four and eight months.

Once a project is formally approved and funds are committed, ATI staff provides management and technical assistance on a regular basis to implement, monitor, and evaluate the project. Based on the specific needs of the project, Project Officers and/or evaluation and technical staff visit the project to discuss progress and resolve problems. This multi-disciplinary approach to project selection and development is an integral part of ATI's knowledge building and sharing process.



ATI's EXPERIENCES were shared with policymakers in Washington at the Forum on "Appropriate Technology for Small Enterprise Development" held on Capitol Hill, October 15, 1987.



### ATI in the Philippines

ATI opened its first branch office in 1987 in Manila, the Philippines. This branch office is intended to develop into a Philippine organization that will work as a catalyst to encourage the development and dissemination of appropriate technology among the rural and urban poor. The Philippine representative will work with the Philippine government, the private sector and local NGOs to share ATI's experience regarding the impact of macro-policies and to help them identify technologies and businesses appropriate to the needs and resources of the Philippines.

### Areas of Expertise

*Agricultural Products Processing:* Small-scale processing and extracting of edible oils; processing of cereals and staple crops; production of animal feed from agricultural by-products; processing of fruits and vegetables; and the design, modification and manufacture of hand and machine-powered tools for oil processing and grain milling.

*Equipment and Support for Small Farms:* Small-scale applications of biotechnologies, such as rhizobium inoculant for increased soybean yields and protein-enriched cassava for animal feeds; production and marketing of small farm implements; animal-driven water pumps and small-scale rainwater catchment tanks.

*Local Mineral Resources:* Small-scale production of cement and cementitious materials; small-scale production and use of lime; production of ceramics, bricks and tiles; improvements in ovens and kilns; and small-scale mining technologies.

At present, ATI has projects in 21 countries in Africa, Asia, and Latin America and the Caribbean. These are:

#### Africa

Botswana	Senegal
Cameroon	Tanzania
Kenya	Zaire
Mali	Zimbabwe

#### Asia

Indonesia	Philippines
India	Sri Lanka
Nepal	Thailand

#### Latin America and the Caribbean

Colombia	Guatemala
Costa Rica	Honduras
Dominican Republic	Mexico
	Peru

ATI promotes market and private sector development by: 1) using non-governmental organizations as implementing organizations to work with small enterprises; 2) focusing on the commercial viability of technologies and the promotion of small-scale profit-making enterprises; and 3) developing rural small-scale industry projects using innovative financing mechanisms.

### Program Mechanisms

ATI carries out its activities in a variety of ways:

#### Cooperative Agreement

ATI receives an annual grant from the Bureau for Science and Technology of the Agency for International Development to design, develop, and implement the above projects. To expand the reach of A.I.D.-provided core funding, ATI seeks supplemental funding from local project partners and entrepreneurs.

#### Response to RFPs

An experienced multi-disciplinary staff with access to other sources of technical assistance gives ATI a strong capability to respond to specialized requests for proposals.

### Other Proposals

Organizations within developing countries can submit proposals asking for assistance in ATI's areas of expertise. ATI also submits project ideas to other international and bilateral donors for funding.

#### ARIES

*(Assistance to Resource Institutions for Enterprise Support)*

The ARIES project is intended to improve support services available to promote small and micro-enterprises in developing countries. ARIES 1) provides short-term assistance to A.I.D. Missions, IVOs, and other institutions supporting small and micro-enterprise development; 2) develops an improved understanding of small and micro-enterprise support; and 3) builds the capacity of private voluntary organizations.



*ALPACA WOOL PRODUCTION and MARKETING project in Peru is second Sectoral/Regional program currently being developed. ATI and UNCDF also are designing an alpaca wool production and marketing project in Bolivia, which will be funded as a joint venture. In both projects, ATI will work with thousands of small-scale producers of alpaca wool to establish a system of alpaca production and marketing of export quality alpaca wool products. The alpaca is a member of the camelid family and a relative of the larger llama.*

## ARIES

ARIES (Assistance to Resource Institutions for Enterprise Support) is a five-year, \$6.8 million A.I.D.-funded endeavor to strengthen the capabilities of support organizations in developing countries to implement small-scale and micro-enterprise development programs. The three major components of the project are research, training and technical assistance. As a subcontractor to Robert R. Nathan, Inc., ATI will provide up to 91 person months of training and technical assistance over the life of the project.

Private voluntary organizations and non-governmental organizations that support small and micro-enterprise development often need training in business planning, information systems, financial management, personnel administration, project management, and cost-effectiveness evaluation. ARIES uses the ATI Commercial

Analysis Manual for some of its training workshops. ARIES helps U.S.A.I.D. Missions and developing country NGOs in some of the following ways:

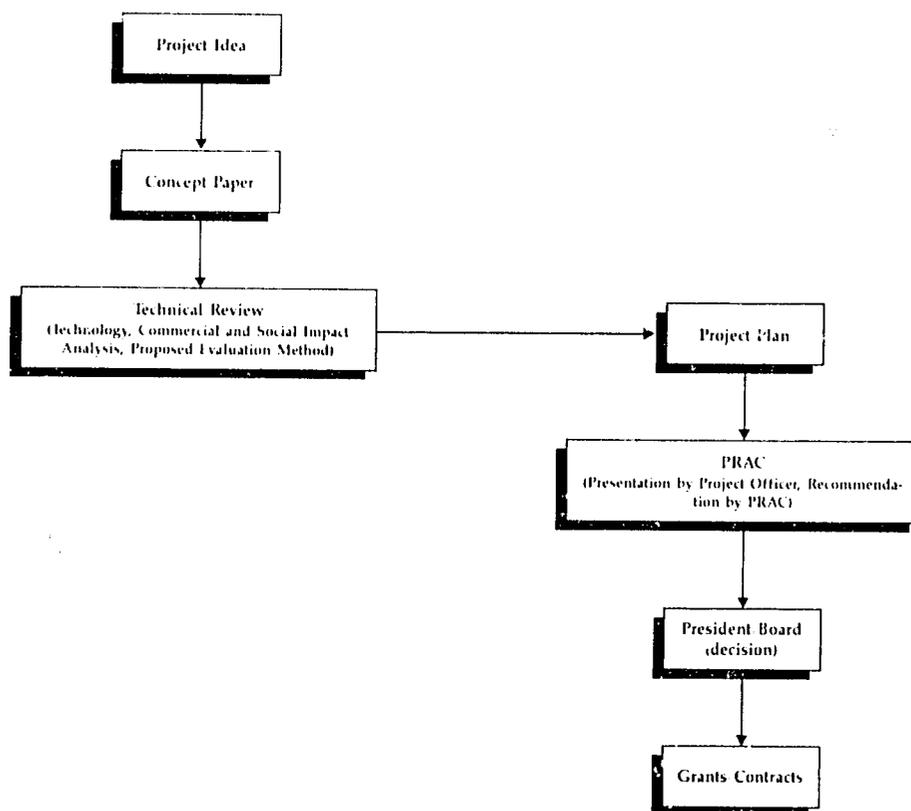
- designing, implementing and/or evaluating overall program strategies for assisting the small and micro-enterprise sector;
- establishing planning processes within local institutions to carry out small and micro-enterprise development projects;
- designing, implementing and/or evaluating programs that assist small business development through financial assistance, management and vocational training, marketing assistance, and identification of trade and investment opportunities;
- developing technical and administrative capacity within intermediary organizations; and

- designing, monitoring and evaluating systems for programming Food for Peace (U.S. food aid) proceeds and other U.S. government funds denominated in local currencies to support small and micro-enterprise programs.

Work ATI will perform under the ARIES subcontract will include:

- Collecting data to update information on the current status of 26 small-scale enterprise development programs reviewed under the A.I.D.-sponsored PISCES I and II programs in the late 1970s.
- Collaborating with Technoserve to prepare an accounting manual to provide guidance to organizations operating credit programs for small-scale enterprises.
- Supplying professional staff to participate in activities described above.

### Project Approval Process



# Removing Barriers to Spark Dynamic Small-Scale Enterprise Development

By Ton de Wille

ATI's experiences over the past five years have revealed myriad opportunities to improve the economies of many developing countries by reducing the existing inefficiencies that prevent their potential for growth from being fulfilled. Because of these inefficiencies, important factors of production—land, capital, and labor—are underutilized or employed at low levels of productivity, especially in the rural areas.

Conventional development policies which attempt to achieve high annual growth rates in a short time, primarily through large-scale and urban enterprises, have hindered the establishment of small-scale enterprises. Yet small-scale enterprises are often inherently more efficient than large-scale enterprises in adding value to local human and material resources. Generally, per unit of investment, small-scale enterprises proportionately create more employment and result in greater increases in productivity than large enterprises.

For example, a study sponsored by ATI shows that while economic conditions in rural areas in Taiwan and the Philippines two decades ago were more or less similar, rural development has progressed much further in Taiwan than in the Philippines. One reason for this is that Taiwan adopted a set of macro-policies that favored small-scale enterprise development. In the Philippines, a 1% increase in agricultural output leads to a 1% increase in rural non-agricultural employment, while in Taiwan a similar 1% increase in agricultural output leads to an increase of more than 2% in rural non-agricultural employment.

Yet conventional development policies, through financial incentives and tax subsidies, among other means, frequently favor the urban and large-scale sectors or imports. To illustrate, consider two types of entrepreneurs who function in very different environments—a village woman who wants to earn some additional income by sewing clothes for her neighbors and a group of wealthy industrialists who wish to invest in a fertilizer factory on the outskirts of a large city. The industrialists are courted by various bank-



SUSTAINABLE jobs in developing countries can be created by ATI for an average total cost of \$2,200 per workplace, says Ton de Wille, ATI President, at the Forum on Appropriate Technology for Small Enterprise Development, held on Capitol Hill October 15, 1987. Leonardo Jiménez Sánchez, Chair of ATI's Board, is at left.

ing institutions that are eager to lend them most of the capital they need, at an annual interest rate of 10%. Because the woman has no collateral, and banks perceive that it is riskier to lend money in rural areas than in urban areas, she is forced to borrow money from a money lender who charges the equivalent of 120% interest a year.

Other policies also discriminate against the small producer. The electric sewing machine purchased by the village woman might cost \$US 450; half of this price is the result of import duties imposed on a "luxury consumer good." The industrialists have been granted an exemption from paying any import duties on the machinery and equipment to be installed in the fertilizer plant. In addition, the government has granted the fertilizer business a five-year tax holiday on earnings. The industrialists are able to convince the government to provide the factory with electricity and to build access roads to transport the fertilizer to warehouses and stores. The rural village in which the woman lives does not have electricity. Since the government pays no heed to her pleas, she is forced to borrow more money

from the money lender to purchase a small generator.

Taking all these factors into account, a small rural enterprise that can add value to local resources—a tailor's shop, a maize or a rice mill, a cheesemaking plant—has to be twice as profitable per unit of investment as an enterprise in an urban area to generate the same net earnings.<sup>1</sup>

In the 1970s, most economists advised governments that the most efficient way to create employment was to establish large-scale industries. Recent experience, in both developing and industrialized countries, shows this no longer is true. For example, *Business Week* reported in 1985 that more than half of the new jobs created in the U.S. in 1984 were in small business. Research by the International Labor Organization and Michigan State University reports similar findings. All available evidence indicates that conventional development policies that favor urban, industrial development have not produced the desired results. Over the last two years, some developing countries have experienced negative annual growth rates. In most developing countries, employ-

ment is failing to keep pace with population increases. Unemployment and under-employment in rural areas are escalating.

ATI's strategy to date has been to establish commercially viable and economically sustainable small enterprises in rural areas and market towns in developing countries. Between October 1983 and October 1987, ATI supported the start of 63 small-scale enterprises and approximately 1,280 micro-enterprises. More than 5,000 direct jobs have been created at an average total cost to ATI of \$US 2,200 per workplace; only \$US 1,500 of this \$US 2,200 represents direct capital investment.

Although the cost per job created by ATI compares well with similar efforts undertaken by the World Bank and other development organizations, these figures still are far too high. Given the millions of economically viable and sustainable jobs that need to be created worldwide and the lack of capital to create those jobs, ATI must experiment further to reduce the cost per sustainable workplace created and broaden the effects of those jobs to increase the incomes of people involved through

backward, forward, and consumption linkages to the new enterprises created.

For example, let us refer to the statistics mentioned above. Although the enterprises ATI established created more than 5,000 direct jobs, it is even more impressive to note that through backward, forward, and consumption linkages, the approximately 1,280 small and micro-enterprises will increase the incomes of more than 144,000 people.

#### ATI's Long Term Strategy: Sector/Regional Approach

ATI's long term program direction calls for a shift from a small project approach—establishing a small-scale enterprise or productive activity using appropriate technology—toward a more comprehensive sectoral/regional approach in order to intensify local impact and to wield a larger influence on policies. In this approach a number (cluster) of small-scale enterprises with backward, forward, and consumption linkages will be established in a specific small geographic region or in a small sector of the economy. A cluster of small and micro-enterprises should enable

ATI to favorably influence some macro and institutional policies in the region and should have measurable impact on the overall social and economic development of that region.

If, as at present, ATI has assisted a local NGO to establish only one small enterprise in a particular region, attempts to overcome political and institutional biases to appropriate technology and to small enterprise development mostly will be ignored. (See some exceptions on page 20.) But if ATI helps to establish 15 or 20 small-scale productive enterprises in an area, the government, banks, and training institutions, if any, will be more receptive to suggestions for change. Thus ATI will work with local organizations to help local banks change their lending policies in rural areas and to work more effectively with small entrepreneurs. ATI also will work with vocational training centers to gear their courses to the needs of the new small enterprises. When small-scale economic activity is concentrated, groups of entrepreneurs could persuade local government authorities to support additional activities in rural areas, such as setting up regional marketing centers to



IMPROVED SHEARING PRACTICES were enthusiastically received by farmers participating in the Wool Products Processing project. The farmer at left uses the improved shearing method, a one-handed spring-loaded shear. The farmer at right uses unwieldy hand-forged scissors in the old manner.

promote the export of the locally manufactured products.

Finally, a cluster approach would significantly reduce the problem of lack of available qualified management for these small enterprises. One of the major obstacles to small enterprise development is the lack of management. Talented management is scarce; it generally is not economically feasible and it does not foster sustainability if expensive management talent is "imported" to operate one small enterprise. However, if clusters of small enterprises are promoted, utilizing qualified managers who assume responsibility for a number of enterprises becomes cost-effective.

The first project ATI has developed using such a cluster/sector approach is the Wool Products Processing project in Guatemala. To upgrade the quantity and quality of wool products, improvements are being introduced in all segments of the wool industry, from sheep breeding through marketing the woven and knitted products. Project innovations begin with the selection of breeding stock. Because the native Criollo sheep does not produce a high quality wool, Corriedale sheep are being crossbred with the native breed. The Corriedales were selected because of their proven adaptability to the highlands and their longer, denser, and more consistent fiber which meets the needs of the weavers. To increase their breeding capacity, an artificial insemination laboratory was established.

To improve the flocks' productivity, movable corrals were introduced, an animal health program has been established, and grass seeds are being provided to develop better pasture; different fodder has been introduced to balance the diet of the sheep. In order to improve the wool harvest, new shearing practices have been introduced; the improved method of shearing not only is more efficient but allows the fleece to be quickly separated into various quality categories. So that the fleece fibers will be the optimal length, the project contains incentives for farmers to switch from shearing twice a year to once a year.

Major improvements also are being made in processing and marketing. A central wool washing facility will introduce the agitation wool washing method followed by solar drying. A

locally manufactured wool opener makes the wool easier to card; a manually operated drum carder has been introduced to exclude waste material and short fibers, and to align the fibers. Yarn production has been improved by introducing changes in the spinning wheel. Adapting a flyer bobbin mechanism from the treadle type traditional spinning wheel to the hand wheel doubles the yarn output. A wool laboratory will be established at the artisan's commercial enterprise to test wool and dyes and to formulate uniform standards and quality control guidelines for each type of wool. Training in weaving and knitting will include courses in design, yarn selection, and dyeing. The commercial enterprise will operate an artisan materials supply store where local weavers can purchase the wool

and other fabric components from the "materials bank" either for cash or credit. Finally, the commercial enterprise will help the artisans promote and market their products, both locally and in other countries. A chart explaining the linkage between all these activities is found on page 15.

The improvements in sheep breeding, selection, and husbandry techniques will improve the overall quantity and quality of wool, and thus increase the incomes of as many as 20,000 highland grain farmers who raise a few sheep to supplement their incomes. Although income augmentation is the major goal of this sector program, the project also expects to create 32 full-time jobs, and to double the value of the wool.

Overall the Wool Products Process-

### Review of Employment Creation in ATI Projects<sup>1</sup> 1984-87

Number of small enterprises	63
Number of micro-productive activities	1,219
Number of direct jobs created	5,269
Number of people affected by backward/forward linkages	144,928
Total fixed capital costs	\$1,261,456
Total working capital costs	\$903,350
Total capital required	\$2,164,806
Total ATI financial assistance	\$5,798,649
Total ATI financial assistance plus overhead (50%)	\$11,597,298
Average capital cost per workplace	\$1,520 <sup>2</sup>
Average ATI financial assistance per workplace	\$1,101
Average overall ATI cost per workplace	\$2,201
Average ATI cost per indirect beneficiary	\$40
Average ATI total cost per beneficiary	\$80

<sup>1</sup> Estimates based on ATI project plans

<sup>2</sup> Includes information on jobs created only for those enterprises where data on total capital required is available or applicable

ing project is expected to directly increase the incomes of 900 small-scale sheep farmers by 1000 percent—from \$US 34 to \$US 331 per farmer per year. One hundred full-time spinners and 500 part-time spinners—mostly women—will double their outputs and more than triple their incomes. By increasing their production of export-quality crafts, 300 weavers are expected to quadruple their incomes from \$US 65 per year to \$US 250 per year. Local skilled craftsmen, such as the carpenters who produce the spinning wheels and carders, will also benefit.

#### Other Activities Under Long Term Strategy

As part of its long term strategy, ATI will direct more attention to broader economic forces and the complementary nature of large, small, and micro-scale enterprises.

ATI's experience over the past years shows that more appropriate macro-policies help remove the inefficiencies inhibiting dynamic development in rural areas and market towns. With the help of the Netherlands Government, IDRC, and local institutions, ATI has organized a series of regional conferences, scheduled throughout 1988, to share with government representatives, legislators, banking officials, and members of the private sector, the knowledge ATI has gained over the past years on the need for macroeconomic and institutional policy changes.

ATI's Long Term Strategy provides a unique approach to expanding the economic opportunities of poor people living in the rural areas and market towns of developing countries. Establishing clusters of small-scale enterprises with backward, forward, and consumption linkages in a small geographic region or in a sector of the economy is the cornerstone of practical step by step development. By working

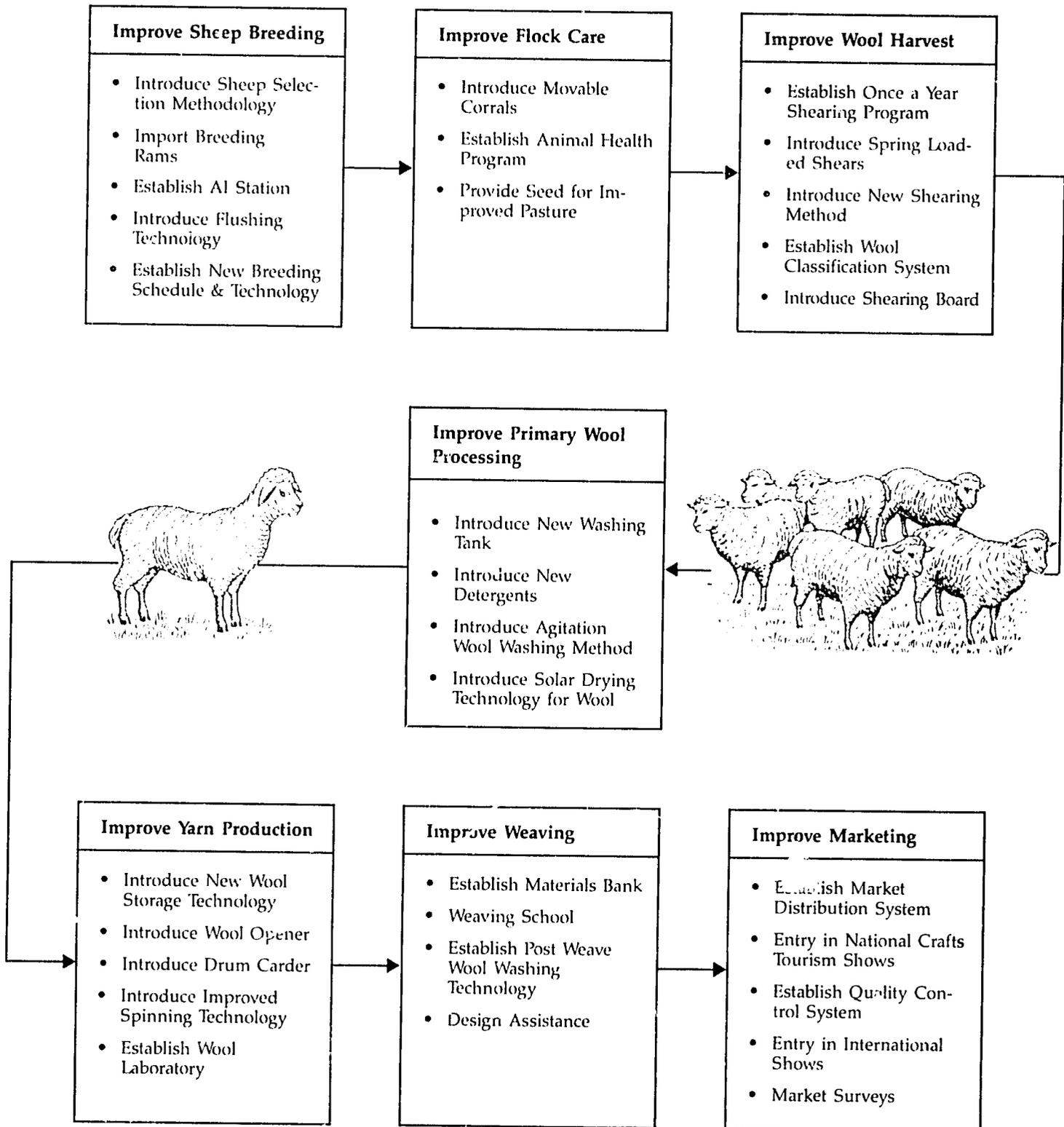
to identify and change those macro-policies that obstruct dynamic development, ATI will be creating an environment in which these small-scale enterprises can prosper and flourish.

<sup>1</sup> Carl Liedholm and Donald Mead, *Small-Scale Enterprises in Developing Countries: A Review of the State of the Art*, MSU International Development Working Paper, no. 25 (East Lansing: Michigan State University, 1986).



MACRO-POLICY CONFERENCE in Thailand (March, 1988) was first of three regional policy conferences addressing the local implications of technology choice. Here, ATI President Ton de Wilde (second from left) and economist Frances Stewart (far left) engage in lively discussion.

## Wool Production and Processing Project Technology Inputs



# ATI's Macro-Policy Program

ATI's mandate to get appropriate technologies into the hands of the rural and semi-urban poor is strongly affected by the macro-policies of national and local governments and financial institutions. In most cases, the general social and economic environment as well as industry-specific regulations, taxes, subsidies, trade and financing policies, and science and technology research and dissemination policies favor large-scale and urban enterprises. As a result, many appropriate technologies remain relatively unused. These technologies tend to be more labor intensive, less capital intensive, and require less foreign exchange than "modern," large-scale technologies. They are more compatible with available skills and resources and more socially and environmentally sound.

Businesses decide at the micro-level which technologies to adopt. These decisions are based on the (1) objectives of the firm, (2) resources available to the firm and relative prices, (3) size and type of the market, and (4) knowledge of available technologies. Frances Stewart of Oxford University emphasizes that government macro-policies can affect these micro-level factors through overall economic conditions (e.g., the money supply, interest rates and the availability of credit, aggregate demand, currency exchange rates, and the distribution of income), direct public expenditures (including investments in infrastructure or enterprises, human resource development, subsidies, and tax preferences), and regulations (especially those pertaining to wage rates, the transfer of technologies, foreign investment and trade, and the size, composition and ownership of economic units).

In some cases, technologies with low or negative social value persist because of inappropriate macro-policies. Special interest groups influence government policies to varying degrees. Current options may be limited by past decisions. Governments and multinational corporations also play a direct role in R&D and the choice of technologies. R&D tends to concentrate around the types of technologies and products currently in use.

Thus, to ensure successful demonstration projects, ATI must seek to influence the relevant policies in the areas where we work. Moreover, although demonstration projects are important in

stating the case for appropriate technologies, this approach is not enough. To have broad impact and to help implement changes in existing policies, ATI must share its experiences with national and local governments and financing institutions.



THE BOOK, "Macro-Policies for Appropriate Technology in Developing Countries," was ATI's first major publication in the policy area. Here, Edgar (Ted) Owens presents a copy of the book to Dr. Nyle Brady, Senior Assistant Administrator for Science and Technology, A.I.D. Mr. Owens, who many considered the "father of ATI," died in 1987.

As part of its work in the area of macro-policies, ATI has produced a book of case studies edited by Stewart, is convening four regional conferences for which papers have been commissioned from LDC experts, and has commissioned additional studies by consultants such as Kaplinsky, James, and Greeley. In addition, ATI staff have examined the connection between micro-level projects and macro-policies.

## Macro-Policy Book

ATI commissioned a set of case studies on the effects of macro-level policies on the potential for adopting appropriate technologies. These studies were edited and prefaced by Frances Stewart and published by Westview Press in 1987 under the title *Macro-Policies for Appropriate Technology in Developing Countries*. These studies cover the following topics: (1) classification of macro-policies, (2) technology choice in agriculture in India, (3) irrigation technology in Bangladesh, (4) small-scale paddy threshing in Thailand and the Philippines, (5) rural linkages in the

Philippines and Taiwan, (6) small-scale sugar manufacturing in India and Kenya, (7) technology choice in public enterprises in Kenya and Tanzania, (8) in-plant technical change in Latin America, (9) the standardization of machine tools in Japan and China, and (10) an interview and conclusions for the set of studies.

## Macro-Policy Conferences

ATI, in collaboration with Queen Elizabeth House of Oxford University and the Thailand Development and Research Institute, held a conference March 21-24, 1988, in Pattaya, Thailand to discuss "Implications of Technology Choice on Economic Development." In addition to ATI, funding came from the Netherlands Government and the International Development Research Center (IDRC) of Canada.

Presentations were based on case studies included in the book edited by Stewart. Local Asian studies on macro-policies for appropriate technology included presentations by Dr. Q. K. Ahmed of the Bangladesh Institute of Development Studies, Dr. Mingsarn Khaosaard of Thailand's Chiang Mai University and Dr. Romeo Bautista of the International Food Policy Research Institute in the Philippines.

The conference was well attended by government officials, bankers, and private sector representatives from Pakistan, Bangladesh, Thailand, Sri Lanka, Philippines, Malaysia and Indonesia. Two Thai TV channels covered the conference, as did Thai newspapers.

Conferences addressing the implications of technology choice in Africa and Latin America/Caribbean regions will also be held in 1988. The Africa conference will take place in Nairobi in late August. Local African studies on macro-policies for appropriate technology will include a presentation on Tanzania by Sam Wange of the University of Dar es Salaam; "The Case of Kenya," by Calestous Juma of the African Centre for Technology Studies and Peter Coughlin of the University of Nairobi; "How Economic Policies in Zimbabwe Have Affected Technology Choice and Technology Development," by Daniel Nedela of the University of Zimbabwe; "Macro and Micro-Policies Affecting Technology Choice and Development in Nigeria," by E. J. Chuta of the Univer-

sity of Maiduguri; and "The Impact of Macro and Micro-Socio-Economic Factors on the Introduction of Appropriate Technology—the Case of Zaire," by Ryzard Piasacki of the University of Lodz, Poland. Eric Hyman, ATI staff economist, will present "Government Policies and the Potential for Adoption of Appropriate Technologies: Three Examples from A.T. International's Experience in Africa."

The Latin America/Caribbean Conference will be held in Mexico City in October. The authors and subjects of the papers to be commissioned for this conference are now being finalized. ATI, in collaboration with the Industrial Development Bank of India (IDBI) and the Government of India, is also planning a macro-policy conference targeted specifically to India policies. This conference, to be held in New Delhi in early 1989, will build upon the framework and models ATI used in its earlier regional conferences.

#### Other Studies Commissioned by ATI

Some studies commissioned by ATI relate directly to ATI's demonstration projects while others look at trends in new technologies. Raphael Kaplinsky of the University of Sussex prepared three studies for ATI. The first examined clay brick manufacture in Botswana, Kenya, and Tanzania and the tradeoffs involved in the choice of production technology. Mechanized production can turn out an inexpensive, higher quality product for consumers, while manual production of a lower-quality and higher-cost product generates more employment. This study also examined the equity effects of alternative ways to disseminate brickmaking technologies.

The second paper by Kaplinsky questioned whether inherent economies of scale exist in technologies and whether mass production is necessarily efficient and equitable. To reduce economic instability, he recommended that more attention be paid to downscaling of plant size, product nature, and firm size. He also noted the emergence of a new paradigm of decentralized production through micro-electronics technologies. From these observations, he concluded that science and technology organizations in LDCs need to reorient research, especially in capital goods production, to reduce dependence on in-

appropriate technologies from industrialized countries.

Kaplinsky's third paper examines the experience of downscaling a modern technology — mini-cement production in India. This process required levels of technological development and management that are well beyond the level generally needed in upgrading village-level equipment, and was only commercially viable under the special conditions prevailing in India.

Jeffrey James of Boston University classified technologies into five categories and assessed their relative potential for appropriateness in LDCs. Upgrading traditional technologies is often the most cost-effective way of reaching the rural and semi-urban poor. In downscaling modern technologies, many of the economies of scale that made the original technology efficient may be lost. Most off-the-shelf modern technologies and innovative replacement technologies tend to be less appropriate for small farms and firms in LDCs because the research that produced these technologies was carried out in developed countries. However, some older modern technologies may be appropriate for medium-scale urban enterprises. If generated through in-country R&D, innovative replacement technologies may also play an important role in LDCs.

Steen Joffe and Martin Greeley of

the University of Sussex concluded that new plant biotechnologies will revolutionize agricultural productivity. Changes will occur in the cost and composition of agricultural inputs, production methods, and composition and processing of products. As international comparative advantage shifts, these changes will present both a threat and an opportunity for LDCs. The authors urge greater recognition of the needs of resource-poor farmers for low-input agriculture. In addition to the inherent characteristics of the technologies, their impacts will be affected by, among others, the degree of privatization, control over research, and the identification of end-user needs and rural institutions.

#### Plans for the Future

In the future, macro-policy activities will comprise 5-10% of ATI's program. Although consultants have undertaken the bulk of the policy-related work up to now, ATI expects to have a small professional staff working in this area. This in-house capability will allow ATI to respond to requests from A.I.D. Missions and A.I.D. Washington, donor agencies, multilateral development banks, and host-country governments to assist in analyzing the effects of existing policies and working with development professionals and decision makers to help implement recommended policy reforms.



COMMUNICATING ATI's experiences to other development professionals, government policymakers, private and governmental organizations and NGOs is very important.

# ATI-ITCR: A Model for Policy Change

*by Ing. Oscar Arce, Vice Rector  
for Academic Research, Instituto  
Tecnológico de Costa Rica*

Our work with appropriate technology and ATI goes back a number of years. In Costa Rica we have a variety of problems, among them a severe housing shortage. It has been estimated that about a quarter of a million Costa Rican families need housing improvements of some kind.

In Costa Rica, concrete is the most widely used construction material. About 65% of the cost of concrete is due to cement. If we could lower the cost of cement, we could lower the price of construction — a very important factor in making housing available for the poor majority.

Looking for alternatives for cementitious materials made a lot of sense. We started concentrating on the physical and mechanical properties of a stream of materials, using a rather traditional approach. Lime was an immediate possibility and it was included as part of the testing process. Very soon, we found out that lime was not a good alternative, since laboratory tests did not yield good results. We were surprised by the laboratory studies because we knew that lime has been used successfully in the construction industry in many countries, especially some developed ones, for many years.

So we were forced to leave our ivory tower—the Institute—and go out into the field. We contacted the actual lime producers and everyone involved in the lime production process. What were our findings?

Chemical analysis showed that our lime didn't meet minimal requirements for the construction industry. But lime has a lot of environmental and agricultural uses besides construction — such as for soil or water treatment. More important, many of our people were economically dependent on traditional lime kilns for their income.

Early on, it became obvious that if we were to revitalize the lime industry we needed to improve the kiln. Traditional kilns are energy inefficient to a great extent and cannot complete the burning process. The main energy source was wood wastings from the timber industry, which is now declining due to deforestation — yet another problem. If we could improve the traditional kiln so that it used less wood, we might be able to make lime production more profitable. Then, we could convince people to plant new trees in a nearby area, so that they would have a permanent source of fuel for their kilns. ITCR also was concerned because environmental and safety regulations were making the lime industry unprofitable. If the lime industry was driven out of business, what would happen to all those families who were dependent on the lime industry for their jobs?

At this time, ITCR first became acquainted with ATI. ATI encouraged us to submit a project proposal for upgrading the traditional kiln. ATI and ITCR could foresee that by improving the traditional technology, we could help all those people dependent on the lime industry to achieve a better social and economic status. More efficient lime kilns would result in increased incomes — and they could take care of their own housing needs.

From this project we learned two very important lessons. Seeking a solution to the housing problem did not necessarily mean that we had to limit our approach to the technical problems present in the housing industry itself. A good alternative would be to increase the incomes of people who need the housing. If we can do that, they will have access to the housing market; with the money they earn they should be able to solve their own housing problem. It also meant that people might be better prepared to take care of their problems in a broader sense: that they themselves would find the solutions to many of their everyday concerns.

More importantly, this specific experience made us aware of the vital importance of keeping in direct contact with our local people and our local communities. We need to leave the isolation

of our universities and make a field assessment of what our people need. This way we will know where to concentrate our efforts and resources to help them make positive changes in their situation. Too often scientific institutions choose a classical approach; research activities are seen as a goal in themselves and academics ignore immediate reality. ITCR, too, was guilty of this.

This approach has made a very important difference in policymaking at all levels. Overall, our housing project now has this type of orientation. We are slowly trying to implement projects in other areas based on this philosophy at an institutional level.

Most important, during the design phase of our national plan for the development of science and technology, we have had an opportunity to share our experiences with people from government and private enterprises. What we learned from the lime project was instrumental in defining a similar strategy on a national level. In the future we will work together with our rural communities to better define their technological needs. By providing assistance to people engaged in a wide variety of small enterprises, we will be able to tackle the problem in a broader way. Instead of analyzing a specific activity, we will pay attention to a complete region and to all the small enterprises either presently in place, or needed. We will try to concentrate our efforts in specific communities to help these enterprises become more competitive and to improve their incomes.

Even though we know this is only the beginning, we already have important results, not only from the technical, but from the economic points of view. Rural communities have changed their views about our role. We now are making contact with each other in a more natural way, and that means we can now cooperate on a more regular basis. Thus, in seeking a solution to the housing problem, we learned how we best can incorporate science and technology in development. We found that we were really able to help society only when we brought our research into the field.



*MANUAL SUNFLOWER SEED OIL PRESS, developed in Tanzania, has been introduced in Zimbabwe. To do this, ATI first had to get the Government of Zimbabwe to change its policy which did not permit small-scale on-farm processing of sunflower seeds into oil.*

*SHARP PRICE RISE in molasses in the Dominican Republic was a result of a change in government policy. This negative policy change forced ATI and CIMPA to reformulate the feed mix for some.*



*IMPROVING TRADITIONAL LIME KILNS in Costa Rica is revitalizing a town's industry. Working with ATI on this project taught ITCR that scientists must leave their ivory towers and work directly with local people to assess the needs of the poor.*

# Changing Policy in Zimbabwe: Sunflower Seed Press

by J. F. Swartzendruber

In early 1986 ATI staff members carried the manual sunflower oil ram press, developed by ATI engineer Carl Bielenberg in Tanzania the year before, to Zimbabwe for demonstration. They wanted to learn whether this technology might be replicated in Zimbabwe, either by the private sector or through a project similar to ATI's Village Oil project in Tanzania. Although initial reactions to the press were very favorable, there was a problem: government policy did not permit small-scale, on-farm processing of sunflower seed into oil. Farmers were required to sell to a parastatal marketing board, at regulated prices, and oil processing was the preserve of a large government-operated firm.

However, several factors led ATI to believe that these restrictions might be lifted in the case of the Bielenberg press. First, there had been a chronic shortage of cooking oil, especially in rural areas,

despite the high production volume of the large oil expelling plant, and prices had been high. Second, the government of Zimbabwe had been searching for low-cost ways to create jobs and generate income in the communal lands. Although these tribally controlled lands are among the least arable in the country, they are home to a disproportionate share of the population, especially the rural poor. At the same time, a trend was emerging in Zimbabwe, as in other African countries, to reduce the importance of parastatals by easing production and marketing restrictions.

With the help of a local agricultural implement manufacturing firm that was interested in producing the Bielenberg press, ATI approached the government to obtain approval to introduce the manual sunflower oil press in rural areas. This approval was given shortly thereafter—positive proof of the government's concern with promoting

economic activity in the hard-pressed communal lands areas. The Bielenberg press aroused great excitement at agricultural fairs, and was demonstrated on television by one of the local manufacturers which had lost no time in starting to produce the press.

Initial market analysis indicates that successful adoption of the ATI sunflower oil technology in the communal lands areas will require access to appropriate credit services, improved seed varieties, and technical and management training. However, observers believe that the press has already convinced policymakers that small-scale, on-farm processing may hold one of the keys to the economic diversification of some of the poorest parts of the country. No opposition has come from large-scale producers. This concept of local self-sufficiency may be extended to other activities as appropriate technologies are identified and transferred to the rural areas.

## A Negative Policy Change

Small-scale enterprises are extremely vulnerable to changes in government policies and in world market prices. This is illustrated by reviewing the history of ATI's Swine Feed project in the Dominican Republic.

After the entire national swine herd was slaughtered in 1979 because of an epidemic of African swine fever, the Dominican Republic government launched an intensive effort to repopulate the swine. Improved breeding stock was sold locally at prices most small-scale farmers could afford. However, the imported pigs were about twice as large as the native animals and the farmers were told that they had to be fed an imported, prepared feed, which was much too expensive for most small-scale farmers. ATI, in conjunction with CIMPA, the Centro de Investigación y Mejoramiento de Producción Animal, designed a project to reduce dependency on imported feeds by complementing commercial feed with locally grown feedstuffs. The project established a distribution system (mini-outlets) to make balanced feed mixes prepared by farmers' associations available in quantities the small farmers could afford.

When the project was initially designed molasses was to be an important ingredient in the feed mix. The molasses was poured on top of local greens to make "ensalada con salsa," a very palatable, high protein feed. Molasses is a by-product of the sugar industry and in 1984 was readily available in large quantities at a reasonable price. In fact, since there was no apparent market, the government-controlled sugar companies sold surplus molasses at a subsidized price. During this period the average price of delivered molasses was \$RD .34 per gallon. This price was roughly equivalent to the cost to produce and handle the molasses; the freight charges were absorbed by the sugar companies.

Shortly after the project was implemented, the world sugar price fell. The Dominican Republic was forced to drastically reduce sugar production. Several refineries closed and most of the others reduced their working hours, causing an increase in unemployment and a decrease in foreign exchange (dollar) earnings. In late 1985, in order to increase its foreign exchange earnings, the Government of the Dominican Republic decided to export molasses. To

discourage local consumption of molasses the price was controlled at \$RD 1.75 per gallon (an increase of 500%). Molasses, already in short supply, became virtually unavailable at the farm level. Farmers, confectioners and other industries that used quantities of molasses had not been forewarned about this policy, and were forced to adjust or totally abandon their production.

At the start of the Swine Feed project, when molasses prices were low, the farmers' associations purchased it in bulk and stored it in large tanks prior to distributing it locally. Now, however, most farmers only use the costly molasses in the swine feed mix during the dry season when fewer greens are available. Fortunately, pigs have learned to eat the local greens—even without the "salsa"—and some farmers use sugarcane juice as a substitute.

This macro-policy change could have spelled disaster for hundreds of small farmers in the Dominican Republic. Thanks to the quick reaction of the local project partner and assistance from ATI, the feed package was successfully reformulated to reduce its dependency on molasses.

# Feed Enriches Farmers' Futures

by Richard Bowman  
and Arleen Richman

In animal husbandry, the amount and quality of feed determine the animal's level of production, no matter what the product—meat, milk, eggs, wool. Feed is generally the most costly ingredient in animal husbandry worldwide. Although everything an animal eats provides energy (calories), only certain feeds contain the levels of protein necessary to maintain optimum levels of production. Tropical plants are generally low in protein; for this reason securing protein-enriched feed, at a reasonable price, has been a focus of development assistance activities, especially in the tropics. Although protein is the most important single ingredient in animal feed, if the feed does not contain the mineral balance most appropriate to the individual species (e.g., calcium and phosphorus for dairy cows) production will fall, the animal's fertility will be reduced, and the animal will be more susceptible to disease.

Lack of proper feed affects animals in different ways. Sheep that do not get enough protein in their diet will have brittle hair fibers not suitable for first quality wool products. If chickens do not receive enough calcium, the eggs they lay will have very thin shells. Dairy cows fed a poor diet not only will produce less milk but their milk will have a lower butterfat content.

ATI works with small rural farmers in a variety of projects to decrease their dependency on costly imported feedstuffs, and at the same time improve the nutrition of their livestock. This means improving the protein content of the feed, reducing its cost—usually by instituting a delivery system or establishing a feed mill—and balancing out and providing the missing ingredients.

Because ruminants (cud-chewers) can utilize the nitrogen in plants to form protein, the solution may involve introducing high protein forages, such as leucaena and pigeon pea (gandul). For example, to improve the pastures for sheep in the highlands of Guatemala, which will improve the quality of wool the sheep produce, ATI's Wool Production project is midway through promising field/grazing trials of several exotic nutritious alpine pasture varieties.



*POULTRY MANURE is used as protein supplement in feed formulated for dairy cows in Mexico. Feed enterprises, established by the Farm Support Enterprises project, serve an average of 30 farmers who own 3 cows each.*

For non-ruminants to produce efficiently, however, they need a digestible concentrate that already contains a high level of protein. One of ATI's most successful projects is the Swine Feed project in the Dominican Republic. When African swine fever broke out in the Dominican Republic in 1979, the government was forced to slaughter the entire national herd of approximately 1,600,000 head of swine. Because pork is an important element in the domestic agricultural economy, the Dominican Republic government launched an intensive effort to repopulate the swine. By mid-1984, breeding stock (imported pigs resistant to African swine fever) were being sold locally at prices most small-scale farmers could afford. But these imported pigs were very large, twice the size of the previous native or *criollo* animal. Farmers were told these pigs had to be fed expensive imported feeds—an approach they could not afford. But could the use of a combination of locally-grown products supplemented by some locally mixed feed concentrates enable the small farmers to profitably raise the new pigs?

ATI's project reduced dependency on imported feeds by substituting locally grown feedstuffs to complement the commercial feed. Ramie, a high protein feed used in Asia, was one component introduced to the small farmers. Although ramie only grows in the rainy season, some small farmers are planting this green and view it as an additional locally-grown nutritious feed component. The small-scale swine producers in the Dominican Republic still use commercial feed but in smaller amounts so their profit margin is greater. And although some of the feed ingredients are imported (in bulk to save money) the commercial feed itself is being prepared and distributed by the farmers' associations, another important cost reduction. The project also trained the small-scale farmers in principles of swine nutrition and what could and could not be substituted in their feed. Sweet potato leaves, rice bran, wheat bran from local mills, yucca leaves, edible roots—all these local greens, roots, and types of bran can substitute for a certain percentage of commercial feed. Farmers were also taught which local traditional feeds

had little or no value—coffee grounds, banana leaves— and therefore should be eliminated from their swine's diet. Most important, this ATI project established a distribution system (mini-outlets) so that the balanced feed mixes prepared by the associations are available locally in quantities the small farmers can afford. Because farmers who never before had access to commercial feed because it was too expensive or simply not available at any price now can purchase this important element of their pigs' diet, swine production has been opened up to a wider cross section of the Dominican Republic population. Today, more than 1,500 small-scale swine producers have increased their incomes by an average of 14%—far higher than the anticipated results.

Ten feed distribution centers are examples of just one type of small enterprise being established by the Farm Support Enterprises project in Mexico. Each feed enterprise is designed to serve 30 farmers who own an average of 3 cows each, or approximately 100 cows total. The overall goal of this project, being implemented by CEICADAR, a regional center of Mexico's Postgraduate College of Agriculture, is to provide the equipment, supplies, and services needed by more than 1,000 small farmers to improve their production and subsequently increase their incomes.

Most small farmers in the Puebla area of Mexico raise a few dairy cows, in addition to corn and fruit trees. Traditionally these farmers only fed their cattle cornstover, alfalfa, and corn/grain—but these cows produced substantially less milk than cows fed a supplement of concentrated feed. Concentrated feed was available in this area, but it was extremely expensive and generally was not available in small quantities. The project has developed a high protein feed supplement containing proportional amounts of poultry manure, molasses, mineral salts, urea and sulphur which farmers purchase separately and add to the traditional alfalfa and cornstover. This mixture, which uses poultry manure as a protein substitute, isn't new to cattle; it's been fed to beef cattle in the past. However, farmers in Mexico, as in other Third World countries, were hesitant to feed this to their dairy cows. Preliminary studies conducted by CEICADAR show



*A FERMENTATION process was used to enrich the protein content of cassava for use as pig feed in Thailand. Moistening cassava chips is the first step in the process.*

that dairy cows fed the correct proportions of feed supplement either increase their production of milk substantially or maintain their production on lowered feed costs.

In Thailand, ATI experimented with a biotechnology to enrich the nutritional content of cassava, enabling the production of a low-cost, highly nutritious stock feed for small-scale pig and poultry farmers. By using a combination of a mold and a yeast in a solid substrate fermentation process, the cassava was able to yield a consistent increase of 11-12% true protein. However, the final product is a feed supplement rather than a complete stock feed. Extensive feeding trials with swine indicated no toxicity and a good feed conversion ratio. Because the price of cassava rose dramatically in Thailand over the project period, the results of this research will be used in commercial enterprises in other countries.

In several countries, ATI has established feed mills to complement existing livestock/dairy production. Feed mills take both high bulk and low volume products like corn and grains, and use appropriately designed mills to

chop grass or grind corn/grain. The chopped grass and ground corn/grain are then mixed with protein-rich ingredients such as soybeans; minerals also are added. The feed mill serves several purposes: it adds value to existing agricultural products; makes feed available to area farmers at a lower cost than imported animal feeds purchased elsewhere; and creates employment and generates income for both the owners of the mill and the farmers growing the produce sold to the mill.

In Thailand a small enterprise development project which included dairy farming as one of its enterprises established a feed mill in its second year of dairy production. The small feed mill buys corn and other inputs from local farmers, grinds up the feed and sells it to the local farmers. Some villagers who do not own cows and are not participating in the dairy farming part of the project grow cassava or corn to sell to the feed mill. The mill charges the same price for feed as other feed stores. However, it delivers the feed to the farmers and eliminates the need for cash disbursements. After its second year of operation, the feed mill paid a dividend to its 81 owner families.

# Inferior Materials Can Produce Portland-Quality Cement

by Carlos R. Lola

Cement, an intermediate product in the manufacture of concrete, is probably the world's most widely used construction material. The first cementitious materials to be used in mortars were gypsum and lime. The Egyptians used gypsum mortars to construct the Pyramid of Cheops in 3000 B.C.; lime mortars first were used in Egypt only in the Roman period. In 1824, Joseph Aspdin obtained a patent to manufacture "Portland cement." To prepare "Portland cement" (commonly referred to simply as cement), finely ground limestone and clay are mixed and then heated in a kiln at 1400 degrees Centigrade. The intermediate product obtained, called clinker, is then ground and mixed with gypsum.

In industrialized countries cement is normally produced in factories that use rotary-kiln technology and produce as many as 5,000 tonnes of cement per day. These large-scale cement plants are inappropriate in many developing countries because they require extensive capital investment (as much as \$US 400 million), three to five years to construct, significant reserves of raw materials, and a well-developed transportation and distribution infrastructure. In contrast, small-scale plants (producing up to 400 tonnes per day) that use a vertical shaft kiln are advantageous because:

1. They can be located wherever there are suitable raw materials and sufficient demand for the product to justify investment in a small-scale plant but not in a large-scale plant.
2. The small-scale plant is designed so that the machinery can be manufactured and assembled locally, eliminating the need for imports and reducing technological dependence on foreign firms.
3. The small-scale plants can begin producing more quickly.
4. Start up and maintenance costs are significantly lower.
5. The small-scale plants demand less from existing power and transport facilities.
6. The concept of small cement plants is compatible with a policy of regional self-sufficiency.

Until 1978-1979 consumption of cement in India was limited to what could be produced in country. Because most cement was used in the north of India

and most cement was produced in the south, it was necessary to transport large quantities of cement over long distances.

In 1979, the Government of India decided to encourage the development of mini-cement plants; it began to provide technical and financial assistance to plants with capacities of up to 200 tonnes per day.

In 1978 the Appropriate Technology Development Association (ATDA) of Lucknow, India, in collaboration with ATI and the Intermediate Technology Development Group (ITDG) of Rugby, U.K., initiated a project in Mohanlal gang to upgrade a 25 tonne per day mini-cement plant to consistently produce standard grade Portland cement. The technology for mini-cement production in India, as in other parts of the world, is based on the batch-operated vertical shaft kiln (VSK), which evolved from the nineteenth century lime kiln. These VSKs, however, have been improved to allow continuous operation.

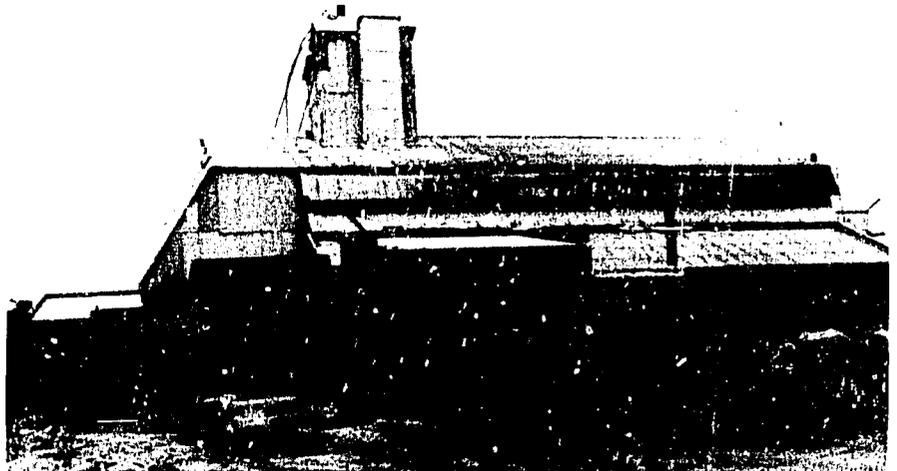
The VSK technology produces cement either by the intergrinding (black meal) or the intermixing (semi-white) process. The ATDA project adapted the process of intermixing. In the intergrinding process, raw materials and coal are mixed at the outset and ground together; the proportions cannot be adjusted before being put into the kiln. In the intermixing process, crushed coal is mixed with pre-ground raw materials immediately before they are fed into the kiln, rather than at the earlier grinding stage. Proportions of coal can be adjusted continuously to compensate for raw materials of variable quality containing different percentages of calcium car-

bonate. Standard quality Portland cement can now be produced using locally available raw material deposits, such as marl and kankar.

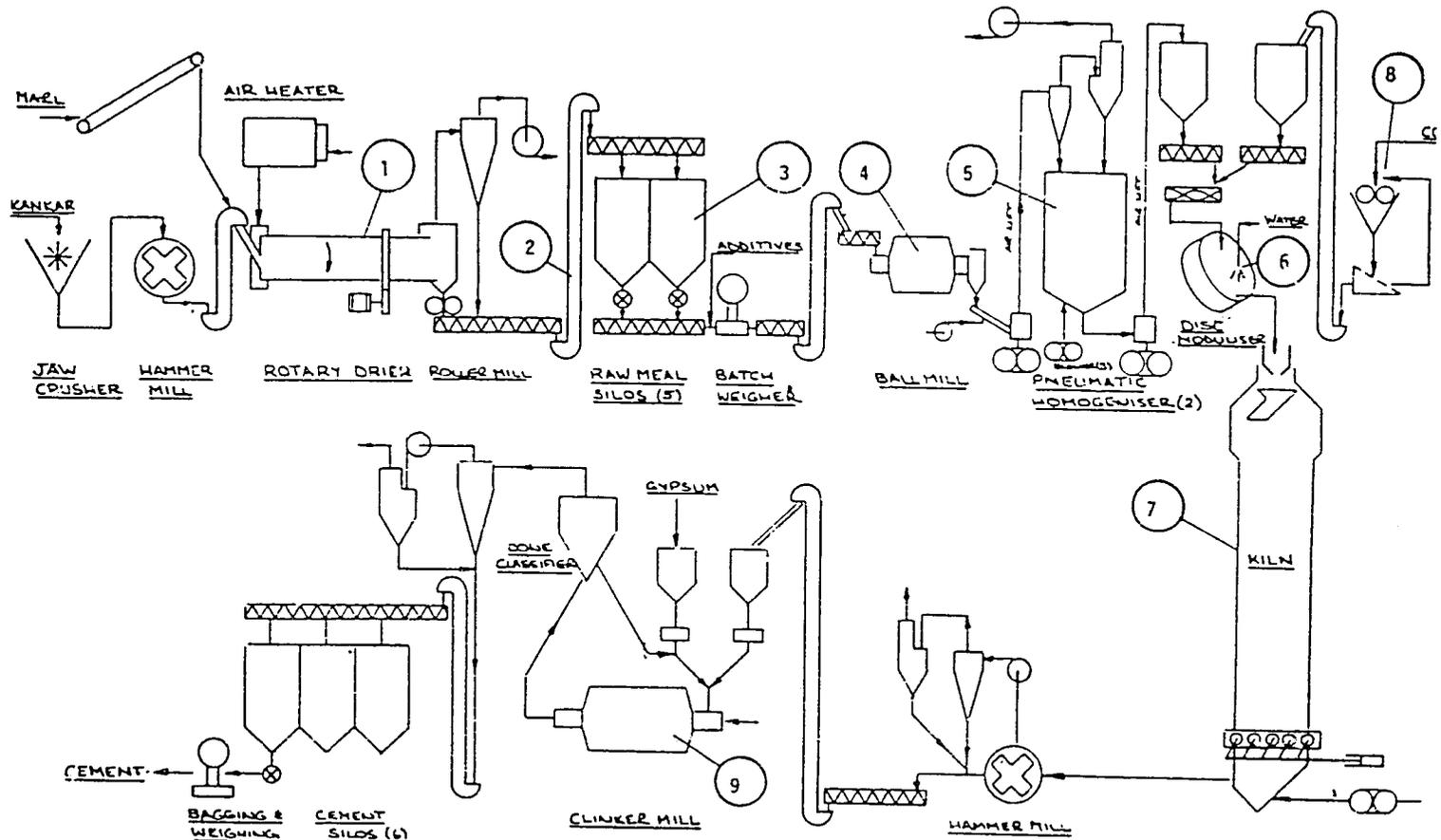
The ATDA Mini-Cement factory, which has a daily capacity of 20-30 tonnes, is based on efficient, modernized vertical shaft kiln technology. Because the whole plant is located under one roof, materials can be handled more easily. Although the process is more labor-intensive than the process used in large-scale cement plants, in those cases which ATI analyzed, the final cost for each ton of cement produced is the same.

Other groups such as the Indian Cement Research Institute have designed small-scale cement plants. Some 30 VSK cement plants are already operational in India and individual investors plan to build an additional 60 plants in the near future. However, ATDA's technology is distinguished from other small-scale cement technologies because it produces a consistent Portland quality cement, a fact attested to by the Indian Institute of Standards. The quality is attained even when the plant uses relatively low quality raw materials, such as marl and kankar, which have a calcium carbonate content of only 45-50% compared to 80% in the customary raw material, limestone. The ATI-financed project demonstrated that in India, where there are favorable government policies, the mini-cement plant does represent a viable alternative to the large-scale plant under appropriate technical and/or institutional conditions.

*ATDA/ATI mini-cement plant in Lucknow, India, has a daily capacity of 20-30 tonnes of consistent quality Portland cement.*



# Mini-Cement Flowsheet



INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP.  
 DRAWN: PRA  
 DATE: 5 APRIL 84  
 REVISED: 6 AUG 84  
 ATDA 20 TON/DAY MINI-CEMENT  
 PLANT, MOHAWALGAMJ.  
 FLOWSHEET

# Turning the Tide: Shrimp Production

by Phoebe Andris

Traditionally, in Indonesia, small pond (tambak) owners who want to stock their ponds with shrimp must depend on what the tide brings in. As the tide recedes, shrimp eggs and larvae are trapped in the farmers' ponds, usually located alongside coastal beaches. Farmers then blindly feed the larvae for four months without knowing how many, if any, shrimp are growing to maturity.

ATI and Yayasan Dian Desa (YDD), an Indonesian based NGO, have been working together to better the odds and give these small pond farmers a reliable source of income. They have developed an integrated service company that hatches and raises Tiger Prawns, provides financing through a profit/risk sharing program, and upgrades pond management for individual pond owners. Marketing and technical assistance are also provided, as well as a continuous supply of quality shrimp fry and feed.

The technology component of the project consists of a hatchery, demonstration ponds, and the Outgrowers Service Unit.

The hatchery is based on the latest techniques used by the Hawaiian Institute of Marine Biology, which provided training to YDD personnel, and adaptations from the Japanese and Taiwanese systems of shrimp production. The hatchery is expected to provide a steady supply of shrimp fry to the Outgrowers Service Unit, where they are grown to marketable size.

The hatchery has the capacity to produce 2 million post-larvae every 26 days; the 26 day cycle encompasses conception, hatching, larvae and post-larvae growth. The hatchery, which is operating at 50% capacity, presently employs 23 people.

The first month of a shrimp's life is the most critical stage of development since larvae suffer an 80% mortality rate during this period. The hatchery operates much like an emergency room in a hospital. The biological and chemical levels in the water are monitored 24 hours a day. The larvae are fed every 3-4 hours and the water quality is checked frequently. A fluctuation of just 2-3 degrees C in water temperature, salinity, or oxygen level can kill



JUVENILES are sold to tambak farmers who then raise them to maturity. Farmers continue to receive technical assistance from YDD.

or stunt the growth of an entire batch — as many as 200,000 fry.

Four broodstock tanks house the 25 female and 25 male Tiger Prawns kept for breeding. New broodstock are purchased from fishermen every 4-5 weeks. One eye of each brood female Tiger Prawn is removed to stimulate hormonal activity, causing her to produce eggs more often. After she mates and her egg sack is full, the female is removed from the broodstock tank and placed in one of 10 spawning tanks. The female lays as many as 1.5 million eggs before being returned to the broodstock tank. Fourteen hours after spawning the eggs hatch. The nauplii, the first larvae, begin their rapid metamorphosis.

The larval and post-larval rearing tanks house the fry at various stages of development. The shrimp are grown and transferred at each stage to new tanks. It is difficult to see larvae with the naked eye; in fact larvae only begin to look like shrimp 12-14 days after hatching. During the post-larvae stages, the fry grow 1-2 centimeters in length. To grow this fast they need large amounts of food; each day they eat more than they weigh.

The hatchery also produces feed for the fry. Brown and green algae (phytoplankton) are grown at the laboratory to be fed to the larvae from hatching until day 10. The algae is

poured into a spawning tank at the rate of 4 small buckets every 3-4 hours. At approximately day 8, the fry graduate from the phytoplankton diet to a mixture of algae and freshly hatched artemia (brine shrimp), also prepared in the hatchery's laboratory. After day 12 of post-larvae development (22 days after hatching), artemia is supplemented by store bought flake or ground pellet feed. Because of the fry's voracious appetite and rapid growth, the quantity and quality of their feed is very important. If they get too hungry, the fry may begin to eat each other.

Twenty day old post-larvae are shipped to a demonstration pond where the tambak farmers may observe them. They are raised at the pond for 3-4 months until they reach the juvenile stage and are sold to the farmers. The demonstration pond permits the farmers to obtain a firsthand look at the controlled production system and the careful procedures for checking salinity, temperature, and algae growth in the ponds. As the fry grow larger, they can withstand 5-10 degree C changes in water temperature; now the ponds need to be checked only once a day. The survival rate for the fry at the demonstration pond is 50%; once they are harvested and transferred to the outgrowers, their chances for survival are even greater. A traditional tambak farmer would consider himself very fortunate if his fry's survival rate was 20%.

The Outgrowers Service Unit (OSU) is known as the Sharing Program in Indonesia—a reference to the shared profit/risk financial component. Technical experts from YDD visit each tambak farmer or group of farmers (some ponds are owned by clans) to advise them on pond depth, soil composition, and other technical issues. Once pond improvements have been made, and the tambak owners have received formal training, the farmers are given a supply of 20,000-30,000 juveniles to grow. The YDD field manager checks the farmers' ponds daily and is on 24-hour call to provide emergency

technical assistance. This is difficult in remote areas where the pond cannot be reached by car.

The project provides the juveniles and feed for the farmers, and the farmers provide the labor and land for the final production stage. Once the shrimp are sold, the farmer splits the profit 50/50 with the project. The project's share of the profit is used to cover operating costs in providing the same farmer with the next batch of juveniles. This process is repeated for six cycles; at this point the farmer should be very familiar with the improved technology and have earned a profit that will per-

mit him/her to begin purchasing juveniles from the OSU at a very reasonable cost. The project sells the juveniles to its sharing partners for 75 rupees each; it costs YDD approximately 73 rupees to raise a Tiger Prawn to the juvenile stage.

Five farmer groups currently participate in the Sharing Program. The first outgrower, Umbar, has earned Rp. 1,068,305 (\$US 650) with his 50% share of one harvest—an impressive income for a tambak farmer in this area of Central Java. At least 40 small pond owners are expected to become outgrowers in the Sharing Program.



LARVAE and POST LARVAE rearing tanks house fry at various stages of development.



SHRIMP RAISING TECHNOLOGY is being promoted via venture capital investment in Indonesia. Here a "mother prawn" is being transferred to a spawning tank.

# Appropriate Chips for Developing Countries

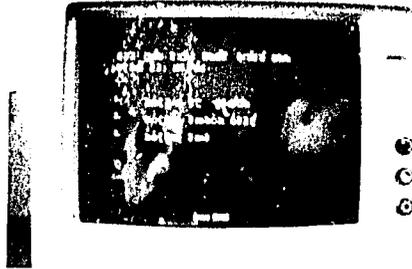
The computer revolution is spreading to the most remote corners of the developing world. Low prices and versatility make micro-computers an increasingly appropriate tool for use in LDCs. Computer technology has improved and computing/price ratios have dropped sharply in the past decade. A micro-computer that cost \$5,000 in 1987 was the equivalent of a \$3 million IBM 370 mainframe computer of the early 1970s. At the same time, costs of software packages are also lower. Because of the greatly expanded market, a software package for a micro-computer can be purchased for a fraction of the royalty fees for a similar package designed for mainframe computers. Many development experts fear that introduction of micro-electronics will seriously hamper employment generation in developing countries. On the other hand, the advances in S&E that can be achieved through the use of micro-computers should increase productivity and efficiency in the Third World. ATI is currently focusing on three areas for micro-computer use in developing countries.

- Standard applications to help project partners improve their data processing and reporting capacity.

Word processing, electronic spreadsheet (Lotus 1-2-3), and database management (dBASE III plus) packages are useful in these applications. For example, a small enterprise can use an electronic spreadsheet package for cash flow analysis and accounting statements. Database packages help businesses keep track of inventory and organize mailing lists.

- The use of micro-computers in computer-based training programs.

Recent developments, especially in CD-ROM, make the micro-computer a cost-effective training and extension tool. By using computer-based instruction materials for job and skills training, developing countries can compensate for the shortage of trained experts. Because the few available experts face many demands on their time, and rural travel in the



COMPUTER LESSONS in Sinhala, and training videos, are being used in Sri Lanka to teach rural villagers basic skills in spice cultivation.

Third World can be difficult, it makes financial sense to produce training programs which can be used by less formally educated staff. In Sri Lanka, ATI is presently supporting a project that uses a combination of computer-based lessons and training videos (CVT) to teach basic skills in spice cultivation, harvesting and drying to rural villagers. This project is ATI's first attempt to test the effectiveness of computer video training in transferring technical skills directly to rural populations in a developing country. If the CVT program is successful in Sri Lanka, ATI plans to create additional interactive computer programs, complete with video and graphics, to help disseminate proven appropriate technologies, such as brickmaking, shrimp culture, and the Hotchkiss wheelchair.

Software for instructional use can trace the progress of trainees and give them feedback by passing them on to a higher level or retaining them for make-up sessions. For example, if a question is asked and the trainee answers incorrectly, he will not be permitted to continue on to the next section but will be required to review the previous material and answer the question again. Previously the hardware required for this application was so expensive that it was impossi-

ble to use in rural and remote areas. However, PLATO micro-computer packages developed by Control Data Corporation have made it possible to develop sophisticated training programs which only require a small investment per learning station.

- The use of micro-computers in the planning and development of market towns and small cities.

Professor Britton Harris of the University of Pennsylvania City Planning Department, in conjunction with ATI, has proposed the development of a micro-computer software package to plan market towns in developing countries. (Market towns are centrally located with populations ranging from 25,000 to 100,000.) Many market towns are expected to triple or even quadruple in size in the next twenty years. In developing countries, personnel are ill-trained to plan effectively for the future housing, sewage, transport and power needs of these cities. Nevertheless, the use of micro-computers can aid relatively untrained planners and officials in this task. For example, a population forecasting package which predicts future age distribution in an area can be used to indicate the number of schools needed. Plans can be completed more rapidly and easily because complicated equations or computations are already programmed into the package.

Not only are there few urban planners in developing countries, but urban problems are interrelated. For example, transport problems may be related to poor planning of land use. A small-scale industrial park may be located ten miles from residential areas, adding traffic to an already congested one-lane road. Although software packages already exist for separate planning activities, there is no single package currently available which addresses developing country urban problems and contains and links together all necessary software components. The proposed package, which also includes drawing and mapping devices, should fill this gap.

# Venture Capital: The ATI Experience

by Paul Bundick  
and Michael O'Donnell

Small enterprise development will play an increasingly important role in economic development assistance programs in the years ahead. The upsurge of interest in the small-scale sector has been propelled by a number of factors including:

- mounting pressure to create millions of new jobs;
- shifts in the world political economy reducing availability of investment capital for large-scale industries;
- developments in technology that favor small-scale applications; and
- growing evidence that small enterprises are more efficient in terms of both output and employment creation per unit of capital invested than comparable large-scale firms.

Although small enterprise programs can increase employment opportunities and off-farm income in developing countries, the problems associated with setting up successful small enterprises are formidable. Success depends upon dealing effectively with a complex array of problems, such as unfavorable macro-policies, bureaucratic red tape, high cost of capital, and scarcity of managerial and technical skills.

To remove the obstacles constraining the development of small industries which seek to reach and directly benefit the rural poor, ATI developed the concept of a small venture capital company (VCC). Between 1984 and 1986, four VCCs were established by ATI and other cooperating organizations—one each in Indonesia, Thailand, the Philippines and Sri Lanka. While the VCCs are not identical, the model emphasizes four important themes: 1) shared financial risk by means of joint ownership and equity financing, with the aim of benefiting the rural poor; 2) searching actively to identify investment opportunities; 3) playing an active role in forming joint ventures to take advantage of the identified opportunities; and 4) identifying and moving innovative technologies into the marketplace.

The ATI experimental VCC model differs from conventional venture capital companies primarily in terms of objec-



COMMERCIAL MUSHROOM PRODUCTION is one of several technologies on which the Philippine VCC is concentrating.

tives. The conventional venture capital company has one primary objective—profit. The VCC invests to achieve three objectives: 1) socio-economic benefits for the rural poor; 2) the commercialization of innovative appropriate technologies; and 3) profits achieved by setting up commercially viable enterprises. The VCC is intended to be an economically sustainable mechanism to achieve a broader set of development objectives than is normally pursued by a private sector firm.

The typical VCC is established by agreement between ATI and an implementing organization and generally (though not necessarily) set up as either a subsidiary or a division of the implementing organization. The VCC identifies opportunities for investments in rural industries that meet the agreed-upon objectives. This includes seeking out the technologies ready to be commercialized and locating interested joint venture partners. The VCC and the joint venture partners become shareholders in a separate company. The VCC provides 70-90 percent of the equity and provides services such as marketing, technical assistance, and bookkeeping and other business services.

## The Four VCCs

The first VCC was established in Indonesia in 1984 in cooperation with Yayasan Dian Desa (YDD), a large not-for-profit community development organization dedicated to the application of appropriate technology for rural development. The VCC originally was to commercialize technology already researched and developed by YDD. However, experience during the first three years indicated that the assumptions regarding the commercial viability of these technologies, the market prospects for the products, and the business skills required to effectively manage this VCC were overly optimistic. A dramatic turn-around occurred when the VCC focused on one technology sector—production of shrimp. This choice was based on the knowledge YDD gained during its first three years of venture capital operations. In order to satisfy the twin objectives of profitability and increasing the income of the rural poor, YDD had learned the hard way that it needed to concentrate on a technology which had dual components. On the one hand, the technology had to have a sophisticated component so that YDD could control it

without having to face rapid competition; it also needed a relatively simple but efficient component that could easily be taught to large numbers of people. In the shrimp production process the production of the shrimp juveniles is complex; the simple component is raising the shrimp from juvenile to market size. YDD has demonstrated its capacity to produce fry at a survival rate of more than 20 percent—far higher than the industry average in Indonesia of 7-8 percent.

The second VCC was set up in Thailand in 1984 within the Population and Community Development Association (PDA), a large, successful non-governmental organization with an established network of projects and services to villages in the rural areas. As in the Indonesian case, after three years it became clear that the original expectations to invest in six enterprises per year were overly optimistic. The time and effort of the VCC staff was used to start up two relatively successful enterprises—bamboo mat production and environmental latrines. Little time was available to identify new technologies and to translate these technology ideas into business ventures. One enterprise, the bamboo mat production, showed that it is possible to

combine the social objective of creation of jobs with the commercial objective of profit-making, although this enterprise currently is plagued by severe marketing problems.

The third VCC was formed in the Philippines as a division within the Filipinas Foundation (FFI), a private non-profit foundation dedicated to the promotion of national art as well as to science and technology research for rural development. Since its establishment in 1985, this VCC has made three investments. One of the ventures—commercial mushroom production—is breaking even. The second venture, wet coconut processing, had to be relocated due to political unrest. However, the technology already has been replicated in another country, Sri Lanka, and negotiations to replicate this technology in several South Pacific Islands are under way. The third venture, production of citronella oil, has proven to be commercially viable in test runs. This VCC's strong links with the Philippine science and technology community led to a focus on technologies that had never been commercially applied. This initial emphasis on innovation resulted in staff time and capital being invested in technology development rather than in establishing less risky, more profitable

enterprises with shorter payback periods. In hindsight, the VCC relied too much on technology-driven investments rather than market-oriented opportunities.

An agreement to set up a VCC in Sri Lanka was signed in 1986 but this VCC has yet to become fully operational. While the VCC that is now established is still a private, limited liability company, in actuality it is operated out of the Employment and Enterprise Development Division of the Mahaweli Authority. ATI recently received the first business plans for the production of a dehydrated rice foodstuff and a dairy.

#### Conclusions and Recommendations

The evaluation of ATI's three years experience with VCCs led to the following conclusions:

- 1) The use of equity capital has allowed a number of small businessmen to contribute to the economic development of their families, villages, and nations. They could not have started productive enterprises using traditional finance.
- 2) More insight is needed on the use of equity versus debt in the start up of a new enterprise.
- 3) When the VCC model was developed, it was assumed that a pool of technologies and economic opportunities existed, ready for commercial exploitation. Either this assumption is wrong or the VCCs find it more difficult to obtain access to this pool than originally thought. There is a need to improve the VCC search strategy for identifying investment opportunities.
- 4) It is easy to underestimate the time needed by VCC staff to start up a new enterprise and to overestimate the potential profitability. In addition, VCC staff often were asked by the parent organizations to perform duties unrelated to VCC interests.
- 5) It is unlikely that the profits earned by a new enterprise will ever equal the total cost of learning and staff development. The VCC will recover



BAMBOO MAT PRODUCTION, an enterprise established under the Venture Capital Company in Thailand, has created more than 700 jobs.

*This article is an overview of a paper by the same authors, "Venture Capital for Small Enterprise Development-The ATI Experience," available from ATI.*

its sunk costs by replicating the same type of enterprises.

- 6) The limited experience in Indonesia in terms of focusing the VCC on a particular technology sector has yielded promising results.

#### Summary of Recommendations

- New VCCs should focus on a specific commodity sector in order to enhance prospects for commercial viability and to make maximum use of resources and learning. The concept of a commodity specific service company is a useful model. Such a service company would promote the replication of a very specific enterprise and provide support and backup services in finance, accounting, marketing, engineering, etc.
- Profitability of the VCC depends on choosing the correct area of specialization, which also determines the kinds of skills and experience needed in staffing the VCC. The VCC should not be fully staffed until the area of specialization has been determined.

The search strategy should be a two step process. The first step should be to cast a wide net looking at a large number of potential opportunities. The amount of resources spent on any one idea should be limited. All the potential opportunities should be prioritized according to profitability, benefits, and replication potential. The second step involves a more detailed analysis of the best opportunities. After thorough analysis, and comparison of possibilities, one opportunity is selected. The first VCC/service company is established to work in this area; staff are hired with expertise in this field.

- In order to improve the search strategy, ATI should initiate, at least once a year, meetings between VCC companies and the S&T community in the country in which they operate.
- ATI should assume the role performed by more traditional venture capital firms and actively work with the VCC to seek out technical opportunities ready for commercialization and provide management and technical expertise.



SMALL ENTERPRISE DEVELOPMENT in India is being facilitated by the Venture Capital Company for Application of Appropriate Technology (VCAT). Memorandum of Understanding regarding the formation of VCAT, involving ATI, represented by Dr. de Wilde (center), and the Industrial Development Bank of India (IDBI), represented by Mr. Nadkarni, IDBI Chairman (left), was signed in Bombay on March 15, 1968. Asia Project Officer, Jack Croucher, looks on.



POTATO PROCESSING, an appropriate technology which has shown high replication potential, will be one "preferred" enterprise for VCAT investment.

# VCAT: A Blueprint for Action in India

by S.K. Gupta  
and Jack Croucher

In its early years ATI concentrated on establishing profitable, commercially viable small-scale enterprises based on technologies appropriate to the needs and resources of each country. However, as demonstrated by ATI's macro-policy studies, and as brought out in discussion at the first of a series of regional macro-policy seminars, these micro-interventions did not exist in a vacuum; they were affected by macro-policies and local situations. ATI's Long Term Strategy recognizes the need to link small-scale projects and macro-policies in order to systematically support the varied requirements of small-scale enterprise development in the field. By focusing on regional or sectoral programs that combine a number of micro-interventions or projects in a particular region of a country, ATI expects to markedly improve the overall social and economic development of that region.

In India, ATI and the Industrial Development Bank of India (IDBI) have jointly designed and financed an innovative, intermediate-level delivery system to promote small enterprise development in various regions of India. The Venture Capital Company for the Application of Appropriate Technology (commonly known as VCAT) expects to provide financial, technical, business, and support services to small-scale enterprise; it meets the long felt gap in the provision of venture capital for adoption of appropriate technologies, especially in rural areas. Five project centers throughout India will provide financial, business and managerial services to an estimated 100 new co-ventures during the first five years of the project that will employ as many as 2,500 people. In addition, VCAT expects to help communicate to Indian policymakers problems facing local micro-enterprise entrepreneurs and thus assist the policymakers to implement positive changes.

## Reducing Risk

Any attempt to develop commercially viable industries and enterprises in the rural sector must address the issues of risk, either real or perceived. Banks and other organizations responsible for promoting micro-enterprise development are concerned with the risks involved with financing, technology, location, and target groups. It is risky to invest in a rural area with individuals or groups who have few assets and lack a proven track record. Existing or would-be entrepreneurs are apprehensive about getting involved with banks and are hesitant to attempt something new, an innovative technology or a different activity. VCAT will identify, minimize, and share all these risks with its partner entrepreneurs. VCAT will seek market-driven investment opportunities and will provide required extension services as well as financial support. VCAT is expected to:

1) provide start-up finance for the search for appropriate science and technology for application to artisanal, agro-processing and small enterprises among others;

2) arrange risk capital for entrepreneurs individually or in groups for productive activities including transfer of technology, its adaptation and assimilation, training and extension, marketing, and;

3) help, create, or catalyze a network of support systems supplemental to the above.

Once the technology is proven and income generating capacity demonstrated, VCAT would withdraw and leave the initiative to others to either replicate, extend, or expand. In this context, VCAT will also act as a resource agency supplementing the initiative of others.

## VCAT Strategy

VCAT's strategy will include:

- Searching for appropriate technol-

ogies within or outside India that have potential applications to defined Indian situations (technology search);

- Adopting or adapting such technologies to the local context (technology transfer);
- Identifying and preparing recipient firms to assimilate the technology sought to be transferred and matching it with individual or collective enterprise (extension);
- Providing risk capital (venture capital) to an enterprise. If needed, VCAT will provide services such as transport and lease of warehousing;
- Training the entrepreneur, if necessary (entrepreneurship development and counseling);
- Providing linkages to complement existing extension and motivational support systems;
- Marketing the product (business services);
- Monitoring the project (extension) and suggesting corrective actions, when necessary.

At the start-up stage, VCAT will be sector and region-specific. Investment proposals emphasizing "sure bets" will be given preference. The facility will attempt to balance risks by selecting appropriate technologies that have high potential for replication, such as potato processing, rhizobium inoculant, and the processing of fruits and vegetables.

VCAT's investments will be in the form of loans or equity financing or both. These investments will focus on upgrading or adapting existing technologies that add value to locally available materials or developing new technologies to that effect. The number of forward and backward linkages will be an additional factor to be considered in selecting investments that hold the most promise to create employment and increase incomes in rural areas of India.

# A Key to Success: Institutional Infrastructure

by Edward Perry

To launch a successful small enterprise which sells a new product, many different business and production skills are needed. The product may need further testing, both in the laboratory and in the field; the production process needs to be designed and established. The final product needs to be manufactured and marketed; credit may need to be made available. Throughout all the phases, technical and managerial support must be available. Because very few non-governmental organizations in developing countries possess all skills necessary to successfully implement a development project, ATI projects often involve a number of different implementing organizations, each adding some necessary element. For example, two development organizations and one manufacturer were selected to implement the Cameroon Agricultural Tool Manufacturing Industry (CATMI) Maize Mill project.

This project locally manufactures an adapted maize plate mill for sale primarily to women's groups in villages in Cameroon. The project grantee and primary implementing organization is The Association for the Promotion of African Community Initiatives (APICA). In addition to coordinating project activities and monitoring project implementation carried out by others (e.g., mill manufacturing and management of a lease/purchase program), APICA is directly responsible for specific tasks undertaken with other project partners. These include: managing loan funds made available to CATMI for mill manufacture; training a CATMI staff member to train mill operators in mill operations and to demonstrate the mill; designing promotional materials for mill dissemination (marketing); and establishing a simple system of accounting for the drafting of periodic financial reports specific to mill production.

ATI's projects always include a commercial production activity. CATMI was chosen to implement this component of the project because of its production scale and skill, because it had developed the milling technology, and because it had strong market linkages in the region. CATMI is expected to manufacture 40 mills; financing will be provided by ATI. CATMI receives financial,



MAIZE MILL project in Cameroon uses three implementing organizations.

management, and marketing support from APICA.

Because grain mills are expensive, usually only rich private entrepreneurs can afford to buy them. While the CATMI mill is significantly less costly than locally available imported mills, its price still is beyond the reach of the majority of the rural poor. To enable the rural and semi-urban poor—the target groups of all ATI projects—to gain access to the use of the mill a lease/purchase scheme was designed. The Northwest Province Development Authority (MIDENO), which has experience in managing loan funds, was selected to implement this lease/purchase phase. MIDENO is responsible for establishing two separate bank accounts, one for credit and one for lease payments, and a recording/accounting system for a lease/purchase fund; selecting the women's groups to be given credit to lease/purchase the mills; establishing a lease/purchase agreement with the selected women's groups; and collecting lease payments periodically.

MIDENO reports on a quarterly basis to APICA on the status of the lease/purchase program. After APICA verifies the report, it forwards the report to ATI. MIDENO works with CATMI to enable the women's groups to lease/purchase the mill. Once the mill has been

installed and the lease/purchase agreement signed, MIDENO disburses to CATMI an amount equal to the retail price of the mill. In effect, MIDENO has purchased the mill from CATMI; MIDENO thus owns the mill until the buyer has made all the necessary payments.

In August, 1987, a protocol agreement was signed between APICA and MIDENO establishing their respective project responsibilities, including management of the lease/purchase fund. The fund was now official; an initial disbursement from ATI totalling 2.5 million CFA francs (\$US 8,300) was deposited by MIDENO in a separate bank account. As required by U.S. government regulations, this account does not earn interest. When two women's groups in Ndu and Ichim qualified for the lease/purchase agreement, money was transferred from the fund to cover the cost of the mills to CATMI. Each group made an initial payment of CFA francs 500,000 (\$US 1,660), which was deposited in the other account, ATI lease repayments, opened by MIDENO. This created a balance of 1 million CFA francs (\$US 3,320) in the repayment account. The interest earned on these funds helps defray the management costs. Funds which are continually added to the repayment account finance the lease/purchase of mills indefinitely.

Eight other women's groups have qualified for loans to lease/purchase the CATMI mill. All have excellent credit histories. Lease applications from other groups that requested financial assistance are being processed. Meanwhile, the lease/purchase arrangement has been expanded, thanks to a \$US 10,500 award from the American Jewish World Services, which will finance lease/purchase of two mills. This money has been set up in a separate lease/purchase account.

It would not have been possible for a single implementing body to undertake the CATMI Maize Mill project, given the project's varied demands. However, three parties with individual strengths in project and small enterprise development, credit management, and manufacturing capacity are working together to bring an appropriate technology to the rural poor in Cameroon's Northwest Province.

# Women, Appropriate Technology and Development

by John Skibiak

Research over the past decade on the role of rural women in the Third World shows that rural women are invariably overburdened. Although they do not spend as much time on non-farm activities as men, and therefore earn smaller amounts of cash, women universally work longer hours than men and their tasks tend to be extremely labor intensive. When women and men collaborate on a single task, such as cultivation, the women usually are responsible for the more time consuming activities such as weeding, harvesting, and sowing. Traditionally women bear the additional burden of managing household activities and earning supplemental income.

Several ATI projects identify and disseminate technologies that release women from the more time consuming

elements of household and agricultural production, yet allow them to control the production process. Most of these projects are located in Africa where time constraints on women are especially severe. In Mali, ATI has collaborated with CMDT (Compagnie Malienne de Développement de Textile) to commercially disseminate two labor and energy saving technologies. In the southern Malian village of Djimina, local women have joined together and purchased a shea nut processing unit that dramatically reduces the time and resources required to extract shea nut oil compared to traditional methods. In other parts of Mali, ATI and CMDT have supported the dissemination of small-scale grain dehullers, to facilitate another domestic task carried out primarily by women. In Cameroon, ATI sponsored the development and dissemination of maize mills, seed planters and a host of small-scale

technologies.

Support for time and energy-saving technologies continues to remain a high priority in identifying and designing new ATI projects. But as older ATI projects mature and affect larger numbers of the rural poor, ATI faces the seemingly Herculean task of measuring the degree to which the new technologies have changed women's lives and work.

All labor and energy saving projects are predicated to a certain extent on the assumption that time released from domestic chores will be reinvested in other productive activities such as growing more food or earning more cash. However, a recent UNIFEM<sup>1</sup> publication notes that there are very few case studies which actually measure the impact of time and energy saving technologies on women. To date, most research on the allocation of time savings has focused on agricultural equipment such as tractors or improved in-



*RURAL WOMEN'S WORK, such as traditional grinding of maize, is extremely labor intensive. Several ATI projects disseminate technologies that release women from the more time-consuming elements of household and agricultural production.*

puts such as seed and fertilizer, which generally are used by men rather than women. The few impact studies that deal specifically with women tend to focus on specific changes in time allocation patterns—on how time savings of one, two or three hours per day are being reinvested. The trouble with this approach, and indeed with all time allocation studies is that they are essentially static. They can, if carried out effectively, provide an accurate snapshot of how family members divide up their day. However, the studies often do not reveal other far-reaching effects of labor saving technologies.

This shortage of data on women, technology, and rural production has made it all the more imperative that ATI pay special attention to measuring the impact of labor saving technologies on women. This has been achieved in large part through the implementation of a monitoring and evaluation system, developed in 1987, to provide a more accurate and up-to-date account of project accomplishments.

The system combines both quantitative and qualitative techniques to gather social, technical, and commercial data on each ATI project. Through collaborative efforts with host country universities, local development agencies, or applied research institutes, in-depth interviews are carried out with individuals, households and other relevant units to establish a baseline against which subsequent changes can be compared. Using the data and information gathered during regular project monitoring, ATI is able to compare and assess changes at both the regional and local levels.

One of the first projects to use the new evaluation methodology was the ATI/SODERZA hydropowered grain milling project established in Kivu Province of eastern Zaire. Begun in 1985, the project was one of ATI's first attempts to provide women with the technological means to reduce substantially the amount of time traditionally devoted to milling of staple foods. By 1987, production records at each milling site suggested that labor savings had greatly exceeded initial projections of 1,000 hours per week. In the remote village of Bishalalo, for example, it would take 800 hours to mill by hand the amount of grain that the local mill now is processing in one six-hour day.



*SHEA BUTTER processing unit in Mali is one of many ATI projects that free up women's time.*

The total impact of these time savings on the life of rural women or their families is not adequately reflected in abstract terms of hundreds or thousands of hours. Yes, the mills did save women and frequently their children the 12 hours of time needed to mill a weekly supply of cassava for a family of eight. Women also reported that the savings allowed them to spend more time in the field or in domestic activities. However, it was only after the consequences of mechanized milling were viewed from the perspective of the total cassava production process that it became clear that the true value of the new mills was only marginally related to the particular way women chose to reinvest their new labor savings.

Interviews revealed that dried cassava was milled not only for domestic consumption but for sale at local markets. Indeed, the sale of cassava flour provides a substantial number of women with their only source of cash income—an income, incidentally, which they control.

Mechanized milling of cassava offered the women of Kivu province a

new opportunity to dramatically increase the amount of cassava flour they could process and sell. Many reported that they were marketing up to five times the amount they sold before the mills were introduced. Still others remarked that they had increased their supply of dried cassava by purchasing it from growers in more remote districts—thereby establishing what development specialists refer to as “backwards linkages.”

ATI's experience with the hydromilling project has demonstrated that the potential impact of labor saving technologies extends far beyond changing time allocation patterns. By introducing new elements in a larger production chain, hydropowered milling has increased incomes and provided employment to both men and women—including many who may never even use the mill.

<sup>1</sup> Marilyn Carr and Ruby Sandhu, *Women, Technology and Rural Productivity*, UNIFEM Occasional Paper No. 6 (New York: United Nations Development Fund for Women, 1988)

# Palm Oil Processing: Identifying a Market Niche

by Eric L. Hyman

More than four-fifths of the edible crude oil produced in Cameroon is palm oil, the principal cooking oil in much of West and Central Africa. It is also an important source of vitamin A.

Oil palm is indigenous to Cameroon. Much of the semi-wild palm harvested in Cameroon is Dura; some of this spread naturally from old plantations. Fresh fruit bunches of Dura have an oil content of 8-11% by weight and the fruits have large kernels. Tenera, a hybrid dwarf palm developed in the late 1950s, is cultivated intensively on new plantations. Tenera is shorter than Dura and therefore easier to harvest; instead of climbing the tree, farmers can use a sickle attached to a long pole to harvest. Tenera fruits are larger than Dura, and have more oil-bearing pulp because the kernels are smaller. The oil content of Tenera averages 22.5% of the fresh fruit bunch (ffb) weight. In West Africa, Tenera yields 9 tons of ffb per hectare; selected Dura typically yields 3 tons of ffb per hectare, and mixed semi-wild stands yield 1-1.5 tons of ffb per hectare.

The variety of palm grown influences the choice of pressing technology because it affects the profitability of oil extraction. The relative extraction efficiency of different types of presses varies with the ratio of pulp to kernel, which is low for Dura and high for Tenera.

Raising Dura provides supplementary income without taking up much time. Cultivation is minimal. Most of the labor is incurred in harvesting and processing the palm fruits. Palm yields are less seasonal than many other crops. The trees are long-lived and propagate naturally, but may take 7 years before they bear fruit.

In contrast, it requires considerable effort to establish and maintain Tenera plantations, especially in the early years. Tenera begins bearing fruit after 4-5 years, but maximum production only begins in the tenth year. As stands age, the number of bearing trees per hectare may fall and the number of bunches per palm decline. The economic life of a plantation is 25-30 years.

In 1986, Cameroon had almost 60,000 hectares of productive Tenera plantations; more than 10% of this was owned by smallholders. Most artisanal



*VERTICAL PALM OIL EXPELLER is more efficient than the traditional method of alternative village scale technologies. It is priced at less than half the cost of presses of similar efficiency.*

production comes from semi-wild palm which covers approximately 385,000 hectares of land. Only a little more than one-quarter of this is harvested because of the difficulties in obtaining labor and in marketing the palm oil.

Large-scale industrial production of crude palm oil amounted to 95,000 tonnes in 1986, and artisanal production has been estimated to be 28,000-32,000 tonnes. Although large-scale palm oil mills conventionally operate on double or triple shifts per day, the capacity use rate at large-scale mills in Cameroon is only 24% due to low world market prices, domestic transportation and sales problems and high costs of production. Because large-scale mills in Cameroon cannot compete with Southeast Asian producers, most of the production is sold on the domestic market where government policy pegs the price above the world market level.

The artisanal sector offers important advantages in meeting the rural demand. First, rural consumers prefer the

sharp taste of local oil with a high free fatty acid content over the taste of industrial-quality oil. Second, production costs are low because of the relatively inexpensive source of palm fruits and low equipment costs. Unskilled labor, often from unpaid household members, is the main input. Third, artisanal production has been more stable than industrial-scale production. Fourth and most importantly, the industrial product often is not transported to rural areas. When it is available there, its price is higher than in urban areas because of high transportation costs and lower demand.

Because the quality of fruits deteriorates in a short time, the fruits need to be processed rapidly. Transportation costs are high because palm fruits are bulky. The traditional process is slow and industrial-scale mills may face delays and high costs to collect and transport fruits to processing centers. Consequently, artisanal production using a press that operates quickly and is

located near the harvest site offers many advantages.

The domestic demand for palm oil in Cameroon is projected to increase from 135,000 tonnes in 1985 to 238,000 tonnes by the year 2000. The total output of palm oil from large mills is not expected to meet this demand because of the aging of existing industrial plantations. Even with replanting, the total output of palm oil from large mills is projected to be only 1.5% greater in the year 2000 than at present. The Cameroon Development Corporation predicts a supply shortfall of 48,400 tonnes in the year 2000.

The shortfall in supply can be met either through imports or expansion of artisanal production. At present, it is illegal to import palm oil. The large unused area of semi-wild trees and new smallholder plantations of Tena could support expanded artisanal production. Toward that end, Plan Palmeraies Villageoises (PPV), a program of the Catholic Mission, is working with farmers to improve the semi-wild oil palm stands by interplanting them with Tena.

The traditional process of palm oil extraction by foot stomping is laborious and yields a low percentage of the oil contained in the fruit. In Cameroon, the traditional process is still used in several provinces. To the extent that artisans upgrade their technology from the traditional process to simple pressing equipment, rural incomes can be increased, labor drudgery reduced, and consumer benefits boosted from an increased supply of palm oil.

Most artisanal-scale palm oil producers in Cameroon have access to an old Colin press, a manually operated horizontal expeller. Small farmers who do not have their own expellers can purchase pressing services in exchange for an in-kind payment of one-fifth of the oil extracted. The client also provides the labor for hand pressing or pays the fuel cost for motorized pressing. However, most of these Colin expellers are more than 30 years old and are in disrepair, resulting in poor productivity and frequent downtime. Replacement parts are no longer available from the distributor.

The Association Pour la Promotion des Initiatives Communautaires Africaines (APICA), an international NGO



*PALM OIL FRUITS are a source of popular cooking oil in Cameroon. More than 4/5 of edible crude oil produced in Cameroon is palm oil.*

with headquarters in Cameroon, sought ATI support for a project to rehabilitate existing Colin expellers and produce auxiliary equipment such as cooking drums, bunch strippers, and clarifiers. APICA started its own subsidiary for the reconditioning, Outils Pour la Communauté (OPC), and subcontracted for certain parts. The original plan for the Cameroon Palm Oil Processing project stipulated that OPC was to purchase as many as 75 used Colin expellers and recondition and sell them to farmers' groups. The farmers' groups, consisting of 20-25 families each, were to finance the purchase of expellers by entering into lease/purchase agreements at 10% interest.<sup>1</sup> After five years of paying for lease and maintenance costs, and a small additional payment, the groups would obtain title to the expellers.

The original project plan had to be modified because very few Colin expellers were available for purchase and reconditioning. Despite maintenance difficulties and disrepair, most Colins were being used and their owners did not want to sell them. Only 12 could be purchased at reasonable prices. Imported parts were difficult to obtain because the expellers were no longer being manufactured; the repair costs were high. Also, because the reconditioned expeller was costly, orders were few.

Thus, APICA and ATI decided to manufacture a simpler, less expensive modification of the Colin expeller that

would require fewer imported parts. To date, two types have been designed—a horizontal axis and a vertical axis expeller. These expellers were named "Caltechs" (a combination of the names of the designers of the press). Both expellers are more productive and efficient than the traditional method or alternative presses used in other West African countries. Both Caltech expellers depulp and press at the same time—a feature not found in alternative presses.

The horizontal Caltech is a smaller version of the Colin expeller, with one major change—substitution of a reducer for the gearing that was subject to frequent breakdowns. Later, a far cheaper vertical axis Caltech based on a different design principle was developed.

After the reorientation, the project became more successful. As of early 1988, 50 expellers of all three types had been manufactured, sold, and installed. The availability of financing (lease/purchase arrangements) played an important role in encouraging sales.

The impacts on palm oil production and labor productivity are less than originally anticipated because most artisanal producers in the Otele area had already been using a mechanical press, rather than the traditional method. However, it also means that displacement of women's traditional activities has been minimal. The principal impact has been to increase the incomes of the purchasers.

The horizontal Caltech is a modification of an accepted technology that is well-proven in Cameroon. The modifications make it more appropriate for a smaller scale of palm oil production and allow it to be locally produced at a lower cost than its alternatives. The manual and motorized versions of the horizontal Caltech have been working well to date although the market is narrower than originally expected. The vertical Caltech has the potential for much wider application due to its substantially lower cost.

<sup>1</sup> The idea of user groups was de-emphasized when it was discovered that the dominant ethnic group which constitutes most of the potential market in the project area does not have a tradition of group cooperation.

## Two Small-Scale Enterprises in Africa

### Consumers Prefer Energy Efficient Charcoal Stoves

by Arleen Richman

TIGONI, KENYA—Kamwana Wambugu, the headmaster of a public secondary school, is a very proud man. He is proud of his students who, in a nationwide test, scored in the superior range. He is proud of his family. He is equally proud of his small business, making improved charcoal stoves (jikos) and jiko liners, a business which until recently he operated out of his home. "The technology may look simple," he says, "but it's taken three years hard work to reach this point."

Mr. Wambugu's improved jikos now constitute 70% of the total sales of improved jikos in Nairobi, Kenya's sprawling capital city. His three employees produce a total of 100 improved jikos a week, complete with ceramic liners. These are sold directly at local markets. In addition, his workshop turns out 600 finished liners a week; these are sold to "fundis," informal sector metalsmiths in Nairobi who install the liners in the jiko cladding, or outer part. Mr. Wambugu recently purchased land some 2 miles away from his home, about 18 miles from Nairobi, on which to expand his business.

His business is typical of the small production, private sector businesses ATI envisioned when it committed itself (in 1984) to support the expanded dissemination of the "bell bottom jiko" produced in Kenya under an earlier U.S.A.I.D. project. ATI's assistance to the Kenyan Energy Non-Governmental Organizations Association (KENGO), a local not-for-profit consortium, to help support the dissemination of the improved fuel-efficient jikos included a modest loan fund to assist potters to buy equipment and to provide working capital for the production of jiko liners. Mr. Wambugu received a 9,000 shilling loan (\$US 530) from KENGO to start up his business. Although KENGO is no longer involved in ATI's project, ATI has incorporated a financing mechanism for prospective jiko entrepreneurs in a venture capital project it is presently designing with Technoserve/Kenya. During the project more than 125,000 improved jikos were produced.



CERAMIC LINER INSERT, being fashioned in this picture, improves combustion efficiency of traditional jikos.

More than 80% of urban Kenyan households cook with jikos. The new stove is essentially a traditional jiko with an added ceramic insert to improve the combustion efficiency. Supports on the top hold a cooking pot; a door cut into the side permits the ashes to be removed and controls the draft. The improved stove is easier to light, cooks more rapidly, and lasts twice as long as the traditional stove. Because the improved jiko uses 25% less charcoal than a traditional jiko, consumers can save the equivalent of between \$US 1.00 and \$US 2.50 a month in charcoal purchases. A reduction in charcoal use also means a reduction in the number of trees that need to be cut down, a fact that is very important in Kenya and other African nations where forests are being felled at an alarming rate. Since a medium-size traditional jiko sells for \$US 2.50 and an improved jiko sells for about \$US 5.00, the higher initial cost of the improved stove can be recovered in less than three months.

Mr. Wambugu explains that it takes an unskilled laborer just one minute to

make a jiko liner on the jiko jolly, a simple motor-driven mold. An ATI engineer designed and built the jiko jolly to produce liners of uniform shape, size, and consistency, at a faster pace than hand molding. "Before the jiko jolly, all liners were molded by hand," recalls Mr. Wambugu. The quality of the liners overall was very poor, they cracked easily, and sizes were not consistent. Mr. Wambugu, who considers himself a personal friend of the ATI engineer who designed the jolly, credits this project officer with interesting him in starting his business.

Although he says, "I already have a good business," Mr. Wambugu believes the market for improved jikos could be much larger than at present "because the potential is so great." Ordinary people are aware of the cost savings and the other advantages, he says, "but we don't have the supply lines to market the improved jiko everywhere, particularly in areas far from Nairobi." Developing the market and increasing and diversifying his supply lines have become his major goal.

John Mechanier, age 24, a fundi in the Shauri Moyo market on the outskirts of Nairobi, who purchases liners and installs them, supports Mr. Wambugu's views. "Right now I am assembling seven liners a day. I could assemble more and will, if the market expands," he explains. He makes a 15 shilling (\$US .90) profit on each improved jiko that he sells, and he sells his jikos both wholesale and retail, outside Nairobi and at the Shauri Moyo market itself. What do he and his customers like most about the improved jiko? "It's economical, it saves charcoal. There's no question about its superiority," he says with authority.

Mr. Mechanier is one of 100 fundis in the Shauri Moyo market who make the improved jiko. They salvage steel and other metals, mainly from oil drums, to make the cladding and they buy the liners from Mr. Wambugu and other local suppliers. At present in Kenya 3,000-5,000 improved jikos are being produced and sold each month. As additional ceramic liner producers pur-



*METALSMITHS in Shauri Moyo market salvage steel to make cladding and buy liners from suppliers like Mr. Wambugu.*

chase jiko jollies and adopt improved clay processing methods, the number of improved jikos produced should rise substantially. The improved jiko and the jiko jolly have already been transplanted to other countries in East Africa. Because many other countries in Eastern and Southern Africa use stoves similar to the Kenya jiko, there is a vast potential market for adapted, improved stoves.

A woman in the market shopping with her neighbor for a jiko was pleased to see "so many jikos with those good ceramic liners. Today we're lucky." She explained that the stoves produced with the jiko jolly usually sell out within a few days of availability. "I bought this type of jiko a year ago, and I love it," she exclaimed. "The liner hasn't cracked yet." When it does—liners have a life expectancy of 8 to 12 months—she only has to bring her improved jiko down to the market and have a fundi, perhaps John Mechanier, install a replacement liner. Most likely the liner will have been produced by Kamwana Wambugu.



*PROUD ENTREPRENEUR, Kamwana Wambugu, established a business to produce improved charcoal stoves (jikos); his business now commands a majority of total sales of improved jikos in Nairobi.*

# Creating Jobs is Good Business in Tanzania

by Arleen Richman

ARUSHA, TANZANIA—Businessman Aliasghar Sherif believes that helping people to help themselves not only makes you feel good, but it's good for business too. He's been helping small-scale village potters since Sherif Dewji & Sons, his family's business, first began to commercially manufacture pottery some eight years ago. In 1984, this help was formalized under an ATI contract for the Tanzania Village Potteries Project.

As the project's implementing organization, Sherif Dewji received a loan from ATI to perfect glazes from local materials and to supply materials (firebricks, glazes and kiln furniture) and training to rural potteries to increase the value and marketability of their products in order to generate additional income and increase employment. Sherif Dewji now supplies materials and training to a dozen rural potteries; the company repaid in full the loan from ATI a year in advance of its due date.

"Helping local potteries and local people always pays us back, usually with dividends," explains Mr. Sherif.

For example, in the course of working to upgrade the traditional pottery produced at the Singisi Cooperative, Sherif Dewji & Sons identified a nearby source of clay for its own commercial pottery. He claims, "By being on the scene and providing technical assistance and training to small local potteries, I can identify skilled workers who eventually may elect to come to work for my business."

The Singisi Women's Cooperative Society is one of the small potteries that has benefited from Sherif's help. For years, the women who belonged to this cooperative only produced traditional pottery. Bending from the waist to the ground, they molded by hand local clay into pots of one or two designs. Kilns were not used. Instead the pots were fired in dirt pits covered with straw. The pots had limited value and were used to cook or store water by the women who produced them. Some pots were bartered for grain or other produce; they were not marketed outside the cooperative. In 1975, Sherif Dewji gave the cooperative a wheel (gratis) and trained two workers to use it. This was before Sherif Dewji began working with ATI to upgrade local small pottery industries.

Today six people—three skilled potters and three laborers—are employed in the cooperative's small pottery enterprise. The pottery has a kickwheel to fashion small objects and a flywheel for larger pots. Mary Phillips, a member of the cooperative's governing committee, explains, "Making traditional pottery without using a wheel takes a lot of time. In our pottery today, we can make 40 pieces of unglazed medium-size tableware in the same amount of time it takes to make one or two traditional pots." The Singisi Cooperative has applied for a loan to upgrade their kiln so they can produce glazed products that are more durable and more attractive and thus command considerably higher prices.

"Now we are selling everything we make, but the glazing process should double our income," says Ms. Phillips. The co-op also raises dairy cattle and tailors clothes; although all of its 265 members are women, men are employed in the small industries. All profits are reinvested in either income/employment generating activities or labor-saving devices, such as a maize mill. CAMARTEC, a parastatal which administers the Village Pottery project for ATI, helped the Singisi Cooperative apply for the loan to construct the upgraded kiln.

When the Village Potteries project was inaugurated, Sherif Dewji was the largest commercial producer of glazed pottery and tableware in Tanzania. Recently Dewji shifted its product line from tableware to industrial ware, specifically ceramic insulators for electrical power lines. Because they now only make tableware on special order, a considerable market has been created for off-the-shelf glazed pottery, which the Singisi Co-op and other small-scale potteries hope to fill. Dewji will continue to produce firebricks, glazes, plaster of Paris, and other materials to sell to the rural potteries.

The Mwangi Pottery Works also expects to earn a share of the market Sherif Dewji is leaving. A year ago, Mr. Sadi M. Semo, the owner, enrolled in a ceramic class taught by Aliasghar Sherif. Subsequently he applied for a loan to purchase materials and



BUSINESSMAN Mohammad Sherif admires first kilnload of glazed pottery completed by Mwangi Pottery Works. Sherif Dewji taught ceramic techniques and design to the pottery owner and his assistant, Peter (shown here).

kickwheels, and to build a temporary simple updraft kiln, which Mr. Semo expects to soon replace with a kiln constructed of firebricks. Mr. Semo and one assistant received six weeks of training from Sherif Dewji in ceramic techniques and design.

Today, Mr. Semo's business employs one laborer and two assistants. His main assistant, Peter, 20, formerly worked in a tailor shop for 1,000 Tanzanian Shillings (TSh) a month; now he is earning 1,500 TSh a month. He is very proud of the first kilnload of glazed pottery he has completed but realizes the business must expand its marketing efforts beyond the town if they are to be able to produce at or near full capacity. Mr. Mohammad Sherif, Ali's brother, describes the Mwangi Pottery Works as a pioneer pottery. "Ten years from now, you'll see them doing different types of work, making different items. They are truly pioneers." From the beginning Mr. Semo has been experimenting, taking risks, to make a better product. For example, he personally tested clay from various local sources before deciding to use a combination of clays dug three miles away. Mr. Semo hires a truck once a month to transport the clay to his work area.

The Sherifs also are always experimenting to find the mixture of businesses that generate the most profit and create employment. "Promoting economic development in the rural parts of Tanzania is inborn in all our businesses," explains Mohammad Sherif. Prior to 1980, the Sherifs were merchants, engaged primarily in packaging seed beans and coffee beans for export. They shifted their focus to small-scale industry because they believed that for the next decade the Tanzanian economy could best support activities that used locally available raw materials and did not require imported machinery. Ceramics was one of the first small-scale industries in which they invested; there was no competition and there was a large market since laws at that time forbade the importation of tableware. They are committed to ensuring the success of the Tanzanian Ceramics Association, which they organized as part of the ATI project. This association has trained personnel from five new potteries in glazing



*TRADITIONAL POTTERY is produced by women, who bend from the waist to the ground, to mold local clay by hand.*

techniques and is forming a marketing unit to promote the products of its 15 members. The Association has exhibited

its products in the country's capital, Dar es Salaam, and expects to be a permanent exhibitor when the Textile and Ceramic Center opens in Dar. Closer to home, they were featured at an exhibition of traditional and local goods in Arusha sponsored by the Alliance Francaise, in June 1988.

The Sherifs estimate that they have helped to create at least 100 jobs in the ceramic industry, including twenty-five jobs in the five rural potteries established under the ATI project. Thirty of these jobs resulted from several trainings and workshops they conducted for the Zanzibar Association for the Disabled. The help the company freely gives to villages and to small entrepreneurs in Tanzania has been formally recognized by an award from the Tanzanian Government. Aliasghar Sherif believes the award is "frosting on the cake." He says that he plans on training new potters, his "customers...and potential customers...and perhaps future employees for many years to come."



*SINGISI WOMEN'S COOPERATIVE employs six people; it has both a flywheel and a kickwheel.*

# Weaving Bamboo Grass Mats Brings Hope to Thai Villagers

By Arleen Richman

CHAIYAPOOM AND KHON KAEN PROVINCES, NORTHEAST THAILAND--The middle-aged Thai woman held out a small bowl of sticky white rice topped by a dab of fish paste. "Before we started weaving the bamboo grass mats, this is all we had to eat twice a day," said Prar Thomakun gesturing to the dry, dusty countryside. "In the dry season," she added, "sometimes we didn't even have that." The arid Northeast region, where her village of Kok Sa-ahd is situated, is the poorest area in Thailand; the majority of people here engage only in subsistence agriculture.

Today 684 poor rural families living in 13 villages in Chaiyapoom and Khon Kaen provinces have enough to eat, even during the dry season. By participating in the Bamboo Grass Mat project, they earn cash to buy fish paste, dried seafish, fruits and vegetables and, on occasion, meat. "They still don't have much, but for the first time they have hope," comments Khun Vicha Vudhisen, who has managed this project for the Population and Community Development Association (PDA) since its inception in 1985.

"When PDA first started working here in family planning, the average family earned less than 5,000 Bhat a year (\$US 250)," he states. Today, thanks to the villagers' sales of braided or plaited grass mats to the Thai Plait Industry Co. (TPI), the average family has increased its income by 33%, or approximately 1,700 Bhat per year. The mats are to be sold via a Thai exporter to Korean fishermen who use them as drying racks for seaweed. The seaweed gatherers claim that the fragrant "ya pek" grass gives the seaweed a special taste.

The villagers weave the plaits on machines provided by TPI, the first company to be established under PDA's rural, small-scale industries program (RSSI). TPI was created and financed under a venture capital scheme initiated by PDA; ATI provided technical and financial assistance. RSSI, the for-profit subsidiary of PDA, a non-profit organization, owns 88% of TPI; the remaining 12% is owned by a private company--Thai Bamboo Grass Ltd. (TBC). The shareholders agreement between TBC and RSSI stipulates that TPI will allocate a number of common shares specifically to be purchased by

village weavers on the installment plan.

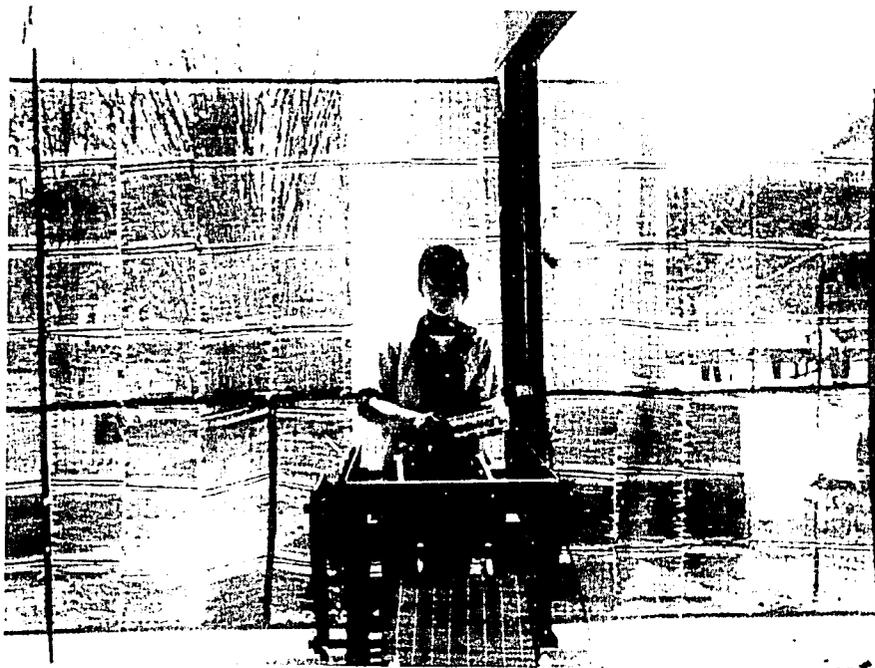
Although initially the poor farmers feared that their hard work might end up earning them nothing, the opportunity to earn cash heavily outweighed their reluctance to take risks. "In this dry area the farmers get little income from cash crops. This represents one of the few opportunities to earn cash, especially in the dry season when there is nothing to do here," explains Ms. Nancy Tibud, TPI company representative. In each participating village, a villager (company representative) is trained to repair the weaving machines, which are shared among the villagers. The TPI representative also distributes commercial cotton thread and bamboo strips to the participating households, collects the mats and pays the set price for each plait that meets specification.

Today the bamboo grass mat industry has become a family and community enterprise. The project dovetails with the agricultural cycle; the bamboo grass is cut after the rice has been planted when labor demands in the rice fields are minimal.

Everybody, including children, cuts the aromatic bamboo grass, which grows wild in the poorest quality soil and previously was considered almost useless. (Young stalks were used as animal feed.) The grass grows back, year after year. In some areas designated as national parklands, PDA negotiated with the Government to obtain permits to cut the grass. Some villages located far from abundant supplies of natural grass hire trucks to take them to the parklands.

After cutting, the grass is spread out in the sun to dry. Once dry, the grass is sorted for quality and length. Choice grass then is woven in the traditional manner, by hand on a simple, metal vertical loom. The mats are cut to uniform size by a mechanically driven cutting machine before they are packed and stored for export. When the project began, many of the mats were poorly woven and/or contained damaged, dirty grass which did not meet company standards. Although weaving is a traditional craft in this area, PDA/TPI had to train the participants in selection, harvesting and proper weaving to meet export standards.

The villagers say weaving is easier than any of their other tasks but it is very time consuming. Although both



THAI BAMBOO PLAIT industry was the first company to be established under PDA's Venture Capital Company project. Today its major focus is on marketing.

men and women harvest and sort the grass, women do the bulk of the weaving because the men think "the women are better at it." The women set up their small looms outdoors, next to one another. They weave, chat, and watch their children; in a seven hour work day, they can earn 30-40 Bhat (\$US 1.20 - \$US 1.60).

Most of the earnings go to buy food. Due to the poor rice harvest in this arid region, families can grow only enough rice to last six months. In addition to buying rice, fruits and vegetables, and other food, some families now buy ready-made clothes, rather than sew the clothes themselves. Others have bought furniture, radios, or are saving to buy a bicycle or a TV. One village now has a TV—hooked up to a car battery because the village still does not have electricity.

The villagers would like to produce even more mats, but first TPI must solve its marketing problems — a result of losing a major subcontract for the Korean market. TPI is developing a marketing strategy and has begun to promote decorative place mats and a type of window blind at local trade fairs.

The 13 participating villages see this project and similar productive activities as their road of hope. In Pia Fahn village, a few families have bank accounts "in case we get sick." One couple used their earnings to buy seeds to grow beans and corn for additional cash income; other families bought piglets to raise for cash. Not surprisingly, the people are beginning to feel more confident about asking the Government to provide services to their villages. Just recently, the Government built a primary school to serve the 56 school-age children in Pia Fahn.

Wan Prem Chi, a 47-year-old farmer who lives in Pia Fahn, opened a bank account this year for the first time in his life. He says, "We see how this project can help develop the community. We want this project to stay, and we want others, but it's difficult in this area where there really is nothing. We know that we need irrigation, we need crop management. This is the first time in my life that I have extra cash and that I know my family has enough to eat every day. But we all hope this is only the beginning."



*BAMBOO GRASS was considered almost useless until grass mat production enterprise was established. Vicha Vuadusen has managed this project since its inception in 1984.*



*WOMEN do majority of the weaving, although both men and women harvest and sort grass.*

# From Feed to Fruit Trees: Farm Enterprises Meet Local Needs

by Arleen Richman

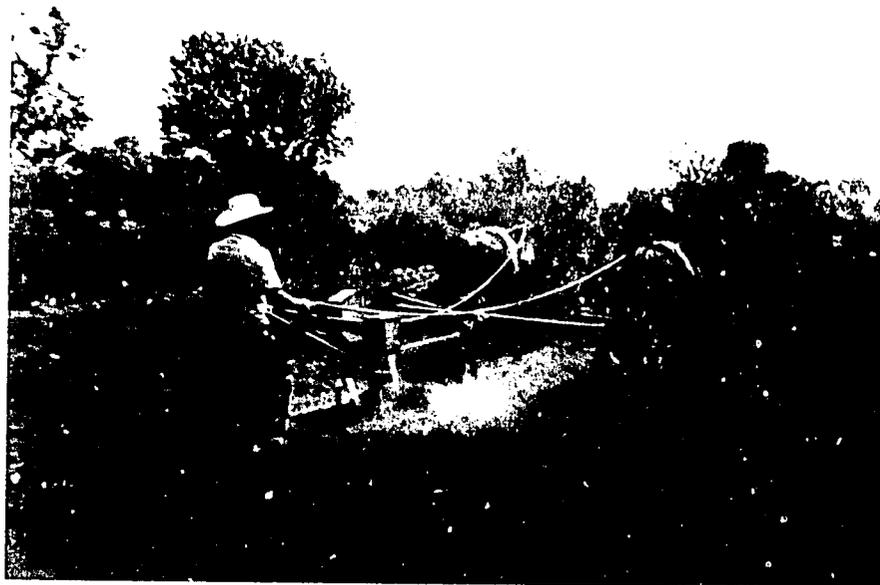
PUEBLA VALLEY, MEXICO—Farmers Tomas Palma and Angel Rodríguez glanced at their watches as the horse-drawn multibar completed planting the last row of the 1/2 hectare cornfield. The multibar had made the necessary furrows (plowed), planted the corn seeds and spread fertilizer in two hours. "I will be totally convinced when I see the seeds sprout," commented Señor Rodríguez, "but if I were planting the way I normally plant, I'd be only half done."

Planting corn the traditional way—first plowing the field, then sowing the seeds—without applying fertilizer—takes about 6 hours per hectare. In its test run, the multibar had reduced the work by one third, and it had applied fertilizer as well.

"Scientists and development experts used to think that small-scale farmers had plenty of time (and labor) to spare—that what they lacked was better technologies. But we have learned that farmers do not have the time and labor to do the many tasks necessary during a limited time period, such as the planting season," explains Dr. José I. Cortés Flores, director of the Farm Support Enterprises project. ATI is implementing this project with the Teaching, Research and Training Center for Regional Agricultural Development (CEICADAR), a regional center of the Postgraduate College, headquartered in Montecillo, State of Mexico. Dr. Cortés points out, "Increasing the productivity of the small farmer, the farmer who owns less than 5 hectares of non-irrigated land, is a complex task."

Referring to lessons learned from earlier work undertaken by the Colegio and INIFAP (National Institute for Forestry, Agriculture, and Livestock Research), specifically the Plan Puebla project, Dr. Cortés commented that the small-scale Mexican farmer is not a specialist. "Therefore, we cannot just study and concentrate on improving one specific technology, such as increasing the amount of corn produced, which was the fundamental objective in the early days of Plan Puebla."

The Farm Enterprise project considers the overall picture and the ways in which farming activities complement



MULTIBAR, in its test runs, reduced the time required to plant corn by 1/3 as compared to traditional planting.

and are dependent upon each other. In Plan Puebla, primary emphasis was placed on increasing the production of corn by some 50,000 small farmers. (Corn production did increase on average from 1 ton/hectare to 3 tons/hectare.) However, explains Dr. Cortés, "Plan Puebla did not stress the importance of cornstovers, a valuable by-product and the major dry matter ingredient in feed for dairy animals." Their work in Plan Puebla taught CEICADAR to listen to the farmers. "The farmers know what they need," points out Dr. Cortés, "and we have to pay attention to their needs." Puebla area farmers wanted to know how to get more milk from their cows; they wanted to know how to improve the yield of their fruit trees to bring in additional cash income.

In the Farm Enterprise project, notes Dr. Cortés, "We look at the crops the farmers raise, their livestock, and the other services or support they need to maximize their incomes and maintain a balanced approach to small farming." This project is establishing a number of small enterprises to provide the equipment, supplies, and services more than 1,000 small farmers need to improve their production and subsequently increase their incomes. Area farmers will be able to rent or buy the multibar,

which will be manufactured locally. Other small enterprises will sell high protein feed to dairy farmers, make cheese, provide mechanized forage cutters (for cornstover), train draft animals and supply quality fruit trees to area farmers.

Juan Espinosa L. is a typical area farmer. He owns 2 cows, 3 pigs, and raises alfalfa and corn on 5 hectares of land. He was one of the first farmers in the Puebla valley to buy feed from the feed enterprise to supplement the cornstover and alfalfa, which constitute the bulk of the diet of his dairy cows. "My cows now produce the same amount of milk as a year ago, 15 liters per cow," he says with pride, "but I'm saving around 40% compared with what it would have cost if I bought the commercial feed in feed stores."

## Dairy Feed Enterprise

Feed costs are a major factor in increasing the profitability of dairy cows. Some farmers only feed their cattle cornstover, alfalfa, and bits of grain, but these cows produce substantially less milk than cows fed a supplement of concentrated feed. The project has developed a high protein feed supplement containing proportional amounts

of poultry manure, molasses, mineral salts, urea and sulfur which farmers purchase and add to the traditional alfalfa, silage or cornstover.

"The trick is maintaining a balanced feed ration according to the instructions of the project's veterinarian," explains Señor Crescencio Lima, owner of the dairy feed enterprise. This mixture, using poultry manure as a protein substitute isn't new; it's always been fed to beef cattle. However, farmers were hesitant to feed this to their dairy cows. Preliminary studies conducted by the Colegio showed that dairy cows fed the correct proportions of feed supplement either increase their production of milk or maintain their production on lowered feed costs. Señor Crescencio Lima buys 20 tons of pollinaza (poultry manure) from a poultry factory 20 miles away each week and cleans this by running it through a sieve; he buys 30 tons of molasses from the government's sugar plant and also the sulfur, mineral salts, and urea. The farmers buy the pollinaza, molasses, and other ingredients separately and mix them with cornstover, alfalfa, and other feed.

This feed business, one of ten feed distribution centers to be established, is designed to serve 30 farmers with an average of 3 cows each, or approximately 100 cows. Recently, due to inflation, the price of feed had to be increased

considerably and some original customers stopped purchasing the feed supplement. But Señor Crescencio Lima is confident that these customers will return once they grow accustomed to the price increase. "Right now, I have a group of steady customers, and this group will grow," he says.

Angel Rodríguez buys pollinaza and resells it to his neighbors "because I am convinced that this feed does increase milk production and that it does not contain anything bad for dairy cows." Someday he would like to invest in a feed business of his own. Meanwhile, four of Señor Rodríguez's cows are being monitored in a study which is following production of 18 cows, half fed on traditional rations and half fed the pollinaza feed supplement. Señor Rodríguez, who does iron work in addition to running his small farm, credits this project with "teaching me many things. Even though I work in iron, until I started speaking to the project engineers, I didn't know that making stalls for the cows would increase their milk production. I also learned to put a roof on the shed because cows need shade."

Tomas Palma, the owner of one of the larger dairy farms in the San Pedro Tlatenango area, learned when he was a boy how important stalls, shade, and feed supplements are to dairy cattle. His

parents own a large dairy farm, and "they always used a commercial feed supplement," he says. Señor Palma owns 23 dairy cows. He buys molasses from the project's feed enterprise, but buys his pollinaza directly from the chicken factory. Even though he owns a tractor, he plans to purchase a multibar because it has so many uses, especially on some smaller, irregular plots. He's also very interested in the project's nursery which sells quality fruit trees. He plans to buy 50 trees and plant them in the next rainy season.

#### Fruit Trees Flourish

After only one and a half years, the green thumb and grafting skill of Don Elias, owner of the nursery, is recognized locally and beyond the Puebla area. His fruit trees recently were awarded a certificate of quality from the National Commission of Fruiculture. Working with four members of his family and two local people contracted on a daily basis, he has produced more than 8,000 high quality grafted young fruit trees to sell. Before he began this business, which was financed by ATI through a loan from FIRA Bank of Mexico, farmers in the area who wanted fruit trees to intercrop with corn, alfalfa, and other cash crops bought inferior quality rootstock from roadside sellers. The farmers had to wait 2-3 years before the trees could be grafted, and an additional two years before they bore fruit, if the trees managed to survive until that time. There was no guarantee of quality, and the farmers were given no assurances as to the type of fruit the tree would bear. Don Elias is the first farmer in the region to use an interstock to do double grafting in a single step; this produces dwarf trees which are especially desirable for intercropping. Farmers now can purchase a variety of grafted trees which bear fruit from May (pears, plums, apricots) to December (tejacote) for sale or home consumption.

Don Elias is a very careful worker. Proudly, he demonstrates how he uses steam to sterilize the soil before he plants the seeds, which he has chilled to ensure faster growth. Then he displays his grafting techniques which he learned first in a classroom (sponsored by the project), and then practiced in the field. He has taught four of his ten children the double grafting technique that draws customers from a



FARMER ANGEL RODRIGUEZ is convinced that feed supplement is increasing his cows' milk production. Project veterinarian compares milk production of two of his cows, being fed the feed supplement, with two other cows who receive only traditional rations.

wide area "I don't just sell trees," he says, "I give instructions so that the people can take care of them." He frowns when Dr. Cortés explains that the Bank wanted the project to hire professionals to do the grafting. "I explained the work had to be done by the farmers; they are trained by us. This is their project, their work, and their future," Dr. Cortés concludes. Ironically, just recently two bankers purchased 4000 trees to be delivered in six months. "Buying trees in advance is very unusual," comments Dr. Cortés. Don Elias estimates that it costs him 450 pesos to produce a tree; he sells them for about 750 pesos. Although this price is double the price of a rootstock in the market, his reputation for quality has attracted many repeat customers. "Just this morning two farmers returned to buy 40 trees; they had bought ten previously and they report all are doing fine," he says. These farmers told Don Elias that two years ago they purchased 50 rootstocks from roadside vendors; less than 25% survived.

#### Small-Scale Cheese Factories

Quality is what Señora Carmen Ramirez de Diaz says she will strive for in the small cheese factory she expects to establish shortly; the start-up funds are being supplied by a bank loan, arranged through the project. Señora Ramirez, who describes herself as "basically a homemaker," has made cheese at home on occasion for 20 years. Seven years ago she was selling clothes in small farmers markets, and more recently opened a small "bodega" (grocery store). Two years ago, she completed a course in cheese-making sponsored by the Colegio. While waiting for her loan to be approved, she received "hands-on" training in cheese-making, supervised by a master cheesemaker/instructor from the Ministry of Agriculture. She is confident of success. "I know the market," she says with certainty and, "I have already arranged to sell part of my production to my brother-in-law who is in the cheese business in Mexico City."

Señora Ramirez expects that her business will become as successful as the cheese enterprise that Teodoro Flores and his wife Imelda started in a room of their house several years ago. "My family had four cows and we



*LEARNING TO MAKE CHEESE IS FUN and should be profitable too for owners of two small-scale cheese factories established under Mexico's Farm Support Enterprises project. Shown here are an instructor from the Department of Agriculture, Señora Ramirez, who recently obtained a loan to finance a small queseria, and Teodoro Flores, who has been commercially making cheese for 2 years.*

couldn't sell the milk when we wanted because the collection hours were very inconvenient, and the price was not so attractive," explains Señor Flores. "I felt the solution was to use the milk to make cheese. I received some instruction and lots of encouragement from the Colegio; now through the project I have applied to the bank for a loan to help us expand this business."

The Flores "only use top quality natural ingredients." Señora Flores says, "Our regular customers buy everything we produce; we have nothing left to sell in the market." Even though they have plenty of competition, "customers prefer our pasteurized sweet cheese." Señora Flores notes that right now, "We buy 120 kgs of milk every day—this is a seven day a week business. We easily could buy 500 kg." She has decided that once the loan to finance the expansion of their business comes through, "We will pay more than the going market rate for top quality milk." Dr. Cortés says that because of the Flores' cheese business, less milk in the area is now available for sale to the government and the middlemen. Prices are going up, and "because the Flores only buy top quality milk, local dairy farmers are taking care to feed their cows supplemental feed."

"Here you can see how the various systems interlock—the cheese business,

the price of milk, the feed enterprise," comments Dr. Cortés. "The dairy cows and maize are interdependent. By increasing the value of one, you also increase the value of the other. By providing the services that the community needs, which we do in the project, you complete the balanced approach. This way economic benefits in the area are multiplied; everyone wins."

Bank officials say they are impressed by the success of the initial micro-enterprises—and of the quality of products, especially the fruit trees and the animal feed. "We are recommending to all our clients that they buy trees from Don Elias," says a representative of FIRA, Bank of Mexico, which is managing the project's enterprise loan fund.

Bank officials consider the loan fund an experiment to determine if the loans will be repaid. (Previously in Mexico, loans in the agricultural area were often treated as poverty lending—farmers were not made to feel that these had to be repaid.) If this part of the project is successful, the Bank will encourage commercial banks to make loan funds available to small farmers, thus ensuring the availability of credit, which up to now has been very difficult to obtain. Comments one official, "This project has great potential for changing the life of the small farmer, not only here in Puebla, but all over Mexico."

*Achievements/Findings sections report on progress and note adjustments made during 1987-88 in expectations, technology, etc. An \* in front of any category indicates that this information has been revised since the project was initially implemented; explanations for the revisions can be found in the Field Program Section of the Report of Appropriate Technology International 1984-87. Otherwise, project descriptions contain the same information as in ATI's Annual Reports for 1984, 1985 and 1986.*

## AFRICA PROJECTS

### DEMONSTRATION PROJECTS

#### Animal-Driven Pumps, Botswana

*Project Partner:*

Rural Industries Promotions (RIP)/Rural Industries Innovation Centre (RIIC)

*Purpose:*

To establish a production unit that produces and sells animal-driven pumps which lower the cost of water supply in rural areas for both agricultural and domestic uses.

*Expectations: (Revised\*):*

During a four-year project period, 8 animal-driven pumps will be installed. A regular water supply will enable at least 100 low-income rural families to increase their incomes by 20% or more.

*Technology:*

The project will produce and install simple, locally designed animal-driven pumps, consisting of a gear box comprised of metal sprockets which drive and are driven by a series of belts and chains. Powered by donkeys or mules, this device can drive either a shallow well, low-lift centrifugal pump or a deep well, high-lift piston pump. The animal-driven pump has 50% less "down time" than commonly used diesel pumps and can be easily maintained by relatively unskilled personnel. In addition, the animal-driven pump is less expensive than the diesel pump (it does not use costly imported fuel for its operation) and, under certain conditions, decreases pumping time by 30 to 40 percent compared with diesel pumps.

*Achievements/Findings:*

Six Mark I animal-driven pumps were installed. An internal technical evaluation of the first animal-driven pumps resulted in an upgraded version of the pump, called the Mark II. Two Mark II pumps have been installed.

Several government sponsored agricultural projects have become enthusiastic supporters of the ADP; the U.S. Ambassador's Self Help Fund purchased an ADP for a horticultural syndicate.

ATI's financial involvement in this project will conclude in 1988. However, as a result of a market assessment in October, 1987, RIP is planning a follow-on project to strengthen the marketing of pumps and to establish a broader technology transfer capability.

\*See Report of Appropriate Technology International, 1984-1987.

#### Brick Production, Botswana



*HAND OPERATED CLAY CRUSHER was tested in Botswana Brick Production project.*

*Project Partner*

Southern Rural Development Association, Minerals Holding Trust (SRDA/MHT)

*Purpose:*

To establish two small-scale, commercially viable brickyards which produce a high-quality brick that is less expensive than imported brick and affordable by low income people.

*Expectations:*

After three years, two brickyards will be in operation with a joint production capacity of 3 million bricks. This will double the supply of low-cost building materials in the area and enable 800 low income families to gain access to adequate low-cost housing annually. At 60% capacity, pre-tax profitability of the company will total about \$US 12,220 annually by the second year. By demonstrating the commercial potential of small to medium-scale brickmaking, it is expected that these operations will pave the way for interested small investors and entrepreneurs to establish similar businesses.

*Technology:*

The project will introduce new brickmaking technologies to a local organization to improve the efficiency of the production process and to increase the quality and durability of the bricks produced. The project will use a modified intermittent Hoffman-type kiln and will introduce low moisture brickmaking technologies. Two different manual presses and a hand-operated clay crusher are being considered.

### *Achievements/Findings:*

The compressive strength of the bricks produced by the Moshaneng brickyard was increased from an average 25 kg/cm<sup>2</sup> to an average of 72 kg/cm<sup>2</sup>. The wastage rate also dropped from 15-20% of overall production to only 5%. An innovative double chamber kiln was introduced, allowing higher throughput and more efficient labor and space utilization. One brickyard, which demonstrated the technical viability of the project, has been established. Because the implementing organization was reluctant to test the commercial viability of the brickyard, ATI ended its financial involvement in the project prior to project completion.

## **Grapple Processing, Botswana**

### *Project Partner:*

Thusano Lefatsheng (TL)

### *Purpose:*

To demonstrate commercial opportunities in wild plant processing by establishing a profitable enterprise which produces high-quality grapple products for export and employs inexpensive and simple production technologies.

### *Expectations:*

By the third year of the project, more than 280 grapple gatherers will increase their incomes by as much as 25% over current levels as a result of higher prices paid for the raw material. By adding value to a local material through in-country processing, capital formation in rural areas will increase significantly. In addition, the project will create five full-time jobs in a rural area.

### *Technology:*

Grapple (*Harpogophytum procumbens*) is a wild plant found in great abundance in the Kalahari desert. Currently, its large, tubular roots are gathered, sold, and exported to Western Europe for processing. Using a simple, low-cost, labor-intensive, and high yielding technology, this project will dry and grind the roots locally to produce grapple tea which will then be packaged and exported. This represents the first processing for export of this type in Botswana.

### *Achievements/Findings:*

The unique nature of the organization and the project attracted a great deal of attention. As a result of this demonstration project, a new donor (HIVOS) awarded a \$US 600,000 grant to Thusano Lefatsheng for a greatly expanded plant production and processing project. More than 4,200 kgs of wild grapple were collected, processed, and sold in 1987. The number of villages participating in wild grapple collection expanded from 3 to 10. Now that TL has attracted major donor support, ATI is gradually reducing its financial involvement in this project.

## **Lime Production, Botswana**

### *Project Partner:*

Southern Rural Development Association, Minerals Holding Trust (SRDA MHT)

### *Purpose:*

To (1) establish a small-scale, commercially viable limeyard that produces a high-quality product competitive with lime imported from South Africa; (2) develop the capacity to disseminate lime production technologies throughout Botswana; and (3) develop lime-based products for new small industries.

### *Expectations:*

Major benefits expected from the project include foreign exchange savings of approximately \$US 128,000 annually as locally produced lime is substituted for imported lime, direct employment opportunities for at least 77 rural people, capital formation in a rural area totaling about \$US 33,600 annually, and the availability of locally produced lime wholesale for 10% less than the price of imported lime.

### *Technology:*

The project will use a locally modified version of an Indian-designed, mixed-feed, vertical shaft kiln. The kiln is relatively cheap to construct, fuel-efficient (using coal) and has a relatively high output capacity in relation to its size. The kiln is operated continuously, and the use of a slaking platform will ensure the production of hydrated lime of high quality. One kiln (4.5m high and 1.5m inner diameter) will have the capacity to produce four tons of quicklime per day.

### *Achievements/Findings:*

Two kilns, which share a slaking platform, packing machine, storage facility, and water supply system, were constructed. A third kiln, with a more sophisticated design, will be finished by the end of 1988. As a result of a new inner lining and better kiln control, fuel consumption was reduced from 210 kg of charcoal/ton of lime to 190 kg/ton. The lime operation at Segeng succeeded in producing lime acceptable to portions of the market previously served by imports from South Africa. The technical performance of both kilns has been demonstrated. The project will provide an excellent opportunity to compare the cost effectiveness of the two types of kiln. Because SRDA was reluctant to test the commercial viability of the lime production enterprise, ATI has reduced its financial involvement in the project. However, as a result of this project, SRDA is now negotiating with UNIDO to establish a small-scale Portland cement plant.



MAIZE PLATE MILL, introduced in Cameroon, is expected to provide women's groups with access to milling technology.

## Hammer Mills, Cameroon

### *Project Partners:*

Association for the Promotion of African Community Initiatives (APICA); Ecole Nationale Supérieure des Industries Agro-Alimentaires du Cameroun (ENSIAAC); North-East Benoue Project; Cereal Office; Manufacture Camerounaise du Cycle (MANUCYCLE)

### *Purpose:*

To laboratory, field and market test a medium-scale hammer mill to process cereal grain. If the mill proves viable, it will be manufactured in North Cameroon.

### *Expectations:*

It is anticipated that one job will be created for each of the 318 mills to be manufactured. Each mill operator is expected to earn approximately CFAF 120,000 (\$US 400) per year. Based on the expectation that each mill will serve 100 women, 31,800 women will be able to reduce the amount of time they spend preparing grain by more than 98% as compared to the traditional method.

### *Technology:*

APICA has developed a simple, low-cost, easy-to-operate medium-scale mill capable of producing high quality flour from local cereal grains. It consists of a circular chamber with swinging hammers or beaters on a rotating shaft. The flour passes through a screen, or sieve. Sieve size determines flour fineness. All parts except the shaft, pulley and rotor can be locally machined. The smaller, less costly mill is very suitable to small, previously unserved villages and sparsely populated rural areas, as well as urban neighborhood settings.

### *Achievements/Findings:*

Project implementation began in May of 1988.

## Anguh Maize Mills, Cameroon

### *Project Partners:*

Association for the Promotion of African Community Initiatives (APICA); B.A. Anguh Agricultural Tools Manufacturing; Northwest Development Authority (MIDENO); Northwest Cooperative Association; and Peace Corps.

### *Purpose:*

To locally manufacture an adapted maize plate mill primarily for sale to women's groups and other village groups in rural areas of Cameroon, thereby increasing labor productivity.

### *Expectations (Revised\*):*

Over a four year period, 40 mills will be manufactured locally and sold on the local market. A revolving loan fund created by the project will facilitate the purchase of these mills by over 20 village groups. Labor productivity will increase in approximately 4,000 households, due to significant reductions in labor time and arduousness relative to traditional hand grinding and hand milling operations. In addition, 40 new jobs will be created in rural areas.

### *Technology:*

This project will manufacture a modified version of a locally available, diesel-powered plate mill for maize. Imported plate mills are almost entirely made from cast-iron parts. The major strength of the Anguh mill is that components have been redesigned so that they can be made from mild steel plate, sheet, and angle bar, enabling all mill components, except the bearings, grinding plates, and springs, to be manufactured locally in established rural workshops. The Anguh mill is simple in design, durable, and can be marketed for approximately 70% of the retail price of imported mills. Output of the mill is 150 kg/hour assuming two millings of shelled maize, a rate roughly equivalent to the capacity of imported motor-driven plate mills and far superior to the hand-driven mills or the traditional process. The Anguh maize mill is the first locally manufactured, motor-driven, plate mill in Cameroon.

### *Achievements/Findings:*

Recent design changes in the mill increase durability and improve the milling efficiency and ease of operation. Regular manufacturing of the mill began in July, 1987. Nine mills have been completed and sold; there are orders for an additional 15 mills. The revolving loan fund to finance the purchase of these mills by women's groups was established. Eight women's groups have qualified for loans and will be supplied with mills when they are available. American Jewish World Services awarded \$US 10,500 to the project to finance the lease/purchase of two mills in 1988.

\*See Report of Appropriate Technology International, 1984-1987.

## Composite Flour, Cameroon

### *Project Partners:*

Ecole Nationale Supérieure des Industries Agro-Alimentaires du Cameroun (ENSIAAC) and Institut de Technologie Alimentaire (ITA)

### *Purpose:*

To develop and perform consumer acceptance tests on bread and other baked products made from composite flour and produce such baked goods and local non-wheat cereal flour on a commercial basis.

### *Expectations:*

As a result of this project, employment will be created for 15 persons and extra annual income of \$US 31,300 will be generated. Depending on the amount of non-wheat material incorporated in baked goods and on the type of cereal, annual capital formation for the mill enterprise will vary between \$US 5,200 and \$US 25,200. Foreign exchange savings in 1991 due to the substitution of locally produced cereal flour for imported wheat will total as much as \$US 123,700. In addition, the establishment of a mill enterprise will guarantee a market for the hinterlands' surplus cereal production, benefiting approximately 200 farmers.

### *Technology:*

All baked items currently consumed in Cameroon are composed of all-wheat flour causing a drain on foreign exchange and reducing the market for local cereal grains. Composite flour is a combination of wheat flour and local non-wheat flour used to make leavened bread and other baked goods. This project will test consumer acceptance of composite flour baked goods and establish a milling enterprise to produce composite flour for sale to local bakers. The processing unit consisting of an abrasive disk dehuller and a roller mill has been designed to produce high quality sorghum and maize flour on a scale corresponding to the estimated market demand. Local bakers, using equipment currently available (i.e., ovens, kneading-trough, dough shaper, divider, water cooler and scales) will produce composite flour goods after receiving supplementary training in blending and baking processes. This is the first commercial production of composite flour baked goods in Cameroon.

### *Achievements/Findings:*

After sensory testing, five types of composite flour baked goods—three types of breads, cookies and cakes—were designated for market testing. A study is also being designed to determine the market for commercially produced local cereal flour. Market testing began in May 1988; preliminary results are expected by the end of the year.



COMPOSITE FLOUR baked goods are being tested in Cameroon.

## Maize Planter, Cameroon

### *Project Partners:*

Association for the Promotion of African Community Initiatives (APICA); Cameroon Agricultural Tools Manufacturing Industry (CATMI); Northwest Development Authority (MIDENO); Promotion of Adapted Farming System based on Animal Traction Project (PAFSAT)

### *Purpose:*

To test a hand-operated injection planter for maize and beans which can be manufactured locally from available materials. If test results are positive, the injection planters will be sold to farmers in Northwest and West Cameroon.

### *Expectation:*

The planter will be manufactured and sold to approximately 2,500 farmers in Cameroon. Each farmer's annual income will increase CFAF 16,930 (\$US 56) through increased crop production and seed savings, generating a total annual income increase by project's end of CFAF 42.3 million (\$US 141,000).

### *Technology:*

CATMI has developed a simply constructed, robust, hand-operated injection planter for maize and beans. This spring-action walking-stick type planter is equipped with an adjustable depth control plate for depths of up to 60 mm. The planter is placed in the ground and pushed forward onto the spring-loaded foot, causing the point to open and deposit a seed. The seed is then recharged from a hopper. Different seeds can be planted by using different size plates. The planter weighs 2.2 kg and is 3 feet long when fully extended.

### *Achievements/Findings:*

Tests determined that the CATMI planter is best suited to local conditions. On-farm testing is being conducted during the planting season (March-September).

## Palm Oil Extraction Unit, Cameroon

### *Project Partner:*

Association for the Promotion of African Community Initiatives (APICA)

### *Purpose:*

To create a commercially viable enterprise that manufactures and leases/sells improved palm oil extraction units to small-scale palm oil producers.

### *Expectations (Revised\*):*

Over a five year period, 57 presses will be manufactured and sold to local village groups and private entrepreneurs. Of this total, 25 will be leased/sold through the use of a five-year revolving loan fund established by the project. More than 1,000 households will benefit through increased palm oil production and labor productivity. In addition, approximately 200 new jobs will be created in rural areas through the operation of oil extraction units.

### *Technology (Revised\*):*

The Caltech palm oil press is more efficient than the traditional method or alternative village-scale technologies. It depulps and presses palm nuts in one operation; its rate of extraction is between 18 and 20 percent; and it can press between 125 and 310 kgs of fresh fruit bunches per hour, depending on the version.

### *Achievements/Findings:*

As of early 1988, 50 expellers (of all three types) had been manufactured, sold and installed. The manufacturing enterprise TOOLS recorded its first profit for the year ending June 30, 1987. A vertical axis version of the Caltech press was developed. Its extraction rate is the same as the original manual horizontal axis version and its capacity is only slightly lower. Because the vertical press costs less than half the price of the horizontal press it should attract more buyers. TOOLS has begun to diversify its product line to include hammer mills and diggers. A market survey is now under way to determine the market potential of the Caltech press in Benin, Togo, Ivory Coast and Guinea-Conakry. Results of market research conducted in Zaire have led ATI to design a project to disseminate the presses in that country.

\*See Report of Appropriate Technology International, 1984-1987.



## Ceramic-Lined Jikos, Kenya

### *Project Partner:*

Kenya Energy Nongovernmental Organizations Association (KENGO)

### *Purpose:*

To initiate production of ceramic-lined, charcoal-burning stoves by as many as 20 informal sector manufacturers of traditional stoves in areas of high demand throughout Kenya, and to field test the 'Kuni Mbili', a ceramic-lined portable wood burning stove.

### *Expectations:*

Many of the estimated 1,000 metalworking artisans who presently spend 1/3 of their time manufacturing jikos are expected to adopt this technology. The major benefits will be cash savings to consumers; the aggregate household savings will total \$US 470,000 over a two-year period. A market share of 10% would prevent the clearing of 11,250 hectares of natural forest and plantations for fuelwood. In addition, if successful, this project will generate annual gross profits of \$US 64,000 in the informal manufacturing sector, and an additional \$US 31,000 per year after the loans have been repaid. The project will provide work for 25 rural individuals.

### *Technology:*

The improved technology promoted by this project involves the addition of ceramic liners to an existing traditional technology for metal stoves. The ceramic liners are held in place by an insulating layer of a cement/vermiculite mixture. The ceramic liner and attached grate extend only to the narrow half-way point of the metal casing and are manufactured in one piece with a perforated floor acting as the grate. This modification reduces cracking and weight (an important concern in urban Kenyan households where stoves must be easily portable). These ceramic liners have a normal lifetime of nine months when used intensively, compared to three months for a metal grate in a conventional jiko. This technology reduces fuel consumption by 25-30% compared with the traditional metal stove. Local artisans will manufacture and market the jikos in small townships and trading centers.

### *Achievements/Findings:*

A jig (Jiko Jolly) for more rapid and accurate molding of ceramic stove liners was developed by ATI staff and is now being introduced into other countries by other stove programs. Sales of improved stoves have surpassed targets, largely because of deliberate efforts to build upon existing informal sector stove producers and markets, instead of creating new firms or subsidizing distribution by government. Over the project period, more than 125,000 ceramic-lined jikos were produced and sold. Given the success of this project, ATI's financial involvement will be reduced in 1988.

CERAMIC LINED JIKOS—more than 125,000—were produced and sold in Kenya.

## Shea Butter Extraction Units, Mali

### Project Partners:

Division du Machinisme Agricole (DMA); Compagnie Malienne de Développement des Textiles (CMDT); and Centre d'Echanges et Promotion des Artisans en Zones à Equiper (CEPAZE)

### Purpose:

To commercially manufacture two types of shea butter extraction equipment that will enable increased rates of extraction, and to test the technical and commercial viability of the ownership and use of this equipment by village groups.

### Expectations (Revised\*):

As a result of this project, approximately 600 households will increase their incomes from shea butter production. In addition, the supply of shea butter, an important source of calories in Mali, will be increased. The technology will dramatically reduce the arduousness of work for rural women, who are the primary producers of shea butter. Two shea butter extraction units will be installed, and the groundwork laid for wider dissemination of the improved extraction units. There is potential to install at least 100 of these units in West Africa over the coming years.

### Technology:

The project will test two shea butter extraction processes developed and tested by CEPAZE, one motor-driven and the second hand- or animal-driven. The latter is better suited to more sparsely populated shea nut producing areas and to populations accustomed to using animal traction. The improved extraction technology produces shea butter of a similar taste, appearance, and composition to traditional processing. The improved method employs simple solar dryers, a manual or motor-driven decorticator/winnower, an animal- or motor-driven shea nut grinder, and a centrifuge. Extraction rates of the CEPAZE technology are comparable to the GATE-KIT technologies.

### Achievements/Findings:

The interim evaluation concluded that only the motor-driven version had the potential to become commercially and technically viable. A prototype second-generation motor-driven shea butter extraction unit has been built and installed and is operating very successfully. One unit currently working at full capacity is producing 200 kg/hour of shea nut paste and 21 kg/hour of shea butter. The second unit will be installed in the latter part of 1988.

\*See Report of Appropriate Technology International, 1984-1987.

THREE MODIFIED MINI-DEHULLERS are being tested by an ATI project in Mali.

## Mini-Dehullers, Mali

### Project Partners:

Compagnie Malienne de Développement des Textiles (CMDT), Division du Machinisme Agricole (DMA)

### Purpose:

To test the technical and commercial viability of a modified version of the IDRC mini-dehuller and manufacture it locally for sale to village associations and private individuals in Southern Mali.

### Expectations:

By the fourth year, this project is expected to have led to the manufacture and installation of 100 mini-dehullers in rural Mali. Capital formation in rural areas will increase by approximately \$US 340 per dehulling enterprise operating at 80% capacity. One hundred jobs will be created in rural areas and labor productivity will be significantly improved relative to traditional methods. In addition, the mini-dehuller will significantly reduce the labor time and strenuousness of grain processing for rural women, and may thereby increase the attractiveness of local, drought-resistant grains relative to imported foods, that require little or no preparation.

### Technology:

The Prairie Regional Laboratory of the National Research Council of Canada, with the support of the IDRC, has developed a simple, efficient, dry-process mini-dehuller that significantly reduces labor requirements while increasing the recovery rates and storability of local cereals. The proposed mini-dehuller is a local modification of this design, which is considerably less expensive and uses less energy than the majority of mechanized dehullers in use. The modified mini-dehuller is the first grain processing equipment to be manufactured in Mali. Its simple design lends itself to replication in other regions of Africa where millet, sorghum, and maize are grown.

### Achievements/Findings:

Three modified mini-dehullers were manufactured. Laboratory testing proved satisfactory. Field and market testing will begin in late 1988.



## Improved Bricks, Tanzania

### *Project Partners:*

Center for Agricultural Mechanization & Rural Technology (CAMARTEC) and Meru Earthworks, Ltd.

### *Purpose:*

To introduce an improved firing technology which will enable private, small-scale rural brickyards to manufacture bricks of high strength and regular size that will meet the quality requirements of the urban market.

### *Expectations:*

During the project period one to three rural brickyards will be established. One such plant, operating at 60% capacity, will be able to supply material for the construction of between 170 to 200 low-cost houses annually, directly creating work for 130-140 artisans. Between 550-1,200 people will be housed as a result. If successful, as many as twenty additional rural brickyards will be established throughout the country in the next ten years, all of which are expected to be locally capitalized.

### *Technology:*

The project will define a brickmaking production equipment package using low moisture techniques that can be used in decentralized production units in rural areas. Three types of hand-operated brick presses and two types of clay crushers will be tested in order to determine the most profitable use in small enterprises. The projected annual output of the technology is 1.4 million bricks.

### *Achievements/Findings:*

The first phase of the project has documented the output rates, strengths and weaknesses of several models of clay crushers and block presses. The results are being used to define a commercially viable brickmaking operation. In addition to testing the equipment, clay from several sites has been analyzed to locate a clay with desirable characteristics that is available in sufficient quantity. Fifteen thousand bricks were produced in 1987. Project implementation was interrupted for 2½ months while the project moved to another site, more favorably situated relative to the clay. Phase II, full scale production, began in mid-1988.



## Oil Press Production, Tanzania

### *Project Partners:*

Centre for Agricultural Mechanization of Rural Technology (CAMARTEC); Themis Farm Implements & Engineering Company, Ltd.; and Institute for Production Innovation, University of Dar-es-Salaam

### *Purpose:*

To capitalize a private factory in Tanzania to enable the manufacture of affordable, hand-operated, sunflower seed oil presses for use in Tanzanian villages

### *Expectations:*

If successful, 48 oil presses will be installed annually, creating 270 jobs in rural areas and increasing the supply of edible oil for local consumption. In addition, more than 5,000 families will increase their income by a total of \$US 172,000 annually through the increased cultivation of sunflowers on idle or under-utilized land and the sale of sunflower seeds at higher prices.

### *Technology:*

Two types of oil presses, initially developed and tested at the University of Dar-es-Salaam, will be manufactured. The presses are made from common mild steel and can exert 20 to 80 tons of pressure, producing ½ and 2 gallons of oil per hour respectively. The press is the first practical, easily maintained oil press to be manufactured in Tanzania at an affordable price.

### *Achievements/Findings:*

Based on market assessment, a smaller, less expensive hand-operated press (the Bielenberg press) was developed by the project partner and ATI staff to complement the two larger presses. Four different manufacturers now produce the Bielenberg press. Rural oil pressing is being carried out by low income groups who otherwise would have been unable to process their own cooking oil. Twenty presses of all three types have been produced by Themis and are being used to extract oil in rural areas. Themis is now experimenting with a 40-ton IPI press that can be dismantled for easier transport. The project also produces ancillary equipment for seed processing, such as decorticators. Because of its lower price and because it is more practical than the very large, heavy, and costly IPI press, the Bielenberg ram press now is the only press being disseminated by ATI's village oil processing project. ATI's financial involvement in production of the press has concluded; the Village Oil Processing project will continue to assist in disseminating this technology.

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LOCAL COOPERATIVE has purchased one of the village oil presses at Endakiso in Tanzania.

## Rural Potteries, Tanzania

### *Project Partners:*

Centre for Agricultural Mechanization & Rural Technology (CAMARTEC) and Sherif Dewji & Sons Ltd.

### *Purpose:*

To make possible the commercial supply of firebricks, kiln furniture and glaze materials for sale to small village potteries in Northern Tanzania, thereby increasing the commercial viability of small-scale village potteries.

### *Expectations:*

During the three-year project period, this will create 45 jobs in rural areas and result in capital formation of \$US 34,000 in village pottery industries.

### *Technology:*

Firebricks will be produced by pressing low-moisture bricks in a hand-operated press and then drying and firing them. The glaze will be produced by fritting boric acid with ball clay, feldspar, silica and dolomite, and then heating the mixture in a kiln. This glazing process will increase the durability of village pottery, which tends to be porous, fragile and low-grade, thereby enabling village potters to increase the marketability and value of pottery products.

### *Achievements/Findings:*

The project successfully produced firebricks from locally available material. The implementing organization upgraded its product line and production technology and repaid the loan to CAMARTEC ahead of schedule. Sherif now supplies firebrick and fire cement to several industrial foundries, including Tanzanian Railways, and has also secured a contract to supply telephone line insulators. Sherif Dewji in turn has assisted several rural potteries, and has established the Ceramics Association of Tanzania, which has trained four new pottery producers in glazing techniques. Sherif has also provided loans to small potters when CAMARTEC, for institutional reasons, was unable to process these loans.



RURAL POTTERIES, established under ATI project, have created 25 jobs.

Glazeware is now being produced by rural potters, which brings a higher price and a higher value added than the terracotta ware formerly produced. It is apparent that the linkage between Sherif Dewji and the rural potteries is a viable one and has benefited both parties. Sherif has maintained an active role and interest in the progress of the rural potters beyond the terms of his contractual obligation.

## Village Oil Processing, Tanzania

### *Project Partner:*

Evangelical Lutheran Church in Tanzania, Lutheran World Relief

### *Purpose:*

To start a self-financing development company which will provide technical assistance and loan capital to help Tanzanian village entrepreneurs establish and manage small-scale sunflower oil extraction industries.

### *Expectations:*

Nine oil extraction enterprises will be established during the four year project period; thereafter, loan reflows will enable another 3 projects to be started in each of the next four years. If successful, approximately 120 new jobs will be created in rural areas and a total of \$US 251,400 in additional income will accrue to more than 690 farmers over an eight-year period.

### *Technology:*

The project will disseminate the oil press technology tested in the Tanzania Oil Press Production project described earlier.

### *Achievements/Findings:*

After two complete sunflower harvest seasons, 20 privately owned sunflower seed processing units have been established in 14 villages. In 1986-87, ten processing units produced 4,933 liters of cooking oil. In 1987-88, approximately 8,000 liters will be produced by some 32 units in 20 villages. Most of this oil is for local consumption.

To reach poorer, more rural groups than would have been possible under the project as originally designed, the self-financing development company idea has been eliminated. The project now is providing technical assistance and loans to rural, poor, small-scale groups and individuals to enable them to establish and manage small-scale sunflower oil extraction enterprises.

A mid-term evaluation stated that the decision to downscale the technology from the IPI to the Bielenberg ram press has dramatically increased employment opportunities in the project. As originally envisioned, the IPI press would have created 15 jobs (5 jobs per press) by the end of the second year and 30 by the end of the third. Because the ram press is much more flexible and costs much less, many more groups and individuals can afford this technology. By the end of the second year, 20 ram presses were operating; these have created employment opportunities for 40 people.

## Hydro-Powered Grain Mills, Zaire

### *Project Partner:*

Société de Développement Rural du Zaire (SODERZA)

### *Purpose:*

To introduce hydro-powered milling using cross-flow turbines, by (1) constructing two experimental installations, (2) consolidating and upgrading two existing systems, and (3) establishing the commercial manufacture and installation of turbines and mills.

### *Expectations:*

Each of the ten mills is expected to provide indirect income and consumers' surplus benefits to peasants from family sales of milled cassava totaling \$US 12,480 per year, if only 17% of the output is marketed. In addition, each mill should save a minimum of 1,000 labor hours per week normally devoted to the traditional milling of cassava. During the three-year life of the project, 35 jobs and capital formation totaling \$US 107,060 will be created in rural areas. If the technology proves commercially and technically viable, it will have positive implications for energy use in the region.

### *Technology:*

This project will test the use of hydro-technology as a power source for milling through direct drive—a technology that has not been extensively developed or applied in rural areas of the country. The technology employed in this project is a combination of a locally-made hammer mill linked to a cross-flow turbine. The proposed technology is low-cost, produces high quality flour on a single pass, and is easily manufactured, maintained, and repaired. The cross-flow turbines have a medium head capacity and are adaptable to a wide range of flows.

### *Achievements/Findings:*

SODERZA has now completed nine hydro-milling sites (four funded by ATI and five funded by the EEC). By replacing imported bearing housings with its own aluminum castings from scrap, SODERZA has significantly reduced the cost of the turbines. A hand-operated punch press developed by SODERZA and ATI was instrumental in improving the quality of the turbine and also saves considerable production time. SODERZA has electrified three of the sites by connecting inexpensive generators of 2-5 kW capacity to the turbines. Neighboring villages have supplied and installed lines, poles, etc. Sale of electricity has helped amortize the high capital cost of these installations. Electrifying these villages has spurred grassroots efforts for further local improvements.

## Agro-industries, Zimbabwe

### *Project Partner:*

Foundation for Education with Production (FEP)

### *Purpose:*

To diversify and expand the economic base of a farming cooperative in Zimbabwe by establishing agro-industries that provide direct and indirect income and employment for the rural poor.

### *Expectations:*

Over a three-year period, it is expected that the project will benefit up to 5,100 area residents (850 rural families) by: (1) providing a reliable market for local agricultural production and prices for local produce which will be at least 5 percent higher than prevailing producer prices; (2) adding value to local agricultural production; (3) lowering prices for locally produced basic goods and services by 17 percent; (4) providing employment opportunities and skills training for at least 117 people and productive skills training for an additional 43 people a year; and (5) increasing farmers' income by 50-70%.



MILLING AT ONE of 9 hydro-powered sites completed by SODERZA is increasing incomes of rural farmers who sell milled cassava.

### *Technology*

Initial industries to be established include a bakery, a mill, and a shoe-making plant. Industries which the project may later establish include vegetable oil production, peanut processing, and fruit and vegetable processing.

### *Achievements/Findings:*

A maize mill, a bakery and a general store are in business and report strong sales. Once the bakery obtained its flour allocations from the government, two shifts were instituted and it is selling everything it produces. Consumers prefer the project's bread, which is fresher and cheaper than the products baked by its competitors. Because of an excellent harvest in the local area, the mill is grinding more maize than originally anticipated. Two locally manufactured sunflower seed presses have been purchased. Hybrid sunflower seed is being cultivated on the equivalent of 35 hectares per year using a double cropping system.

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## **REPLICATION PROJECTS**

### **Mini-Dehullers, Cameroon**

#### *Project Partners:*

Ecole Nationale Supérieure des Industries Agro-Alimentaires du Cameroon (ENSIAAC); Cereal Office; Manufacture Camerounaise du Cycle (MANUCYCLE); North East Benoue Project

#### *Purpose:*

To laboratory and field test an adapted version of the IDRC/PRL abrasive disk mini-dehuller in order to determine its technical and commercial viability and locally manufacture it for dissemination to village groups and private individuals in North Cameroon. This project is a replication of a previous ATI project in Mali.

#### *Expectations:*

It is expected that 85 dehullers will be installed during the life of the project. Since one job will be created per dehuller, 85 jobs will be created. Each dehuller operator is expected to have average annual earnings of \$US 326, generating a total annual project income of \$US 27,800.

### *Technology:*

This technology offers an intermediary solution between the traditional processing method and industrial-scale units. Present village-level mechanized dehullers are expensive, both in terms of energy costs and capital investment. This dehuller abrades the seed hull against a series of rotating disks. The proposed mini-dehullers will have greater yields and the flour produced will have a longer shelf life than with either the traditional method or village-level mechanized dehuller.

### *Achievements/Findings:*

Project began implementation February 1.

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## **Sunflower Seed Oil Press, Zimbabwe**

#### *Project Partner:*

G. North & Sons

#### *Purpose:*

To produce, test and evaluate the manual ram-type sunflower seed oil press developed by ATI in Tanzania to determine whether this press is suitable for use by the Zimbabwean peasant farmer.

#### *Expectations:*

During the one-year period covered by this grant, G. North and Son will laboratory and field test 10 prototype sunflower seed oil presses. The results of data collected on production, mechanical reliability, payback period and consumer acceptance will determine suitability and commercial potential of the press.

#### *Technology:*

The press which is being purchased and tested is a small, 100 kgs weight, continuous throughput, manually operated ram type press which can process unhulled sunflower seed. The press uses a hand-operated lever arm to move a piston back and forth inside a cylinder. As sunflower seed is fed into the cylinder from a hopper, it is compressed by the piston and pushed through a pressing cage where oil seeps out through the seed cake which accumulates. The press can be manufactured using locally available materials.

#### *Achievements/Findings:*

Shortly after start of the project, G. North discovered that a manufacturer was already producing the press. This manufacturer has sold 31 presses, mostly to private buyers. The first press it manufactured has processed 22 tons of sunflower seed in less than two years. The project plan was amended to allow G. North to purchase the presses instead of producing them itself. Six presses have now been purchased and installed and are now being tested. If the present project shows that there is a sufficient market for two press manufacturers in Zimbabwe, a follow-on project will begin to disseminate this technology.

# ASIA PROJECTS

## DEMONSTRATION PROJECTS

### Integrated Potato Processing Technologies Project (IPPT), India

*Project Partner:*

Society for Development of Appropriate Technology (SOTEC)

*Purpose:*

To provide subsistence farmers in India with three alternatives to distress selling of potatoes by introducing a combined package of potato processing technologies: rustic stores, sun drying units and hammer mills. Value will be added to the potatoes and farmers will have access to an improved market for stored potatoes, potato chips (dehydrated potato slices) and potato powder.

*Expectations:*

Phase I, a demonstration project of 2 years, will establish 27 rustic storage units, 3 drying units and 1 hammer mill. Rustic storage units will be owned by individual families; a farmers' society will own the drying units and hammer mills. One hundred and twenty-six new seasonal jobs will be created and a minimum of 75 farmers are expected to increase their

incomes by approximately 25% through sale of potato products. During Phase II (the expansion phase, undertaken with commercial financing), 54 rustic stores will be built and 6 additional dryers and 2 mills established.

*Technology:*

Rustic storage units are mud huts with thatched roofs which are designed to be cool, dark and properly ventilated to ensure adequate humidity during the summer months. A maximum of ten tons of potatoes can be stored in the units for three to four months.

The potato slice drying and processing technology consists of equipment such as a drum washer-cum-peeler, a slicer, chemical bath and stackable drying racks.

The hammer mill is a 7.5 HP electric motor-operated stone mill of 16" diameter which is sealed to avoid loss of valuable potato dust. A machine is attached to the mill which sieves the powder to remove large particles. The output of the mill is approximately 200 kg of powder per hour.

*Achievements/Findings:*

The project has been approved by the Government of India for immediate implementation.



POTATOES are treated in a solution to prevent their turning color.

### Venture Capital for the Application of Appropriate Technology (VCAT), India

*Project Partner/Co-Funder:*

The Industrial Development Bank of India (IDBI) (IDBI is contributing \$US 6.1 million over seven years.)

*Purpose:*

(1) To form and implement a private, not-for-profit corporation, the Venture Capital Company for the Application of Appropriate Technology (VCAT), to direct the application of science and technology to rural development in India by replicating and expanding upon ATI's venture capital strategy;

(2) to encourage government, non-government organizations and international agencies to adopt policies which enhance the use of appropriate technologies in small enterprise development.

*Expectations:*

Five project centers throughout India will provide financing and business and managerial services to approximately 100 new co-ventures during the first five years of the project. These co-ventures are expected to create as many as 2,500 jobs.

### *Technology:*

Rural small-scale enterprises will be promoted by using start-up and equity capital as a leverage to generate additional investment. Projects will be planned by a team comprised of VCAT technical and business officers, an extension worker and the co-venture partner. ATI will provide technological and other assistance, train VCAT staff, provide VCAT with exposure to ATI-supported technologies worldwide and provide a technical advisor for three years, subject to an annual review by ATI and VCAT.

The small enterprises established through this project will be based on some dozen appropriate technologies that have high replication potential, such as potato processing, rhizobium inoculant and processing of fruits and vegetables.

### *Achievements/Findings:*

VCAT is expected to be incorporated and capitalized by September, 1988. Feasibility studies and business plans have been submitted for potato processing and chrome tanning projects.

## **Venture Capital Company, Indonesia**

### *Project Partner:*

Yayasan Dian Desa (YDD)

### *Purpose (Revised\*):*

To demonstrate a delivery mechanism using small venture capital investments and a vertically integrated service company to promote YDD-tested shrimp raising technologies. Small pond (tambak) owners will increase their incomes by producing quality products for the domestic and international markets.

### *Expectations (Revised\*):*

Upgraded pond management may increase production by as much as 100%, thereby benefiting the 40 small pond owners. A shared profit/risk financing arrangement should attract many small pond owners to adapt the upgraded pond management technology. Laborers will be hired to assist each participating farmer; thus more than 40 jobs will be created.

### *Technology (Revised\*):*

The project will test the economic and social impact on small pond owners of a vertically integrated approach: combining a hatchery, financing through profit-sharing, technical assistance, and a feed production unit. Technology dissemination will include initial introduction of the medium-density improved shrimp culture and management techniques developed by YDD; funding through a shared profit/risk arrangement with small pond owners; marketing and technical assistance; and a continuous supply of quality shrimp fry and feeds.

\*See Report of Appropriate Technology International, 1984-1987.

### *Achievements/Findings:*

The shrimp hatcheries, laboratory, and office facilities have been constructed. A filter was installed at the hatchery to improve the quality of the water and the survival rate of the fry improved. Two units of the hatchery are operating at 50% capacity; 500,000 larvae have been hatched and began growing in stage two tanks. Survival rate of fry overall is 20%—a considerable improvement over the national figure of 7%. The hatchery reported a positive cash flow of \$US 6,000 for the first three months of 1988. Five outgrowers (contract growers) were selected. They will finish raising the shrimp fry in their individual ponds which have been improved to meet necessary standards for quality growth.

## **Turbine Driven Agro-Processing, Nepal**

### *Project Partner:*

New Era

### *Purpose:*

To test the technical and commercial feasibility of a locally designed and manufactured turbine-driven heat generator to be employed in agro-processing enterprises in rural Nepal.

### *Expectations:*

The project will increase the incomes of over 600 households through backward linkages to agriculture. The profits generated by the enterprise will be invested in other productive ventures in the region. In addition, the project will test the potential of community-owned agro-processing enterprises, based on the heat generator, to create off-farm employment in industries with strong linkages to agriculture in the hill regions of Nepal.

### *Technology:*

This applied research project will assess the technical and commercial viability of a water turbine-powered, mechanical heat generator-kettle unit as a cost-effective source of process heat for manufacturing food and related products in the hills of Nepal. Initially the enterprise will process citrus fruits and dairy products for local markets using simple boiling methods and, if successful, expand to other products including soap, dried fruits, vegetables, and spices. Although water turbine technology has been widely and successfully tested in the hill region of Nepal, most such turbines are utilized solely for grain milling and oil expelling, which do not exploit the full capacity of the generators. This project will diversify and expand the use of a heat generator to take advantage of the available capacity of the technology.

### *Achievements/Findings:*

The milling operation, oil press, and grinding operation are being operated by a village association, established in connection with the project. The villagers developed a strong sense of community around the project. The project successfully tested the use of the heat generator, and found it had no commercial application. ATI's financial involvement in the project has ended.



*PAG-ASA KILNS convert coconut shells into high quality charcoal to be used as an industrial raw material to manufacture activated carbon. Coco-Charcoal Project in the Philippines began implementation in mid-summer, 1988.*

## Organic Fertilizer, Philippines

### *Project Partner:*

Filipinas Foundation, Inc. (FFI)

### *Purpose:*

To demonstrate the commercial viability of decentralized, small-scale production enterprises, which deliver a stable organic fertilizer product of consistent quality and at a reasonable cost. The intended market is small-scale rice and corn farmers seeking to lower production costs and increase yields.

### *Expectations:*

This project will generate additional income benefits to small poultry farmers, Ipil-Ipil (*Leucaena leucocephala*) leaf gatherers, and rice and corn farmers. Rice and corn farmers can realize between \$US 14 - \$US 24 savings per hectare through reduced fertilizer costs. Yield increases of up to 20% can be realized over the short term, increasing gross revenues by approximately \$US 86 per hectare. Each of the 40 proposed fertilizer plants will employ at least 10 people, thereby creating at least 400 jobs in rural areas. The project will also stimulate foreign exchange savings by decreasing the need for imported chemical fertilizers.

### *Technology:*

The project will verify the production technology for "Anihan 2000" fertilizer and test the efficacy of the resulting organic fertilizer products. The least-cost formulation of the product will be developed through (1) strict quality control of the raw materials used at present, and (2) the substitution of various agricultural wastes which have little or no commercial value. The Anihan fertilizer technology depends on the composting of specified animal waste, plant biomass, and minerals under controlled conditions to ensure a reliable product of consistent quality. The technology overcomes the major problem associated with organic fertilizer manufacture — variable nutrient composition — by standardizing the raw materials used and tapping a single source of dolomite and rock phosphate minerals, the quality of which will be monitored through chemical analysis.

### *Achievements/Findings:*

The plant was commissioned and FFI developed three new least-cost fertilizer formulations for use primarily with corn and rice crops. Farm trials were undertaken to determine efficacy under field conditions.

The final evaluation concludes that the Anihan 2000 fertilizer is a very promising technology and that the fertilizer production company will become commercially viable. However, at present the depressed price of urea makes it difficult for its organic fertilizer to compete with chemical fertilizer, which is very high in urea. Several organizations in the Philippines are discussing with FFI purchase/use of this technology. ATI financial involvement in this project has ended.

## Rural, Small-Scale Industries Development, Philippines

### *Project Partner:*

Filipinas Foundation, Inc. (FFI)

### *Purpose:*

To test a rural, small-scale industries strategy designed to create jobs and increase incomes of poor people. Manufacturing enterprises will be established that use appropriate technologies appraised by the Filipinas Foundation and financed by a venture capital mechanism established by the project.

### *Expectations/Technology*

Based on estimates of enterprises proposed, over the five-year project life, approximately 250 new jobs would be created and more than 30,000 farmers would increase their incomes through raw materials supply or through reduced cost of commodities produced. If such outputs are achieved, preliminary estimates indicate that \$US 146 in direct and indirect economic benefits will result from every \$US 1.00 invested by the Venture Capital Company during the project's first five years. Subject to feasibility studies demonstrating the commercial viability of particular production technologies, the project will invest in a variety of technologies, such as commercial mushroom production.

### *Achievements/Findings:*

The mushroom enterprise achieved a positive cash flow after one year of operation and showed a small profit for 1987. The mushroom and spawn substrate production enterprise employs 14 full-time and 5 part-time workers. In early 1988 the project started negotiations with outgrowers. The business experience of the enterprise was shared with 13 potential entrepreneurs in a week-long training session held in Bangkok, Thailand, in October, 1987.

The wet coconut processing plant constructed in Tagbanon was closed by FFI due to political unrest. Another site in Leyte has been selected where equipment improvements will be tested. ATI assisted in replicating this technology in Sri Lanka.

The citronella oil enterprise should be initiated in 1988.

A mid-term evaluation of the project indicated the need to consolidate and replicate the mushroom, wet coconut, and citronella oil enterprises rather than seek new investment opportunities. As a result, the Expectations/Technology Statements have been revised to read:

Over the remaining three years of the project life, approximately 9 new enterprises will be established. These will be replications of existing FFI-established enterprises described in detail below.

*Auricularia mushroom spawn production:* Six jobs will be created at the enterprise and ten rural contract growers will increase their incomes by \$US 75 per month. If viable, additional enterprises can be established, realizing significant savings in foreign exchange. (Currently 70% of the 24,000 kilo-yr national demand for *Auricularia* mushrooms is met by imports.) Company profits over the 5-year project period will total \$US 75,125.

*Wet Coconut Processing:* This enterprise uses an improved version of the traditional wet processing method to produce coconut oil, soap, charcoal, animal feeds and vinegar for local consumption. Fifteen jobs will be created in each village-scale coconut processing plant; annual profits of each plant will range between \$US 12,000 and \$US 15,000. At the end of five years, coconut farmers/employees will own at least 30% of the stock in the plant.

*Citronella Oil:* Thirty tons of citronella oil are expected to be produced each year, beginning the second year after start up. The enterprise will plant Citronella grass, extract and process the oil from the leaves and market the refined oil in the Philippines. Fifty-two jobs will be created by the enterprise, an additional 33 workers will be needed to maintain the plantation; 1176 workers will be needed to establish the plantation.



MUSHROOM ENTERPRISE in Philippines showed a small profit for 1987. Project expects to expand to outgrower stage in 1988.

## Cinnamon Processing, Sri Lanka

*Project Partner:*

Appropriate Technology Consultants (ATC)

*Purpose:*

To increase incomes of small-holder cinnamon producers by strengthening their competitive advantage in producing and selling processed cinnamon products. Traditional technology will be upgraded, marketing techniques will be improved and quality assurance procedures will be introduced.

*Expectations:*

ATC and the Ambalangoda Cinnamon Growers Association will establish a small-scale cinnamon processing company to commercially test the improved technologies. Improvements in extraction efficiencies will earn leaf oil producers \$US 25 more per acre harvested per season. The incomes of 150 cinnamon growers/producers will increase 5-25%. Each plant will create 8-10 jobs; some of the small-holder cinnamon producers are expected to elect to take equity participation in the plant.

*Technology:*

The traditional technology for distilling cinnamon bark and leaf oil has a low overall extraction efficiency, wastes fuelwood and results in a final product of inconsistent quality. Serious problems include inefficient condensation systems and poor firing techniques. The project will manufacture and test an improved still. An improved condenser will be introduced, increasing extraction efficiency 250% compared to the traditional bark oil stills and 27% higher than modern, stainless steel models. Firing techniques will be revised to reduce scorching and control the still's internal pressure and temperature. A number of additional design features will be improved to facilitate loading and unloading, oil collection and increased capacity.

*Achievements/Findings:*

A technical evaluation of the traditional bark oil still was conducted, as well as a baseline study of the cinnamon producers in Ambalangoda. Although a new bark oil still design was found to be technically viable the project focus has shifted to production of leaf oil which appears to be more marketable than bark oil. A production site has been selected near Galle, close to the producers of leaf oil.



CINNAMON BARK OIL STILLs were found to be technically viable but production has shifted to leaf oil, due to market demand.

## Computer-Video Training, Sri Lanka

### *Project Partner:*

Participatory Institute for Development Alternatives (PIDA)

### *Purpose:*

To develop, test, and evaluate the application of computer and video-based training for the transfer of technical skills to rural villagers in Sri Lanka. The project will test the cost-effectiveness, sustainability, and impact of computer-video training on increasing the incomes of small-scale spice growers in 10 rural villages in the Matale, Kegalle, and Kandy districts.

### *Expectations (Revised\*):*

If successful, this technology will have major implications for the transfer of needed technical skills to rural populations in other developing countries. This project will add value to the resources of more than 3,000 rural families by increasing their ability to produce higher yields and better quality spices.

\*See Report of Appropriate Technology International, 1984-1987.

### *Technology:*

This project will adapt an innovative education and extension methodology to the educational levels, skills, and conditions found in rural villages in Sri Lanka. The technology enables local specialists in spice cultivation, extension, village education, and communication to design and extend high quality education and training programs to rural areas of the country. The technology employed by the project consists of a series of training videos and computer-based lessons that teach basic skills in spice cultivation, harvesting, and drying. This method has proven very successful in transferring technical skills in a cost-effective manner in the U.S. This project represents the first attempt to test its effectiveness in transferring technical skills directly to rural populations in a developing country.

### *Achievements/Findings:*

In March, 1988, a new implementing organization, PIDA, assumed responsibility for the testing of the training programs and methodology. Computer lessons on spice processing and cultivation have been prepared to be used in combination with videos and training manuals. Four educational video films on cultivation and processing of cloves, cardamom, pepper and nutmeg/mace were produced in Sinhala. Baseline data have been collected from 22 villages.

## Mahaweli Rural Industries, Sri Lanka

### *Project Partner:*

The Mahaweli Authority of Sri Lanka

### *Purpose:*

To establish a private investment company to finance and operate joint ventures in small- and medium-scale industries which use innovative technologies to create jobs, build equity, and increase incomes of the rural poor.

### *Expectations:*

Based on an analysis of the first four investments under consideration, the planned 12 investments will directly create 270 jobs. The effects of the project are estimated to be at least \$US 2.00 in direct and indirect economic benefits for every \$US 1.00 invested by the company during the first five years of operation. Owners' equity will also accrue to many rural producers who will own shares in the industries financed by the project.

### *Technology:*

The Mahaweli Authority of Sri Lanka and ATI will jointly establish a private, limited liability company which will seek out venture partners (individual entrepreneurs, people's companies, producer associations, etc.) to establish industries related to agricultural product and waste processing, farm equipment, and local mineral resource utilization. The company will promote the commercialization of innovative technologies, balancing high risk projects with less risky ventures to assure the company's profitability. Investments will be made on the basis of comprehensive technical, commercial, and market feasibility studies.

### *Achievements/Findings:*

The Mahaweli Venture Capital Company was incorporated. After initial difficulties, it was decided that the first three businesses would be established as joint ventures with experienced small entrepreneurs in the Mahaweli area. In June, 1988, Mahaweli sent ATI the first business plans developed under this approach. ATI and Mahaweli are also developing a business plan for a feed mill.

## Rhizobium Inoculant, Thailand

### *Project Partner:*

SVITA Foundation

### *Purpose:*

To introduce rhizobium inoculant, a natural bacterium that fixes atmospheric nitrogen in leguminous plants, and gain its acceptance by soybean growers as an integral part of production inputs available to increase soybean production in Thailand.

### *Expectations:*

The use of rhizobium is expected to enable thousands of small-scale growers to increase productivity, lower costs, and increase soybean production in Thailand, where two-thirds of the national requirements, or 324,000 tons, are imported annually. If successful, the project will increase the incomes of 1,600 farmers by at least 25%. After five years, 20 production plants will be established, reaching over 16,000 farmers and producing an annual net gain in income of \$US 2,782,600 to farmers.

### *Technology:*

Rhizobium, a soil bacterium that occurs naturally, works in a symbiotic relationship with legumes to fix atmospheric nitrogen in the soil. The use of rhizobium inoculant with certain legumes increases plant productivity from 20-50% and lowers production costs up to 60% by reducing the need for imported nitrogen fertilizers. This project will develop a simple, small-scale production process for producing rhizobium, based on an aerobic fermentation process using a seed culture and a growth medium under aseptic conditions. A small-scale decentralized rhizobium production unit with a capacity of 8 tons/year will be established to serve difficult to reach rural markets.

### *Achievements/Findings:*

The technical feasibility of small-scale decentralized production of rhizobium inoculant has been successfully demonstrated. Fifteen thousand bags of rhizobium inoculant were sold. Over 1,000 small-scale farmers have been trained in the use and application of rhizobium in soybean production. Most of these farmers report 25-30% increases in soybean yield. The project was closed in November of 1987. Details of the follow-on project to test the commercial viability of a small-scale rhizobium production plant follow. A technology manual is being written to help in the dissemination of this scaled-down technology.

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*RURAL FARM FAMILIES in Thailand who use rhizobium as an input in soybean production report 25-30% increases in soybean yield.*

## Small-Scale Commercial Testing of Rhizobium Inoculant, Thailand

### *Project Partner:*

SVITA Foundation

### *Purpose:*

To demonstrate the commercial viability of the small-scale rhizobium inoculant production technology developed in a previous ATI project.

### *Expectations:*

A joint venture will be formed between the SVITA Foundation and a local businessman and soybean trader who will market the rhizobium inoculant produced by the pilot plant. The enterprise is expected to sell 90,000 bags of rhizobium per year. More than 10,000 rural farm families who are expected to use the rhizobium inoculant will increase soybean yields by 20-50% and incomes by 15 to 45%.

### *Technology:*

See description of technology above in Rhizobium Inoculant project.

After a trial run, the small-scale decentralized rhizobium plant in Ban Mae will produce inoculant for rainy and dry season planting periods for two years. The plant will operate at full capacity (8 tons/year) during the second year.

### *Achievements/Findings:*

The project will begin implementation in September, 1988.



## Rural Small-Scale Industries Program (RSSI), Thailand

### *Project Partner:*

Population and Community Development Association (PDA)

### *Purpose:*

To establish a small finance and technical assistance company which uses venture capital and credit mechanisms to invest in rural small industries based upon improved production technologies which pass technical assessment, commercial appraisal, and economic benefit analysis. The company's objective is to increase income and employment opportunities in rural areas directly through jobs in small industries and indirectly by increasing the demand for raw materials produced by rural farmers.

### *Expectations/Technologies:*

More than 40 companies will be established and approximately 7,000 people will benefit from the project. Subject to feasibility studies demonstrating the commercial viability of particular production technologies, the project will finance a variety of industries, such as:

*Bamboo grass mat production:* Annual income to 300 rural farmers of \$US 43 a month or \$US 350/season with company profits of \$US 13,000 per 8 month production cycle.

*Environmental Sanitation Materials Plant:* This joint venture among village associations, the PDA-owned Ban Pai Development Company and RSSI Co., will manufacture mortar blocks and other components used in construction of pour flush latrines. Majority equity ownership in the company will gradually be transferred to local village groups and/or individuals.

### *Achievements/Findings:*

*Bamboo grass mat production:* In this small-scale industry, bamboo grass—a low-value grass growing wild—is woven into mats using simple, foot-powered metal looms. The project has created more than 700 jobs. Negotiations are under way to sell the existing large inventory of grass mats that has accumulated since a marketing contract with a subcontractor fell through.

*Environmental Sanitation Materials Plant:* For the period, January-March, 1988, the Environmental Sanitation Plant's production of cement blocks was 99.8% of target. Overall production of all items—ventilation bricks, cement rings, and lid covers—was 103.5% of target. For the same period, sales were 300% of target, a reflection of the fact that January to April is the construction season for villagers. Discounts were offered to bulk quantity purchasers.

A mid-term evaluation resulted in a major amendment to this project. The new business philosophy will place first priority on commercial viability of any new joint ventures. RSSI will only set up joint ventures with small rural-area based businessmen, who have previous business experience in the particular venture. Expectations are now limited; RSSI is expected to begin three joint ventures a year.



ENVIRONMENTAL SANITATION PLANT manufactures cement blocks and other components used in construction of pour flush latrines.

## REPLICATION PROJECTS

### Mushroom Training, Thailand

#### *Project Partner:*

Kasetsart University Research and Development Institute

#### *Purpose:*

To train 15 participants in the techniques of mushroom production and its commercial application in a small-scale enterprise.

#### *Achievements/Findings:*

Thirteen participants from five Asian countries and Mexico completed a week long training in October, 1987 in commercially producing tropical varieties of mushrooms. The course included instruction in overview theory, taxonomy, morphology, growth and physiology of straw mushrooms, abalone, oyster, shiitake and champignon mushrooms. Business development components necessary to set up and operate a commercially viable enterprise were discussed. *The Manual for Mushroom Production*, which served as the syllabus for the training, will be published to facilitate further replication of this technology.

At the training, the participants prepared preliminary studies to determine the feasibility of small-scale mushroom production in their own countries. Subsequently, five community development organizations in Sri Lanka, India, the Philippines and Mexico submitted business plans for using the technology locally. The participant from the Scitech Centre in India is experimenting with various media suitable to the Indian climate. PRADAN, another Indian organization that sent a participant to the training, introduced mushroom production to 20 cultivators in two villages, who are producing 40 kgs of oyster mushrooms per 45 day cycle.



PRADAN Foundation in India sent a participant to mushroom training workshop in Thailand. Upon returning to India he began experimenting with various media suitable to local climate.



COMMERCIAL MUSHROOM PRODUCTION is one widely replicated enterprise. Here, production workers in demonstration project in the Philippines pound substrate to be used in assembly of spawn bags.

### Wet Coconut Processing, Sri Lanka

With the help of a consultant provided by ATI, a Sri Lankan entrepreneur successfully started a wet coconut processing plant in north Nugegoda. This is the first international replication of the wet coconut processing technology developed under the FFI Small-Scale Industries project in the Philippines.



PRESSING the grated coconut meat expels the coconut milk.

### Wheelchairs, Sri Lanka

After a staff member of the Sarvodaya Shramadana International attended an ATI-sponsored wheelchair production training workshop, the Sarvodaya Shramadana Movement was awarded a UNICEF contract to produce 12 wheelchairs and 25 tricycles for the handicapped each month. Principal purchaser (75% of all sales) is the Department of Social Services of Sri Lanka.

# LATIN AMERICA/CARIBBEAN PROJECTS

## SECTORAL/REGIONAL PROJECTS

### Wool Production and Processing, Guatemala

#### Project Partners:

Fundación Para El Desarrollo Integral de Programas Socioeconómicos (FUNDAP). The project has been funded as a joint venture by ATI and U.S.A.I.D./Guatemala.

#### Purpose:

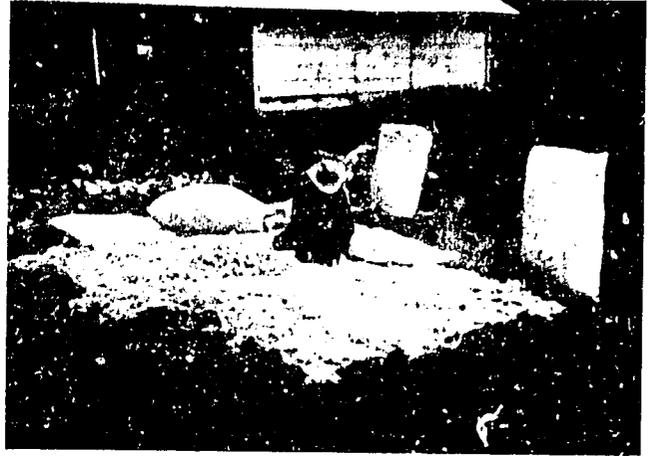
To demonstrate the effectiveness of a system of improved small-scale wool production and processing technologies which will increase the quantity and quality of wool supplied to the weavers of export quality artisanal wool products. The wool products will be marketed through a commercial enterprise owned by the artisans.

#### Expectations:

One thousand Guatemalan highland families who depend on sheep for their livelihood will increase their incomes from the sale of wool \$US 90 to \$US 250 per year. Wool production in the highlands is expected to double; 100 wool spinners will double their output and triple their incomes; 300 weavers will triple their incomes, a result of increased output of export-quality products sold by the new marketing enterprise. In addition, more than 20,000 subsistence farmers who raise sheep in addition to grain will increase their incomes because of the improved sheep and available technology.



HIGH QUALITY CORRIEDALE RAMS from U.S. are being cross-bred with native sheep as first step in improving wool production in Guatemala's highlands.



WOOL CLASSIFICATION system has been introduced by the project. As the wool is sheared, it is separated into four categories.

#### Technology:

Twelve technical assistance centers will be established in the highlands. Through the introduction of improved breeding stock, establishment of artificial insemination technology, selection practices, and improved feed technology, the quality and quantity of the wool obtained from the sheep will be increased. Improved shearing technology, the introduction of a wool classification system and scouring technology will enable farmers to deliver a better product. Drum carders to replace laborious hand carding will be introduced and produced locally. The traditional hand-operated spinning wheel will be modified with a flyer bobbin to enable spinners to increase yarn output. Market assessment and strategy formulation, marketing techniques, and a quality control system will be incorporated into the artisan enterprise.

#### Achievements/Findings:

The first 24 high quality Corriedale rams were shipped to the project to begin the improved breeding process. An annual community event, "The Day of the Ram," was initiated to encourage the community to celebrate and participate in the official initiation of the breeding cycle. Fourteen technical assistance centers have been established. Each contains a meeting facility, a loan fund and a ram bank where artificial insemination can take place and where top quality rams are kept.

Prototype carders and spinning wheels were completed. The flyer bobbin spinning wheel has become very popular with the spinners of the area because it has doubled their productivity. In order to upgrade the quality and quantity of feed for the sheep, 12 new types of alpine grasses and legumes were introduced and tested; the Ruanui, Ariki, Huia and Nui varieties look very promising.

## DEMONSTRATION PROJECTS

### Linares Pump, Latin American Region

*Project Partner:*

Save the Children Federation (SCF), Latin America/Caribbean

*Purpose:*

To transfer the Linares Pump, developed in Colombia, to several Latin American countries, and to test the technology's suitability for supplying water for irrigation, livestock, and domestic uses.

*Expectations:*

A Linares Pump (cost \$US 400) will irrigate one-third of an acre of land at a cost less than that of purchasing irrigated land. At least 320 farmers in 4 countries will visit the 9 Linares Pump test sites for demonstrations. It is anticipated that the project will lead to the establishment of rural-based pump producing enterprises in each country.

*Technology:*

The project will install the Linares Pump, a stream-powered water pumping device originally developed in Ubaque, Colombia, and successfully tested in several other Latin American countries. The pump is an easily disassembled waterwheel with double pistons that operates effectively in streams with depths between .4 and 1 meter and flows of .7 and 1.5 meters per second.

*Achievements/Findings:*

Jesus Linares' pump was awarded first prize for product innovation by the Colombian Association for Small Industries in April 1986. Nine of the 27 pumps manufactured by the Ubaque metalworking shop were shipped to four Latin American countries. Señor Linares trained local teams on site in the assembly and installation of these pumps, which are serving as demonstration centers for local farmers.

During 1987, ATI's involvement focused on an evaluation of the existing technology. As a result of the evaluation, a revised prototype pump was successfully designed and tested. This pump costs less and operates more efficiently than the original pump. Due to increased harvests resulting from available irrigation, farmers are expected to increase their incomes 5-31%. A marketing strategy was developed. Engineering drawings, a brochure, an operating and maintenance manual and an English summary of the technical-economic evaluation produced by the project will help disseminate the technology.

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IMPROVEMENTS in traditional kiln include a refractory brick central vault at the bottom of the shaft, a new set of grates, draft controls, firebox door, discharge chute and chimney.

### Lime Kiln Technology, Costa Rica

*Project Partners:*

Fundación Tecnológica (FUNDATEC)/Instituto Tecnológico de Costa Rica (ITCR), and Cooperativa Nacional de Productores de Cal (COONAPROCAL)

*Purpose:*

To develop and test an improved process for small-scale lime production in the country, using an improved kiln design which should increase the production and quality of lime, and to create a revolving fund to finance the application of the new design in at least 45 lime-producing businesses.

*Expectations:*

More than a thousand people who work in the industry will increase their incomes due to a higher sales volume of good quality lime and direct savings in energy costs from a reduction in the consumption of firewood and imported lime. Results of the project will be documented and disseminated to enable replication of the technology in other parts of Central America and the Caribbean.

*Technology:*

The ITCR will develop and test an innovative kiln design to produce hydrated lime. The design enables continuous production, is thermodynamically efficient (reduces energy losses), and uses the structure of existing shaft kilns. Recommendations will also be made to enhance the hydration procedures to produce high quality lime.

Technical evaluations conducted on a prototype kiln showed that it was not technically feasible to convert a traditional batch kiln to an efficient continuous operating kiln; thus the project was revised substantially to focus on upgrading the traditional lime kiln.



The Revised Technology section now reads:

*Technology:*

ITCR and COONAPROCAL have designed a "modified batch kiln," which allows for better materials handling and discharge, and possibly a more uniform degree of calcination (better output quality) than the traditional kiln. Improved refractory bricks help to reduce heat loss in the kiln.

*Achievements/Findings:*

Improvements made in the traditional kiln include: a refractory brick central vault at the bottom of the shaft, a new set of grates, firebox door, discharge chute and chimney. As a result, heat is distributed more evenly; ash cannot contaminate the quicklime; and workers no longer enter the shaft to discharge quicklime. Environmental and safety conditions have improved. Chemical analyses of quicklime samples from the improved kiln indicate a more uniform quality product. Fuel efficiency in the modified kiln does not appear to be significantly greater, but a better quality lime is produced. Although an experimental mechanized hydration plant was constructed, information on alternative small-scale hydration systems now is being sought. A marketing study indicated that the improved quality lime can successfully compete with imported lime for use in the sugar industry and on coffee plantations. ATI anticipates funding a separate project to disseminate the kiln and hydration technology.

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## **Poultry Improvement Project, Dominican Republic**

*Project Partner:*

Centro de Investigación y Mejoramiento de Producción Animal (CIMPA)

*Purpose:*

To demonstrate the technical and commercial viability of a small-scale (less than 1,000 adult) in-country poultry hatchery and to introduce appropriate rustic poultry production equipment and methods. The project will provide small farmers in the area with greater access to high quality chicks.

*Expectations:*

Women, who traditionally tend the chickens in Dominican Republic farm families, will improve the nutrition of their families by providing eggs and poultry meat. After a trial period to verify the marketability of the products, 540 members of various small farmer associations will be trained in farm level breeding technologies. The expected surplus production will be sold to provide additional income for the family. More than 5,000 farm level poultry breeding operations are expected to be established over a three year period.

*Technology:*

The ATI-CIMPA hatchery will have a capacity of less than 1,000 adult birds which will produce approximately 100,000 chicks per year. For the most part, the hatchery and the equipment will be constructed with locally available materials. The project will import three breeds of day-old dual-purpose (meat and egg) birds of proven adaptability. Farmers will be taught improved flock management practices, including the use of elevated coops. The chickens' diet will be supplemented with prepared feed to roughly 50 percent of their nutritional requirements. Farmers will be trained in simple veterinary skills such as vaccinations and disease detection.

*Achievements/Findings:*

The project began implementation in mid-1988.



*FARMERS in Dominican Republic will be taught improved flock management practices, including use of chicken coops.*

## Swine Feed, Dominican Republic

### *Project Partner:*

Centro de Investigación y Mejoramiento de Producción Animal (CIMPA)

### *Purpose:*

To establish a commercial system to improve the availability of specific feed ingredients and related inputs to small-scale swine producers.

### *Expectations:*

If successful, up to 1,700 farm families engaged in small-scale swine production in the Cibao region of the Dominican Republic will earn an additional \$US 83 per year (average) by lowering their costs of production. Ten local vendors of the supplies such as farmer cooperatives and agricultural supply stores, will each increase their annual net income by approximately \$US 5,000.

### *Technology:*

The project will combine traditional feeds available on the farm with high-protein feed supplements, molasses, ramie (introduced from Asia), veterinary supplies, and appropriate hog raising equipment to enable participants to both lower net feed costs and to increase feed conversion efficiency. Molasses is a by-product of the sugar industry and is the cheapest commercial feed ingredient available in the Dominican Republic. High protein feed supplements are a product of the animal feed industry.

### *Achievements/Findings:*

Fifteen hundred small farm families have thus far increased their incomes by an average of 14%; this far exceeds the original goal to increase the incomes of 1,200 families by 10%. This project was very successful in distributing balanced feed mixes. A final evaluation of the project notes that making balanced feed mixes available locally in quantities farmers can afford has opened up swine production to a wider economic cross-section of the rural population. Furthermore, the non-federate farmers' groups that received loans directly from CIMPA to establish feed businesses have been very successful commercially. For example, the Asociación La Progresista used its \$RD 6,000 loan to generate \$RD 1164 in 8 months—equivalent to an annual return on investment of almost 30%. These profits are used to expand the feed business. Major project accomplishments included establishing 250 mini-outlets to distribute the commercial feed prepared by the associations. The project has proven conclusively that the large exotic pigs, imported after the swine fever eradication program, can be profitably weaned and fattened by large numbers of small-scale farmers using a selection of locally produced feed components. The success of this project has led to successful replications in other regions of the Dominican Republic and in Haiti. ATI's financial involvement in this successful project has now terminated; CIMPA is continuing to expand the project to reach additional beneficiaries.



*SWINE FEED PROJECT in the Dominican Republic proved that large exotic pigs can be profitably weaned and fattened by large numbers of small-scale farmers using a selection of locally produced feed components. Here, a farmer, one of 1500 participating in the project, proudly shows off pig to ATI President Tom de Wilde, Trustee George McRobie, and Marketing Director Irving Rosenthal.*

## Farm Support Enterprises, Mexico

### *Project Partners:*

Centro de Enseñanza, Investigación y Capacitación para el Desarrollo Agrícola Regional (CEICADAR) and Colegio de Postgraduados de Chapingo

### *Purpose:*

To establish 21 rural micro-enterprises in the temperate zones of Mexico. These businesses will provide the equipment, supplies, and services required by small farmers to support improved farm production technologies.

### *Expectations:*

Ten feed distribution enterprises will be established to provide a high-protein feed to small farmers engaged in milk production. Each enterprise will serve an average of 30 farmers, each of whom owns from three to ten milk cows. Six nurseries will provide 28,000 budded certified fruit trees annually to 750 farmers. A medium-sized manufacturer will be contracted to produce 400 animal-drawn corn planters for sale or rental through the project. In addition, two machinery service stations will be established to provide mechanized forage harvesting and processing services to small farmers. Two small cheese production plants will also be established. In total, over 1,000 farmers will increase their incomes through the improved production practices made possible by the sale of necessary inputs. In addition, 48 jobs will be created in rural areas and \$US 82,000 in profits will be generated annually by the 21 micro-enterprises.

### *Technology:*

This project links an effort to develop and disseminate improved farming systems with the rural based enterprises required to sustain these systems. The enterprises to be established by the project are based upon the improved farm production technologies developed by CEICADAR's farming systems group. These production technologies include:

*One-row animal drawn corn planter/fertilizer:* Per season, this planter saves eight days of planting labor per hectare and two days of fertilizing labor compared with hand planting and fertilizing. Fertilizer is more evenly placed and higher plant populations are achieved.



*NURSERIES are providing certified budded fruit trees to farmers.*

*High protein feed for dairy cows:* The Colegio has developed a high protein feed for dairy cows that are usually fed on rations containing a high cornstover content. This feed uses molasses and carriers of nitrogenous waste materials, such as chicken manure, as protein substitutes. The supplement reduces feeding costs by 45 cents per cow per day relative to traditional rations.

### *Achievements/Findings:*

The corn planter has been significantly modified into a multipurpose field tool, called a multibar, with attachments for a reversible plow, a harrow, and a corn planter/fertilizer applicator. The prototype multibar has been modified to increase its efficiency; field tests are now under way.

More than 6,400 fruit trees have been sold; sales are equivalent to 51% of the credit received by the small entrepreneur to start the nursery. Inventory (June 1988) consists of more than 7,200 growing fruit trees, such as apples, peaches, pears, and walnuts; 3,250 pear stakes, and almost 11,000 seedlings.

The dairy feed plant started operations in January 1987. Since then, 193 tons of chicken manure (pollinaza) and 128 tons of molasses were sold. The plant provides feed for 110-120 cows per day. Pilot tests of suggested rations show that dairy cows are either increasing their output of milk or being fed at a reduced cost. Currently, approximately 35 small farmers purchase feed from this enterprise.

The Bank of Mexico, which is managing the project farm support enterprise loan fund, views this project as a banking experiment to determine if small farmers will indeed repay their loans. If the project proves successful, the Bank will encourage commercial banks to make loan funds available to small farmers — thus ensuring the availability of credit, heretofore very difficult for them to obtain.

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## **Annatto Production, Peru**

### *Project Partner:*

Centro Andino Para el Desarrollo-Pachacutec  
(CADER-Pachacutec)

### *Purpose:*

To (1) establish a commercially viable achiote processing plant that produces export-quality annatto food colorant, (2) introduce new techniques for cultivating achiote trees from which annatto is obtained, and (3) introduce a newly developed technology for hulling achiote seeds for processing.

### Expectations:

By the third year of the project, more than 1,800 small farmers in Cuzco will increase their yearly incomes by approximately \$US 150 through a 35% increase in the prices paid for raw achiote seed. By the third year \$US 330,400 in profits will be available for reinvestment and dividend payments to small farmers who are shareholders in the processing plant. The project will create a total of 20 full-time and part-time jobs in the first three years. Reflows from the project will be used to establish a fund to promote subsequent economic development projects with the rural poor in the Cuzco region.

### Technology:

This project introduces an annatto processing technology into the Cuzco region of Peru which will increase the incomes of the rural poor from sales of achiote. Relative to processing plants located in Lima, this plant will benefit from a guaranteed source of raw seed and lower transport costs for seed. In addition, the improved process design allows for an increased extraction efficiency, and an improved filter captures one-third more colorant than existing designs. This is the first attempt in Peru or elsewhere in South America to locate an achiote processing plant in a rural area so that a greater proportion of the benefits accrue directly to the small farmers who grow the seed.



*ANNATTO COLORANT, primarily used in food and cosmetics industries, is final product resulting from processing achiote.*

### Achievements/Findings:

Because of management difficulties the project was amended and project implementation was transferred to a new project partner, Centro Andino Para el Desarrollo - Pachacutec. However, expectations have not changed substantially. The dehuskers, which have been installed in several communities, speed up removal of the achiote husk. The critical element of annatto, the bixin, has been recovered in increasingly higher concentrations, raising the output's market value substantially. Three achiote nurseries have been established — two in the Lares Valley and one in the Quillabamba Valley. A grant from American Jewish World Services for \$US 2,800 financed the self-sustaining tree nursery in the Quillabamba Valley. Several hundred small farmers in the Quillabamba Valley will be additional project beneficiaries. Because they have a ready market for an increasingly valuable crop, some of the co-op members are devoting more of their arable land to achiote production. ATI's participation in this project led to a loan for \$US 866,000 from the Agrarian Bank of Peru to our project partners; this will finance loans to small farmers for planting and cultivating the improved annatto varieties.

Revised Expectations now are:

### Expectations:

Eighteen hundred small farmers in Cuzco are expected to increase their yearly incomes by \$US 100 to \$US 150 through higher prices they will receive for raw seed and through yearly dividends paid to members of the cooperative (CAL). Ten full-time jobs will be created. An industrial plant will be established which will process 480,000 kgs of achiote seeds per year, resulting in production of 24,000 kgs of export quality annatto food colorant per year. Reflows from the project will be used to establish a fund to promote subsequent economic development projects among the Cuzco rural poor.



*THREE ACHIOTE nurseries have been established under ATI's Annatto Processing project, one financed by American Jewish World Services.*

## Placer Mining Equipment, Peru

### *Project Partner:*

Programa de Innovaciones y Aplicaciones de Tecnología Apropriada (PIAT)

### *Purpose:*

To introduce new ore processing technologies for recovering minerals and to improve the mining infrastructure of the Mining Cooperative Santiago de Ananea.

### *Expectations:*

The mining cooperative will process five times its present capacity of ore per day. The 65 members of the mining association will increase their incomes by an average \$US 225 per year from increased wage payments and dividends. The project will also create up to 60 new mining jobs within the Cooperative. CEDCA will establish a Technology Assistance Fund, comprised of an information center and loan fund, to help disseminate mineral processing technologies and to assist small-scale miners in Southern Peru to purchase new mining equipment.

### *Technology:*

This project will employ trommels, sluices, riffles, and monitors. The equipment, initially developed in the United States, has been adapted to meet the specific requirements of the project area. The small-scale trommels will be the first to be adapted for use by small-scale mining concerns and introduced for commercial application in Peru. Small-scale monitors and riffles will be significantly improved over existing models. The improved processing technology will increase the mineral recovery rate from 60% to 90% and increase the daily throughput fivefold. Improvements will also be made in the Cooperative's hydrological infrastructure. This technological package will be tested and disseminated to other parts of Peru.

### *Achievements/Findings:*

Monthly income for each member of the mining cooperative (52 members) has increased from \$US 33 per month (120 grams monthly yield) to \$US 246 per month (900 grams monthly yield). The miners plan to purchase a new tractor with the profits from the increased production. The tractor will be used in feeding trommels and is expected to increase production with resultant increases in income of an additional 30-50%. The recovery rate at the first mine has increased between six and ten times, doubling the value of the shares held by the mining co-op members. Much of the proceeds have been reinvested in additional equipment to expand the site and a larger mining concession has been granted by the Government Ministry. The project was also granted an exemption from the law which states that after a certain time period gold has to be converted into local currency, which is constantly being devalued. Now the co-op members can keep their gold in a safe deposit box and thus maintain the value of their earnings.



*MINERS, members of a mining cooperative, have increased their incomes from \$44 per month to \$246 per month because of their participation in Placer Mining project in Peru.*

## Potato-Based Foods, Peru

### *Project Partner:*

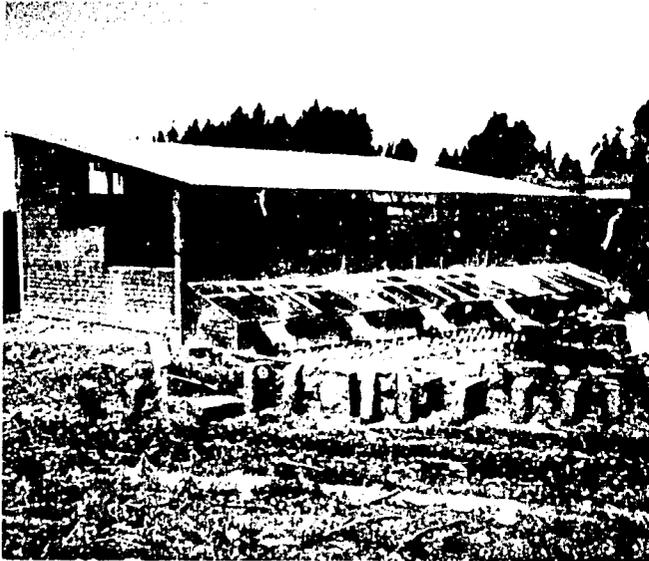
Centro Ideas

### *Purpose:*

To demonstrate that it is commercially and technically feasible for small-scale rural enterprises to produce potato-based foods for low-income urban consumers.

### *Expectations:*

Four processing plants which produce a variety of potato-based foods will be established in rural areas. Using production levels established during the first three years of operation, each plant will generate profits of approximately \$US 11,000 by adding value to potatoes and other agricultural products such as barley, broad beans, corn, wheat, and quinoa. Introduction of potato-based products into the diets of low income urban residents will deliver substantial nutritional benefits at a lower cost than alternative sources. The project will



*SOLAR DRYING is one component of pilot potato processing plant in Huancayo.*

enable low income urban consumers to save approximately \$US 332,000 by purchasing potato-based foods in place of comparable substitutes. Forty-eight new jobs will be created in rural areas. In addition, the project will increase the incomes of 120 producers of potatoes and grains by approximately \$US 97 a year by providing guaranteed, easily accessible markets for their products and by reducing transport costs.

#### *Technology:*

The project will introduce commercial potato processing technologies to different regions of Peru. The specific technology, which combines the processing of potatoes with other grains and legumes, was developed by the Centro Internacional de la Papa (CIP). CIP simplified the processing equipment while maintaining efficiencies and reducing investment costs. The basic potato-based food to be produced is known as the M-6 formula. This product has a high protein and calorie content, supplying up to one-third of the major nutrients required daily by children. This dehydrated product can be used in the preparation of puddings, desserts, soups, stews, and beverages.

#### *Achievements/Findings:*

The pilot plant at Huancayo was established, equipment installed, and test runs are being conducted. Following extensive taste tests, a variety of final products and recipes were selected. Dehydrated potato slices were added to the product line. Marketing of products was begun. Neighboring rural communities were incorporated into the raw materials supply system.

## **REPLICATION PROJECTS**

### **Wheelchair Production, Latin American Region**

#### *Project Partners:*

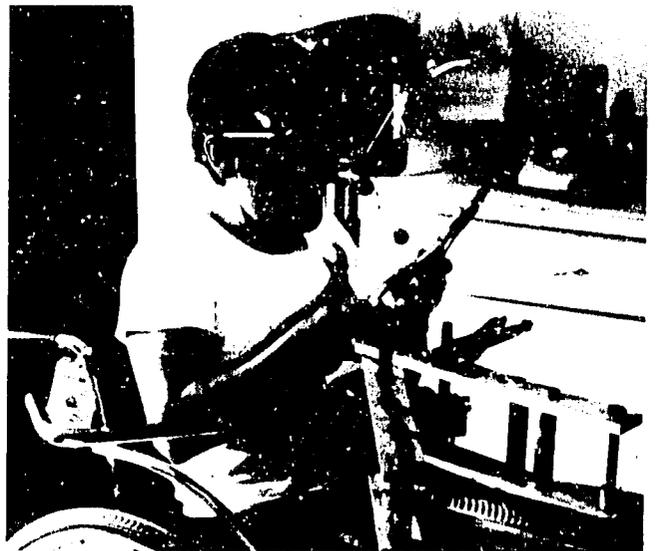
Fundación Carvajal (Colombia); Fundación Hondureña de Rehabilitación e Integración del Limitado (Honduras); Centro de Rehabilitación Vocacional (Guatemala); Programa de Ayuda a Pequeñas Empresas (Dominican Republic), CIPDEL (Peru); Ralf Hotchkiss & Associates (USA)

#### *Purpose:*

To assist small-scale enterprises in Peru, Colombia, Guatemala, Honduras and the Dominican Republic to commercially produce a wheelchair adapted to rural conditions in developing countries.

#### *Expectations:*

This project will establish at least 12 small-scale wheelchair production enterprises in 5 countries. Each workshop will have a production capacity of 100 to 300 chairs per year. Collective annual production capacity will total at least 2,500 wheelchairs. Lines of credit will be extended to rehabilitation institutes to enable them to sell ATI/Hotchkiss wheelchairs to the poor.



*WORKSHOPS that manufacture the ATI-Hotchkiss wheelchair are operating on three continents. ATI provides a production manual, training, and a standardized tooling set of jigs and dies to ensure quality control and standardization of the product.*

### *Technology:*

The Hotchkiss design, developed under an earlier ATI grant and subsequently field-tested throughout Latin America and the Philippines, results in a very lightweight, durable, folding wheelchair that is well-balanced and adaptable to individual fittings. The chair can be manufactured in small metalworking shops from locally available materials. A production manual and a standardized tooling set for wheelchair production were designed to facilitate widespread dissemination of the technology and to ensure quality control and standardization of the product.

### *Achievements/Findings:*

Ten small-scale wheelchair production enterprises have been established in five countries in Latin America. This project has been replicated in Sri Lanka, the Philippines and Zimbabwe and small-scale production facilities are expected to be established worldwide.

*Colombia:* Three producers in Colombia are fabricating a total of 40 chairs a month. Fundación Carvajal, the implementing organization, has established a consumer credit fund to enable wheelchair users to purchase the chairs; 167 wheelchairs were sold through this fund in 1987. Aggressive marketing resulted in public contributions to fund the purchase of some chairs for handicapped individuals. Fundación Carvajal has exported chairs to handicapped organizations and is looking for opportunities to expand its export sales in Latin America.

*Peru:* The project was turned over to a new implementing organization, CIPDEL, which is undertaking a market study to explore new possibilities for sales in the Lima area. CIPDEL is actively setting up and overseeing a total of four Peruvian workshops, and is developing a multimedia promotion package. They have modified the braking system in the model wheelchair to make it more maneuverable. In conjunction with the Credit Cooperative Center, CIPDEL is operating a credit program for consumers; for each \$US 1,000 ATI contributes to a revolving loan fund, CCC contributes \$US 4,000. The average price for a chair is approximately \$US 200.

An entrepreneur in the Dominican Republic who only received training from ATI has financed a small production facility. Smaller projects in Guatemala and Honduras will continue to produce in accordance with market needs.

Spanish and English versions of the wheelchair manual, *Independence Through Mobility*, by Ralf Hotchkiss, are now in print.

## **Swine Feed, Haiti**

U.S.A.I.D./Haiti hired the technical manager of the ATI project in the Dominican Republic to work with small-scale farmers in Haiti to replicate the Swine Feed project there.

## **New Replication Efforts**

In February 1988, to further efforts to transfer technologies internationally (replication), ATI contracted with Socially Appropriate Technology International Information Services (SATIS), a worldwide network of organizations based in the Netherlands, which promotes economic and social improvement in rural and marginal urban areas. SATIS has more than 70 members in 40 countries. Their database of more than 3,000 user groups in 140 countries further expands their capacity to reach potential replication agents.

SATIS will assist ATI to identify and link appropriate organizations that have a serious interest in the replication of the innovative elements of the technologies developed and tested in ATI demonstration projects. SATIS will also assist in the organization of two seminars, each highlighting an ATI-supported technology.

Within ATI, a newly created Replication Working Group is working with the regional programs to identify successful ATI-supported technologies. A database has been developed and implemented which will, on a bimonthly basis, report on the replication activities in each region. The Working Group has established guidelines for the production of Project Profiles which will provide interested organizations and individuals with an overview of each project and its innovative elements. Ad hoc committees will decide on the most appropriate strategy to replicate each successful technology. Technology manuals and computer video training programs will be produced accordingly.

# Companion Ordering Agreement

To make ATI's knowledge and expertise in appropriate technology, choice of technology, transfer of technology, and small-scale enterprise development more readily available to A.I.D. field Missions and other A.I.D. offices, A.I.D. has signed a Companion Ordering Agreement with ATI. This agreement—similar to an IQC—enables A.I.D. units to contract for ATI's services on an expeditious and non-competitive basis.

## Available Services

Under the Companion Ordering Agreement, A.I.D. Missions may request a Technical Services Order for such specific tasks as:

- Sector assessments
- Policy studies
- Project identification, analysis, design and monitoring
- Project implementation, including technical assistance
- Developing training materials for appropriate technologies
- Evaluation of programs and projects and design of evaluation methods
- Design and development of micro-enterprises and/or micro-credit.

## Companion Ordering Agreement Contracts

### Coconut Processing, South Pacific

#### *Work Performed For:*

U.S.A.I.D. Regional Development Office, South Pacific (Suva, Fiji)

#### *Purpose:*

To determine the feasibility, based on market, raw materials, logistics/transportation, social, cultural, political, financial, and economic analyses, of establishing an integrated regional coconut processing venture to produce high value products for the export market.

#### *Expectations:*

To create a new, significant, and stable market for coconut growers, including small landholders, throughout the South Pacific Region; to foster new employment opportunities; to increase foreign exchange earnings; and to establish a manufacturing facility for designated coconut products which can compete in the world export market. Establishing a regional facility should lead to the development of a wide range of small, cottage industries and pre-processing facilities in participating countries, involving, for example, harvesting, husking, oil extraction, and processing.



*WET COCONUT PROCESSING experience in Philippines and Sri Lanka will prove useful in South Pacific.*

#### *Scope of Work:*

The South Pacific coconut industry requested the help of U.S.A.I.D./Fiji in directing the industry away from the very competitive, low profit copra processing/coconut oil/soap operations. The study will be conducted in two phases. Phase I will consist of gathering and analyzing information on the local coconut industry, product identification, market analysis of products identified, a survey of existing facilities, a search for new processing technologies and approximation of costs, all leading to a recommended project option and optimal project location. If justified, a detailed feasibility study including the design and appraisal of the approved investment option will be undertaken in Phase II. Probable sources of financing also will be identified. Glenn Patterson, the agro-industry food technology advisor, is leader of the 8 person team, comprised of ATI staff and consultants. The study will begin in October 1988.

# Mini-Grants Support Project Development

Mini-grants—small grants for amounts of less than \$5,000—play an important role in ATI's development process. Before ATI commits itself to supporting a major development project, it often uses these small grants to determine the economic, commercial and technical feasibility of a particular appropriate technology. Mini-grants may be used to manufacture a prototype, to test and evaluate a particular technology, to determine the need, potential market and/or applicability of the technology, and to collect both financial and socio-economic data relevant to a current technology. Sometimes, although a technology has proven commercially viable in a particular geographic region, ATI requires an assessment of the technology's applicability in another locale proposed as a replication site. Finally, ATI issues mini-grants to support workshops to assess interim and final results of a specific project, to further refine or alter technology within an already funded project, and to support short-term technical and/or managerial assistance.

A brief description of selected mini-grants issued during the last year follows:

## **Centre Canadien d'Etude et de Coopération Internationale, Senegal, \$5,000**

*Purpose:* To collect technical, financial, and socioeconomic data on current operations of multiblade windmills in Senegal.

In early 1983, 200 multiblade windmills were installed in Senegal, financed by the Government of Argentina. These windmills were to have provided drinking water for 10,000 people and more than 40,000 head of livestock—cattle, goats, and camels—as well as irrigate vegetable gardens and seedlings for reforestation. Due to lack of maintenance and repair, this potential never was achieved.

The multiblade windmill appears to be an appropriate technology, given the wind pattern and low-lying lands in Senegal. The study determined that a windmill maintenance and repair service would be commercially viable and

recommended that development include creation of regional repair shops, a central parts depot, and a training program for the repairmen. This project plan is expected to be developed during the latter part of 1988.

## **FOCIDI, Zaire, \$4,900**

*Purpose:* To investigate the technical and commercial feasibility of replicating ATI's improved palm oil press technology (the Caltech Press from APICA/Cameroon) in Eastern Zaire.

Results of market research indicate that the outlook for small-scale palm oil processing is favorable in Zaire. Traditional production methods are unable to meet demand in the rapidly growing towns and market villages. The price differential between palm fruit and processed oil is high and increasing. The vertical axis Caltech press seems to hold the most promise for Zaire because it does not need imported parts. A vertical axis Caltech press from Cameroon will be shipped to Zaire for market testing as the first step in a longer-term project to locally manufacture and sell the Caltech press.

## **Société du Domaine Industriel de Ziguinchor (SODIZI), Senegal, \$2,350**

*Purpose:* To manufacture and test prototype equipment for dehulling and grinding that is efficient and inexpensive enough to be affordable to households or small groups.

A first generation twin-roller palm kernel dehuller/grinder and an impact dehuller for rice and palm kernels were developed.

## **Asociación de los Nuevos Alquimistas (ANAI), Costa Rica, \$4,000**

*Purpose:* To provide support in the overall coordination, baseline data gathering activities, and market analysis required for the development of a project on Tropical Products Processing in Talamanca, Costa Rica.

This regional development plan calls for the introduction of a tropical fruit processing plant and a multi-purpose drying facility (for the fermenta-

tion and drying of cacao) and for drying vanilla, black pepper, and ginger. These activities are expected to increase the income of small farmers in the Talamanca Region of Costa Rica, an area long neglected in the development process.

Two consultancies have been financed under the mini-grant to ANAI. One consultant is designing a multi-purpose cacao dryer; the second is analyzing the market, production, economic benefits and organizational aspects of the project. ANAI has designed a survey to collect baseline agricultural production data and socio-economic information on Talamanca's small farmers. Information collected under the mini-grant will be incorporated in the project plan being prepared for presentation to the PRAC in October, 1988.

## **Compatible Technology, Inc., India, \$2,000**

*Purpose:* To conduct a commercial analysis and market assessment used in designing the Integrated Potato Processing Technologies project.

Information provided indicated that a large market for stored potatoes and potato chips exists in urban areas near the project site. Institutions such as hospitals, prisons, and the military constitute a potentially large market for potato powder.

## **IREC, Sri Lanka, \$5,000**

*Purpose:* Planning grant to collect and analyze data for the prospective Common Property Resources Use and Management project.

Medicinal herbs from uncultivated and wild land and shrimp produced in lagoons by villagers are examples of common property resources identified in the project area which may be developed to generate employment and income. Studies will identify the volume and value of various medicinal herbs and potential markets for these herbs. The technological and economic aspects of small-scale prawn farming are being explored in four lagoon-based villages.

# Appropriate Technology International

## Publications and Videos

### BOOKS

#### Macro-Policies for Appropriate Technology in Developing Countries

Frances Stewart, editor (consultant)  
Westview Press, 1987 \$29.85  
(plus \$2.50 postage)

#### Independence Through Mobility: A Guide to the Manufacture of the ATI-Hotchkiss Wheelchair

Ralf Hotchkiss (consultant)  
ATI, 1985 \$15.00

### WORKING PAPERS

#### The Range of Choice in Oil Processing Technologies for Cameroon

Eric L. Hyman  
ATI, May 1988 \$5.00

#### Technology, Scale, and the Coconut Industry in the Philippines

Eric L. Hyman  
ATI, April 1988 \$5.00

#### Constructing a Punch Press for Small-Scale Manufacture of Crossflow Turbines

Carl N. Bielenberg (consultant)  
ATI, March 1988 \$5.00

#### An Engineering Analysis of Three Manually Operated Sunflower Seed Oil Presses Manufactured in Tanzania

Martin J. Fisher (consultant)  
ATI, March 1988 \$5.00

#### The New Plant Biotechnologies and Rural Poverty in the Third World

Steen Joffe and Martin Greeley (consultants)  
ATI, 1987 \$5.00

#### ATI Brickmaking Projects in Three African Countries

Carlos R. Lola  
ATI, 1987 \$3.00

#### Reorienting Export Production to Benefit Rural Producers: Annatto Processing in Peru

Eric L. Hyman and John P. Skibiak  
ATI, 1986 \$2.00

#### ATI and the Experience of Clay Brick Manufacture in Three African Countries: Production by the Masses or For the Masses

Raphael Kaplinsky (consultant)  
ATI, 1986 \$5.00

#### Change in Economy of Scale: The Implications for Appropriate Technology

Raphael Kaplinsky (consultant)  
ATI, 1986 \$5.00

#### The Experience of Mini-Cement: What are the Lessons for the A.T. Movement?

Raphael Kaplinsky (consultant)  
ATI, 1986 \$5.00

#### The Experience with Improved Charcoal and Wood Stoves for Households and Institutions in Kenya

Eric L. Hyman  
ATI, 1985 \$9.50

#### Upgrading Traditional Rural Technologies

Jeffrey James (consultant)  
ATI, 1985 \$5.50

#### High Impact Appropriate Technology Case Studies

Thomas Fricke  
ATI, 1984 \$5.00

#### Wheelchairs for the Third World

Ralf Hotchkiss, et al. (consultant)  
ATI, 1984 \$1.50

#### ADAUA Earthen Construction Techniques

Carlos R. Lola  
ATI, 1983 \$1.50

#### Macro-Policies for Appropriate Technology: An Introductory Classification

Frances Stewart (consultant)  
ATI, 1983 \$3.00

(A shortened version of this paper was published in the International Labour Review, 122, June 1983.)

#### Manual for Commercial Analysis of Small-Scale Projects

Henry R. Jackelen  
ATI, 1983 \$6.50

### MACRO-POLICY PAPERS

[Macro-Policy Papers are available for \$5.00 each.]

#### Appropriate Technology and Rural Industrial Development in Bangladesh: The Macro-Context

Q. Ahmad (consultant)  
ATI, 1988

#### Changes in Small-Farm Rice Threshing Technology in Thailand and the Philippines

Bart Duff (consultant)  
ATI, 1988

#### Government Policies and the Potential for Adoption of Appropriate Technologies: Three Examples from A.T. International's Experience in Africa

Eric Hyman  
ATI, 1988

#### How Economic Policies in Zimbabwe Have Affected Technology Choice and Industrial Development

Daniel B. Nedela  
ATI, 1988

#### Impact of Macro and Micro Socio-Economic Factors on the Introduction of Appropriate Technology: The Case of Zaire

Ryzsard Piasacki (consultant)  
ATI, 1988

#### Macro and Micro-Policies Affecting Technology Choice and Development in Nigeria

E.J. Chuta (consultant)  
ATI, 1988

#### Macro-Policies and Technology Choice in the Philippines

Romeo Bautista (consultant)  
ATI, 1988

#### Macro-Policies for Appropriate Technology: The Case of Kenya

Calestous Juma and Peter Coughlin (consultants)  
ATI, 1988

#### Macro-Policies for Appropriate Technology: The Case of Tanzania

Sam Wange (consultant)  
ATI, 1988

**Macro-Policies for Appropriate Technology: Case Studies in Thailand**  
Mingsurn Santikarn (consultant)  
ATI, 1988

## TECHNOLOGY APPRAISAL REPORTS

*[Technology Appraisal reports are available for \$5.00 each.]*

**Ram-Type Manual Oil Press**  
Carl Bielenberg, ATI, 1986

**Unconventional Refrigeration**  
Carl Bielenberg, ATI, 1986

**Fibre-Reinforced Concrete Roofing Sheets: Technology Appraisal Report**  
Carlos R. Lola, ATI, 1985

**Mini-Cement Technology: Appraisal Report of the ATDA Mini-Cement Project**  
Marshall Bear (ATI), Frank Almond (ITDG), and Harro Taubmann (consultant), ATI, 1985

## GENERAL INFORMATION

**Reaching the Poor Majority via Technology Transfer and Micro-Credit: Proceedings of the Forum on Appropriate Technology for Small Enterprise Development**  
Arleen Richman, editor  
April 1988

**ATI Mandate**  
An informational brochure describing the Companion Ordering Agreement  
April 1988

**What is ATI?**  
An informational brochure in English, French and Spanish  
March 1987

**Appropriate Technology for Small Enterprise Development**  
Appropriate Technology International, Report 1984-1987

**Technology for Small-Scale Industry**  
Appropriate Technology International, Annual Report, 1985

**Appropriate Technology as a Strategy for Development**  
Appropriate Technology International, Annual Report, 1984

## APPROPRIATE TECHNOLOGY BULLETIN

The *Appropriate Technology Bulletin* reports on the design, technology focus, and implementation of individual ATI field projects. The Bulletin is published four times per year and distributed free of charge. Titles to date include:

- No. 1. Palm Oil Extraction in Cameroon  
June 1984  
[PLEASE NOTE: This Bulletin is out of print, but has been updated by Bulletin No. 14.]
- No. 2. Delivery of Appropriate Technology: Venture Capital in Indonesia  
July 1984
- No. 3. Improved Design for Lime Kilns in Central America  
October 1984
- No. 4. Protein Enriched Cassava for Pig Feed in Thailand  
January 1985
- No. 5. Annatto Production in Peru  
November 1985
- No. 6. Shea Butter Extraction in Mali  
November 1985
- No. 7. Potato Based Food Products in Peru  
December 1986
- No. 8. Improved Charcoal Stoves (Jikos) in Kenya  
February 1987
- No. 9. Upgrading Small-Scale Brickmaking in Botswana  
March 1987
- No. 10. Village Coconut Processing in the Philippines  
May/June 1987
- No. 11. Mushroom Growing in the Philippines  
August 1987

- No. 12. Adapted Maize Mill Production in Cameroon  
November 1987
- No. 13. Wool Products Processing in Guatemala  
February 1988
- No. 14. Palm Oil Extraction in Cameroon  
May 1988  
[Updates Bulletin No. 1.]

## OTHER PUBLISHED WORKS BY ATI STAFF

**Mushroom Enterprise Spawns Opportunity for Filipino Rural Poor**  
Arleen Richman  
*Front Lines*, (U.S.A.I.D.) May 1988

**The Strategy of Decentralized Production and Distribution of Improved Charcoal Stoves in Kenya**  
Eric L. Hyman  
*In Sustainable Resource Development in the Third World*, edited by Douglas Southgate and John Disinger, Boulder, Co., Westview Press, 1987: 151-157

**New Supplements for Swine Boost Profits**  
Arleen Richman  
*Front Lines*, (U.S.A.I.D.) October 1987

**The Identification of Appropriate Technologies for Rural Development**  
Eric L. Hyman  
*Impact Assessment Bulletin*, Vol. 5, No. 3, 1987

**Comparative Merits of Ferrocement as a Substitute for Wood in Fishing Boats**  
Eric L. Hyman  
*Materials and Society Journal*, Vol. 11, No. 2, 1987

**A Pressing Need for Bricks**  
Carlos R. Lola (contributor)  
*African Technical Review*, March 1987

**The Strategy of Decentralized Production and Distribution of Improved Charcoal Stoves in Kenya**  
Eric L. Hyman  
*World Development*, Vol. 15, No. 3, March 1987

**Quality Assurance Requirements for Foods Intended for Export to the USA**

John J. Slavics  
*Sustain Notes*, Vol. 1, No. 2, Fall 1986

**Wheelchair Benefits Third World Disabled**

Arleen Richman  
*Front Lines* (U.S.A.I.D.), August 1986

**AID Grant Helps Create Self-Employment for Indians**

Arleen Richman  
*Front Lines* (U.S.A.I.D.), June 1986

**AID Funding Benefits Indian Craftsmen**

Arleen Richman  
*Front Lines* (U.S.A.I.D.), May 1986

**The Economics of Improved Charcoal Stoves in Kenya**

Eric L. Hyman  
*Energy Policy*, April 1986

**PAPERS PRESENTED BY ATI STAFF**

**The Role of Appropriate Technology in the Development of Science and Technology in Latin America in the 1990s**

Ton de Wilde  
Paper presented at the CONICIT Conference, San Jose, Costa Rica, March 5, 1988

**Upgrading Traditional Lime Kilns in LDCs**

Carlos R. Lola  
Paper presented at the Project Identification Meeting on Local Building Materials, Nairobi, Kenya, December 8-11, 1987

**Technology Indicators of Use for Developing Countries**

Jack Croucher  
Paper presented at the Workshop on Indicators of International Technology Transfer and Flows, Evanston, Illinois, June 22-25, 1987

**Narrowing the Gap between Research and Production**

Carlos R. Lola  
Paper presented at the Conference on Appropriate Technologies for Building in the Third World, Berlin, West Germany, June 10-12, 1987

**Technology Transfer and Sharing Mechanisms: Small is Powerful**

Ton de Wilde  
Presented by Paul Bundick at the Enterprise and Entrepreneurship Development Conference, Technonet, Manila, Philippines, February 1987

**Upgrading Traditional Food Processing Technologies in Africa**

John J. Slavics  
Paper presented at FAO Conference, Arusha, Tanzania, November 7, 1986

**Fibre-Reinforced Concrete Roofing Sheets**

Carlos R. Lola  
Paper presented at the Congress on Advanced Building Technology, Rotterdam, The Netherlands, September 1986

**Appropriate Technology as a Strategy of Development for Rural Areas in Developing Countries**

Eric L. Hyman  
Paper presented at the American Planning Association Conference, Los Angeles, CA, April 1986

**The Strategy of Decentralized Production and Distribution of Improved Charcoal Stoves in Kenya**

Eric L. Hyman  
Presented at the Conference on Sustainable Development of Natural Resources in the Third World, Columbus, OH, Ohio State University, September 1985

**ATI's Projects, Purposes and Technologies**

Ton de Wilde  
Presented before BOSTID's Advisory Board, April 1985

**FILM AND VIDEO**

[All videos are available for \$35.00]

**Small Is Powerful**

A 30-minute documentary which depicts specific projects in Africa, Asia, Latin America and the Caribbean. The film is available in English, French or Spanish in 16 mm, VHS, and PAL formats. A study guide pointing out the facts and achievements of the projects is also available. A ten-minute overview version of the film is available in English

**Ya Pek**

English (15:00 min.)  
Thai (15:00 min.)

A documentary that shows the fabrication of bamboo reinforced water tanks in Thailand

**Los Hornos de Cal**

Spanish (15:00 min.)

Description of lime kiln project in Costa Rica

**Village Coconut Processing**

English (28:00 min.)

Description of village level coconut processing in the Philippines

**Mushroom Growing in the Philippines**

English (35:00 min.)

Examines the mushroom growing project in the Philippines which is a part of the FFI-ATI Rural Small-Scale Industries Program

**Caltech Palm Oil Presses in Cameroon**

English (12:00 min.)

Documentary that examines the innovative Caltech press for palm oil processing

*Price Waterhouse*



February 29, 1988

To the Board of Trustees of  
A. T. International:

In our opinion, the accompanying balance sheet and the related statements of revenues, expenses and changes in fund balance and of functional expenses present fairly the financial position of A. T. International at December 31, 1987, and the results of its operations and changes in its fund balance for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year. Our examination of these statements was made in accordance with generally accepted auditing standards and the standards for financial and compliance audits contained in the U.S. General Accounting Office *Standards for Audit of Governmental Organizations, Programs, Activities and Functions* (1981 Revision) issued by the Comptroller General of the United States and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. The financial statements of A. T. International for the year ended December 31, 1986 were examined by other independent accountants whose report dated February 27, 1987 expressed an unqualified opinion on those statements.

*Price Waterhouse*

**A. T. INTERNATIONAL**  
**Balance Sheet**

	December 31,	
	1987	1986
<b>ASSETS</b>		
Cash	\$ 47,321	\$ 69,662
Grants receivable (Note 2)	4,205,325	4,458,295
Fixed assets at cost less accumulated depreciation and amortization of \$194,375 and \$174,641 (Notes 2 and 5)	130,339	188,911
Advances	21,463	17,085
Deposits	15,520	16,054
Other	37,169	40,907
	<u>\$4,457,137</u>	<u>\$4,790,914</u>
<b>LIABILITIES AND FUND BALANCE</b>		
Accounts payable and accrued expenses	\$ 200,064	\$ 65,894
Grants payable (Notes 2 and 4)	3,164,805	3,791,117
Deferred grant revenue (Notes 2, 3 and 5)	1,090,558	932,193
	<u>4,455,427</u>	<u>\$4,789,204</u>
Commitments (Note 7)		
Fund balance	1,710	1,710
	<u>\$4,457,137</u>	<u>\$4,790,914</u>

The accompanying notes are an integral part of these financial statements.

**A. T. INTERNATIONAL**  
**Statements of Revenues, Expenses and Changes in Fund Balance**

	Years Ended December 31,	
	1987	1986
Revenues - AID grants (Note 3)	\$2,883,865	\$3,340,162
Expenses		
Services to the field		
Financial assistance (Note 4)		
Agricultural product processing	(125,535)	824,251
Local mineral resources	(123,780)	(156,485)
Equipment and support for small farms	215,781	(61,896)
Other	58,882	57,021
	<u>25,348</u>	<u>662,891</u>
Project development and monitoring	646,272	684,060
Technical and evaluation services	367,218	334,057
Other project support	194,886	220,213
	<u>1,233,724</u>	<u>1,901,221</u>
Policy and information services	209,893	234,726
Replication and other program support	153,058	279,688
	<u>1,596,675</u>	<u>2,415,635</u>
Supporting services		
Unrestricted funds		70
General and administrative	1,287,190	924,157
	<u>1,287,190</u>	<u>924,157</u>
Total expenses	<u>2,883,865</u>	<u>3,340,162</u>
Fund balance, beginning of year	1,710	1,710
Fund balance, end of year	<u>\$ 1,710</u>	<u>\$ 1,710</u>

The accompanying notes are an integral part of these financial statements.

**APPROPRIATE TECHNOLOGY INTERNATIONAL**  
**Statement of Functional Expenses**  
**For the year ended December 31, 1987**  
**(with comparative totals for 1986)**

	Program Services							General & Administrative	1987 Total	1986 Total	
	Financial Assistance	Project Development & Monitoring	Technical & Evaluation Services	Other Project Support	Total Services To The Field	Policy & Information Services	Replication and Other Program Support				Total Program Services
<b>Financial Assistance</b>											
Field operations	\$ (3,202)	—	—	—	\$ (3,202)	—	—	—	\$ (3,202)	\$ 670,998	
Policy	28,550	—	—	—	28,550	—	—	—	28,550	(8,107)	
<b>Total financial assistance</b>	<u>25,348</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>25,348</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>25,348</u>	<u>662,891</u>	
<b>Operating expenses</b>											
Salaries	—	\$299,679	\$173,568	\$146,072	619,319	\$116,055	\$83,634	\$199,689	\$ 322,206	1,141,214	1,157,112
Benefits	—	79,615	44,455	31,592	155,662	31,529	17,557	49,086	60,683	265,431	227,180
Consultants	—	35,165	70,042	824	106,031	1,487	6,608	8,095	84,020	198,146	133,560
Travel	—	191,558	66,106	6,088	263,752	40,891	35,042	75,933	48,075	387,760	401,540
Occupancy costs (Note 7)	—	—	—	—	—	—	—	—	268,597	268,597	192,215
Communication	—	336	—	—	336	—	51	51	89,655	90,042	107,774
Materials and supplies	—	—	—	—	—	—	—	—	18,909	18,909	19,313
Copying and printing	—	—	—	—	—	4,759	—	4,759	53,826	58,585	45,874
Publications	—	64	—	—	64	7,724	—	7,724	13,106	20,894	13,679
Recruitment and relocation	—	—	—	—	—	—	—	—	27,051	27,051	12,822
Professional services	—	410	—	—	410	—	4,061	4,061	106,247	110,718	114,964
Insurance	—	21,305	12,174	9,974	43,453	7,406	5,402	12,808	58,430	114,691	116,932
Miscellaneous	—	1,278	61	299	1,638	—	397	397	30,809	32,444	17,280
Equipment maintenance and rental	—	—	—	—	—	—	—	—	38,735	38,735	65,376
Depreciation	—	—	—	—	—	—	—	—	49,458	49,458	51,580
Manila Office	—	16,862	812	37	17,711	42	306	348	17,383	35,442	—
<b>Total operating expenses</b>	<u>—</u>	<u>646,272</u>	<u>367,218</u>	<u>194,886</u>	<u>1,208,376</u>	<u>209,893</u>	<u>153,058</u>	<u>362,951</u>	<u>1,287,190</u>	<u>2,858,517</u>	<u>2,677,201</u>
<b>Total expenses</b>	<u>\$ 25,348</u>	<u>\$646,272</u>	<u>\$367,218</u>	<u>\$194,886</u>	<u>\$1,233,724</u>	<u>\$209,893</u>	<u>\$153,058</u>	<u>\$362,951</u>	<u>\$1,287,190</u>	<u>\$2,883,865</u>	<u>\$3,340,092</u>
<b>1986 Total expenses</b>	<u>\$662,891</u>	<u>\$684,060</u>	<u>\$334,057</u>	<u>\$220,213</u>	<u>\$1,238,330</u>	<u>\$234,726</u>	<u>\$279,688</u>	<u>\$514,414</u>	<u>\$ 924,457</u>	<u>\$3,340,092</u>	

The accompanying notes are an integral part of these financial statements.

**A. T. INTERNATIONAL**  
**Notes to Financial Statements**  
**December 31, 1987**

**Note 1 - Organization**

A. T. International (the Organization) was incorporated on December 10, 1976 as a private, nonmembership, nonprofit corporation. Since its inception, the Organization has been awarded grants totaling \$43,066,395, of which \$2,990,000 was awarded in 1987, by the Agency for International Development (AID), under Section 107 of the Foreign Assistance Act of 1961, for the development and dissemination of technologies appropriate for developing countries. The Organization's current funding award from AID extends through September 30, 1988 and provides additional funding of \$3,394,000 pending its availability and mutual agreement with AID. Since 1980 the Organization has also been awarded grants from various other enterprises totaling \$241,533 of which \$53,421 was awarded in 1987 to be obligated to existing projects.

The Organization is exempt from Federal income taxes under Section 501(c)(3) of the Internal Revenue Code.

**Note 2 - Summary of Significant Accounting Policies**

*Basis of Accounting*

The Organization records revenues and expenses in conformity with the accrual basis of accounting.

*Grants Receivable*

Grants are recorded on the balance sheet when notice of award (or amendment thereto) is received, and are recognized as revenues only to the extent of expenditures that satisfy the purpose of the grant. Unexpended amounts are included in the financial statements as deferred grant revenues.

*Fixed Assets*

Furniture, equipment and leasehold improvements are recorded at cost and depreciated over their estimated economic life of five years on the straight-line basis. Computer software is recorded at cost and depreciated over an estimated economic life of three years on the straight-line basis.

*Financial Assistance*

Financial assistance is obligated when an award is granted and is recorded as an expense and liability at the time the recipient is entitled to the use of the funds.

Deobligations, which are primarily due to subsequent cancellation of grants of projects or grantee projects costing less than originally estimated, are recorded as a reduction of expense and liability in the period the deobligation occurs. The Organization generally reserves the right to cancel grants without cause. The likelihood of exercising this right is considered to be remote.

*Functional Expenses*

The expenses of providing the various programs and other activities of the Organization are reported on a functional basis. Accordingly, expenses are charged to the programs and supporting services benefited.

*Accrued Leave*

Under the Organization's annual leave policy, employees are permitted to accumulate unused leave up to certain maximum amounts. The policy also provides for payment to employees of such unused amounts at termination. The cost of annual leave is accrued as earned.

**Note 3 - AID Grant Awards**

AID grant awards received as of December 31, 1987 have been disbursed or obligated as follows:

Grants awarded:		
1986 and prior	\$16,728,571	
1987	<u>25,348</u>	\$16,753,919
Other expenses:		
1986 and prior	22,416,822	
1987	<u>2,858,517</u>	<u>25,275,339</u>
Grant expenses to date		42,029,258
Deferred revenue as of December 31, 1987		<u>1,037,137</u>
Total AID grant awards received		<u>\$43,066,395</u>

In addition, the Organization has been awarded grants during the year from other enterprises totalling \$53,421 (1986 nil) all of which is deferred as of December 31, 1987.

**Note 4 - Financial Assistance**

Financial assistance obligations and deobligations are as follows:

	Year ended December 31,			
	1987			1986 Net
Obligations	(Deobligations)	Net	1986 Net	
Agricultural product processing	\$ 487,050	\$ (612,585)	\$(125,535)	\$ 824,251
Local mineral resources	246,919	(170,699)	(123,780)	(156,485)
Equipment and support for small farms	215,781		215,781	(61,896)
Other	<u>172,558</u>	<u>(113,676)</u>	<u>58,882</u>	<u>57,021</u>
Total 1987	<u>\$1,122,308</u>	<u>\$(1,096,960)</u>	<u>\$ 25,348</u>	<u>\$ 662,891</u>
Total 1986	<u>\$1,262,492</u>	<u>\$(599,601)</u>	<u>\$662,891</u>	

Additional obligations with respect to new or existing projects amounted to \$601,209 in 1987.

**Note 5 - Fixed Assets**

Fixed assets consist of the following:

	December 31,	
	1987	1986
Furniture and equipment	\$250,957	\$254,095
Leasehold improvements	68,250	68,250
Software	<u>5,507</u>	<u>41,207</u>
	324,714	363,552
Less accumulated depreciation	<u>(194,375)</u>	<u>(174,641)</u>
Total	<u>\$130,339</u>	<u>\$188,911</u>

**Note 6 - Retirement Plan**

The Organization maintains a non-contributory defined contribution money purchase retirement plan. Employer contributions are equal to 15% of each participant's base annual salary. All full-time employees participate in the plan upon employment and become fully vested after four years with no incremental vesting.

Pension expense included in the accompanying financial statements approximated \$154,000 (\$146,000 in 1986). It is the Organization's policy to fund retirement plan costs as they accrue.

**Note 7 - Lease Commitments**

The Organization leases office space under a five-year lease which expires in May 1989. The agreement provides for annual adjustments of the rental amounts based upon a consumer price index. In addition, the agreement calls for a passthrough of expenses to the Organization for utilities, insurance, janitorial and cleaning services, maintenance and repairs and real estate taxes.

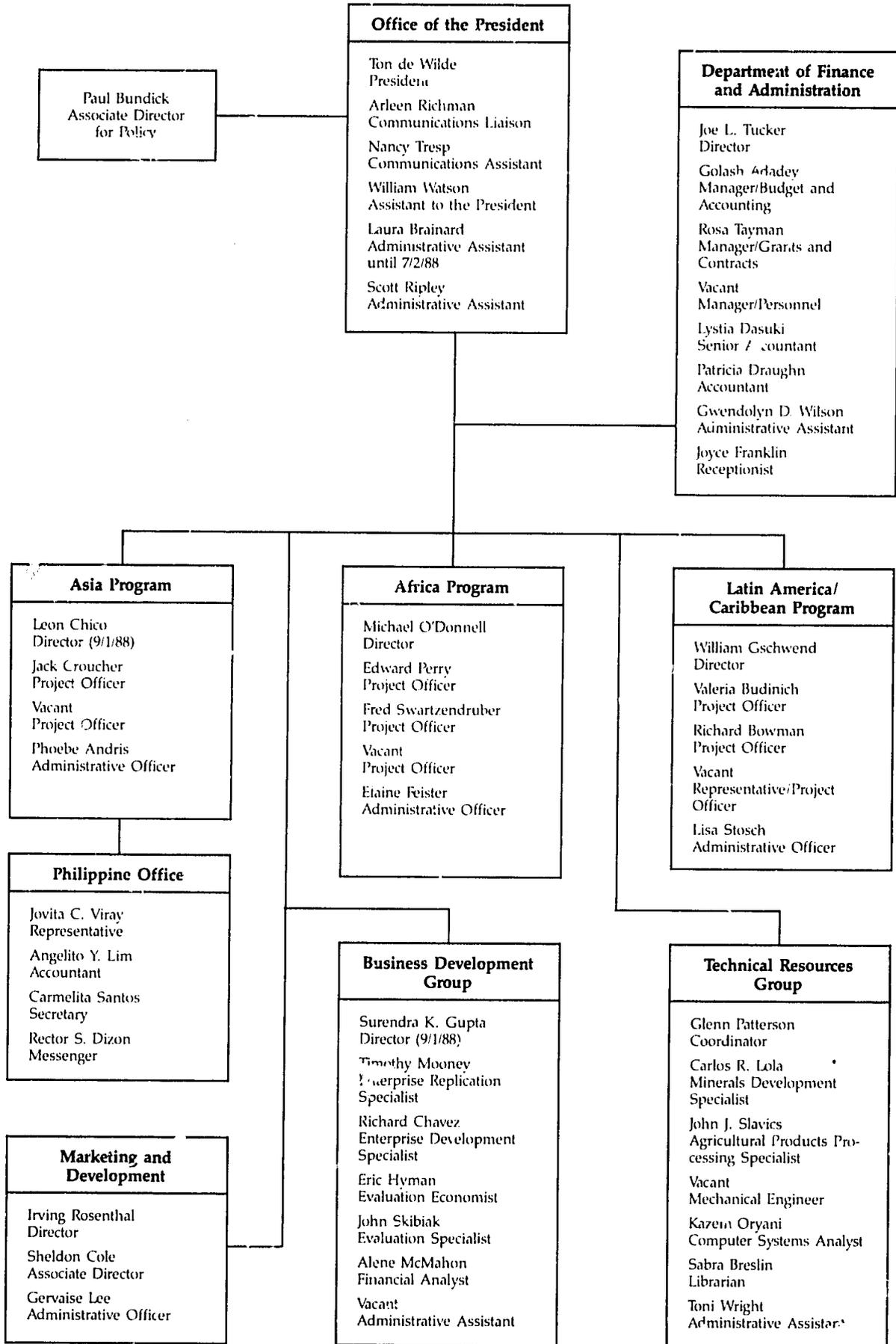
The Organization also leases equipment under operating leases. A summary of future minimum rental commitments at December 31, 1987 is as follows:

	Office space rentals	Equipment rentals	Total commitment
1988	\$208,000	\$13,920	\$221,920
1989	71,600	13,920	84,920
1990		13,920	13,920
	<u>\$279,000</u>	<u>\$41,760</u>	<u>\$320,760</u>



*SLICING potatoes is a simple technology that prepares potatoes for further processing, such as into potato chips and thus adds value to the raw material. Pota's processing technology is expected to be widely replicated throughout India.*

# Staff Members



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