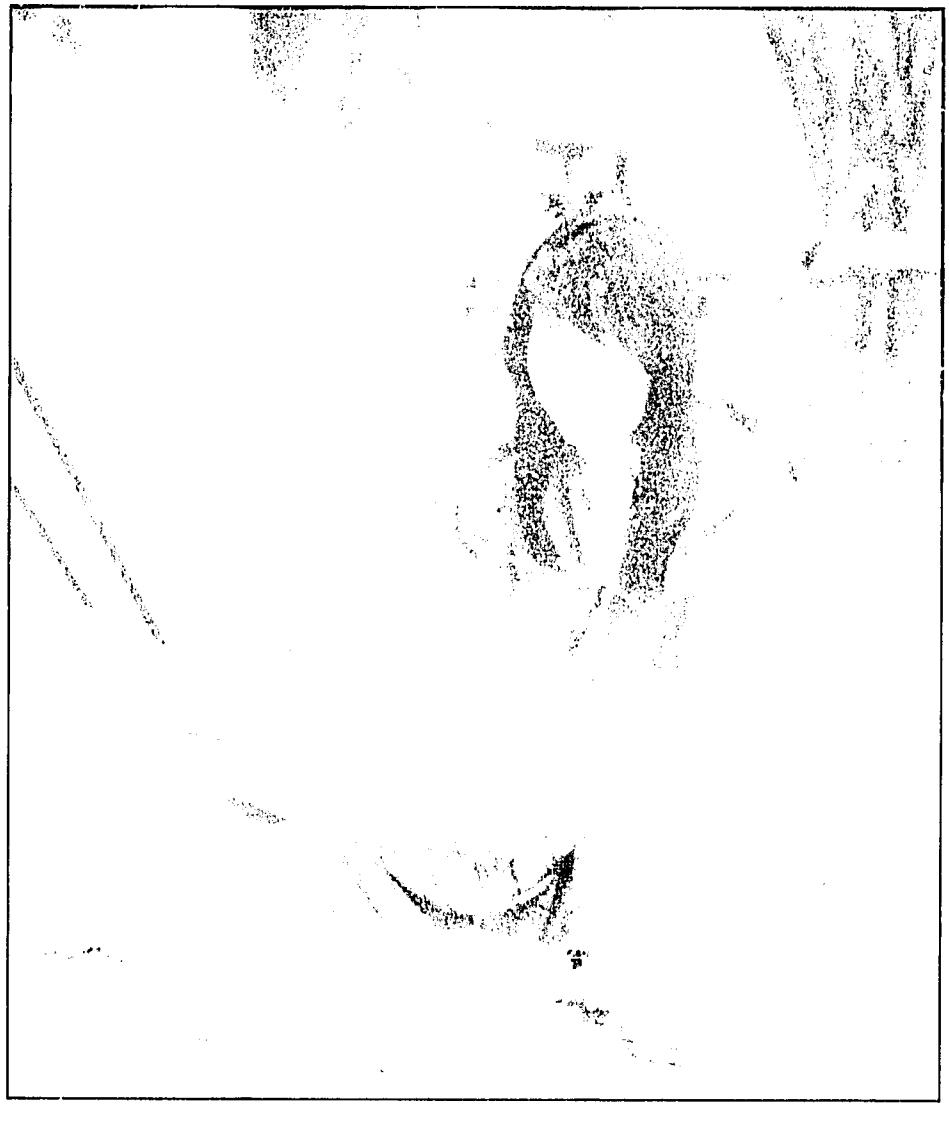
APPROPRIATE TECHNOLOGY INTERNATIONAL

Annual Report



Technology for Small-Scale Industry

Letter from the Chair of the Board of Trustees

INTERNATIONAL

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Annual reports typically deal with quantitative results. In this 1985 report, ATI tries also to assess qualitative accomplishments. ATI's performance over the past year illustrates its effort to achieve an interdisciplinary approach to development. This approach is based on open and effective communications between the various professionals who make up ATI's staff — engineers, technical and business specialists, and social scientists — and the staffs of collaborating organizations in developing countries.

ATI is gaining improved access to the pool of knowledge and experience which can be brought to bear upon the needs of the poor. ATI's experience in establishing commercially viable enterprises has attracted the attention of major international development agencies, such as The World Bank, IFAD, the ILO, and various programs within the UNDP.

The organizations mentioned above are recognizing the need to address traditional obstacles to large investments in appropriate technology. In particular, ATI has contributed to (1) an understanding of institutional infrastructures necessary to support enterprises using appropriate technology; and (2) an understanding of government policies that encourage or inhibit use of appropriate technology. During 1985, ATI commissioned several studies in these areas, the findings of which were presented at a conference sponsored jointly with the Overseas Development Council in January 1986.

In partnership with the Harvard Institute for International Development, Robert R. Nathan Associates, and Control Data Corporation, ATI joined a consortium to carry out the ARIES (Assistance to Resource Institutions for Enterprise Support) project on behalf of the Agency for International Development. ATI's participation in this consortium is important not only for its own sake, but also because it represents an important first step in diversifying ATI's funding base, a crucial objective for the coming years.

ATI's 1985 achievements, both quantitative and qualitative, it seems to me, create continued expectations for success.

Francis Keppel

Francis Keppel
Chair
Board of Trustees

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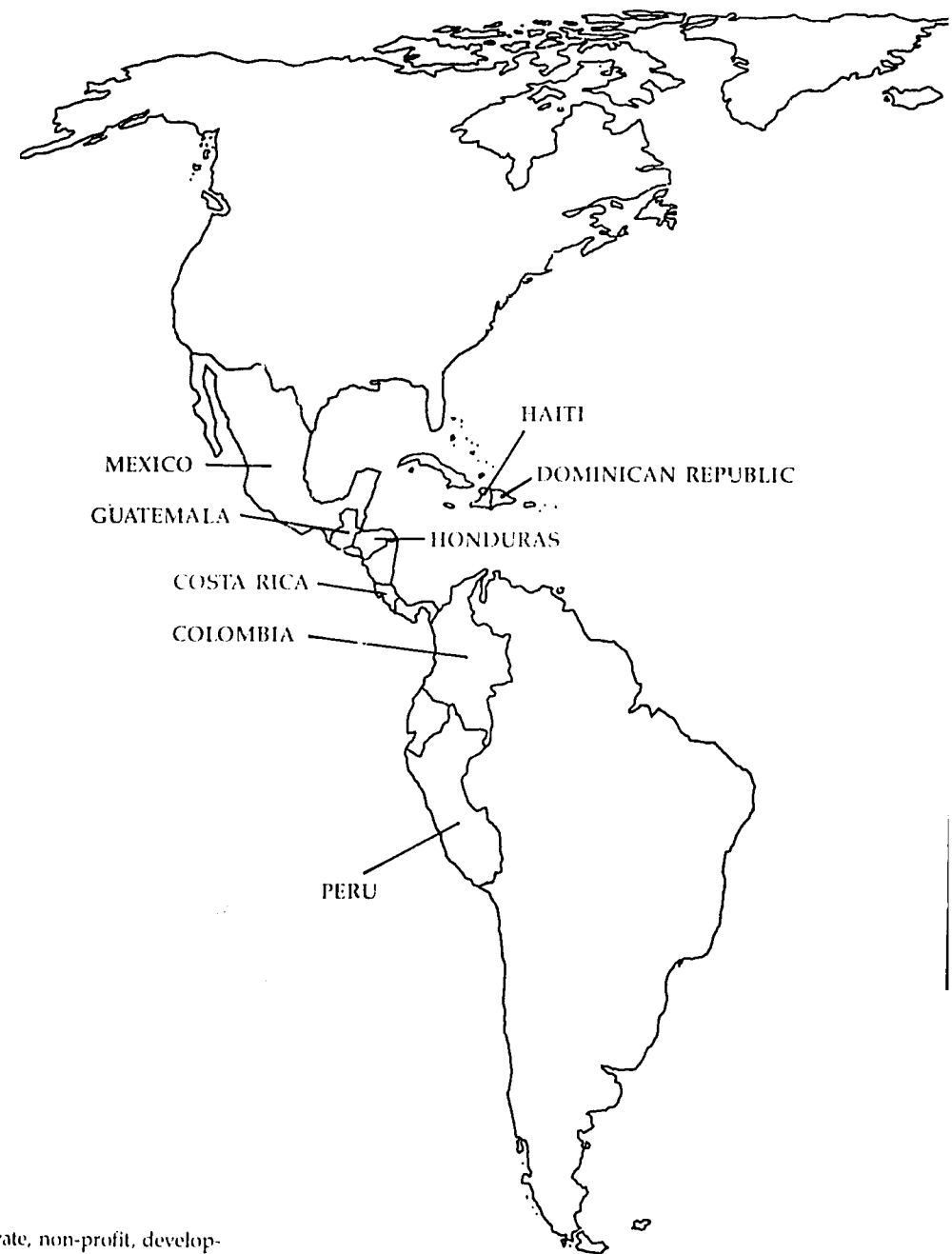
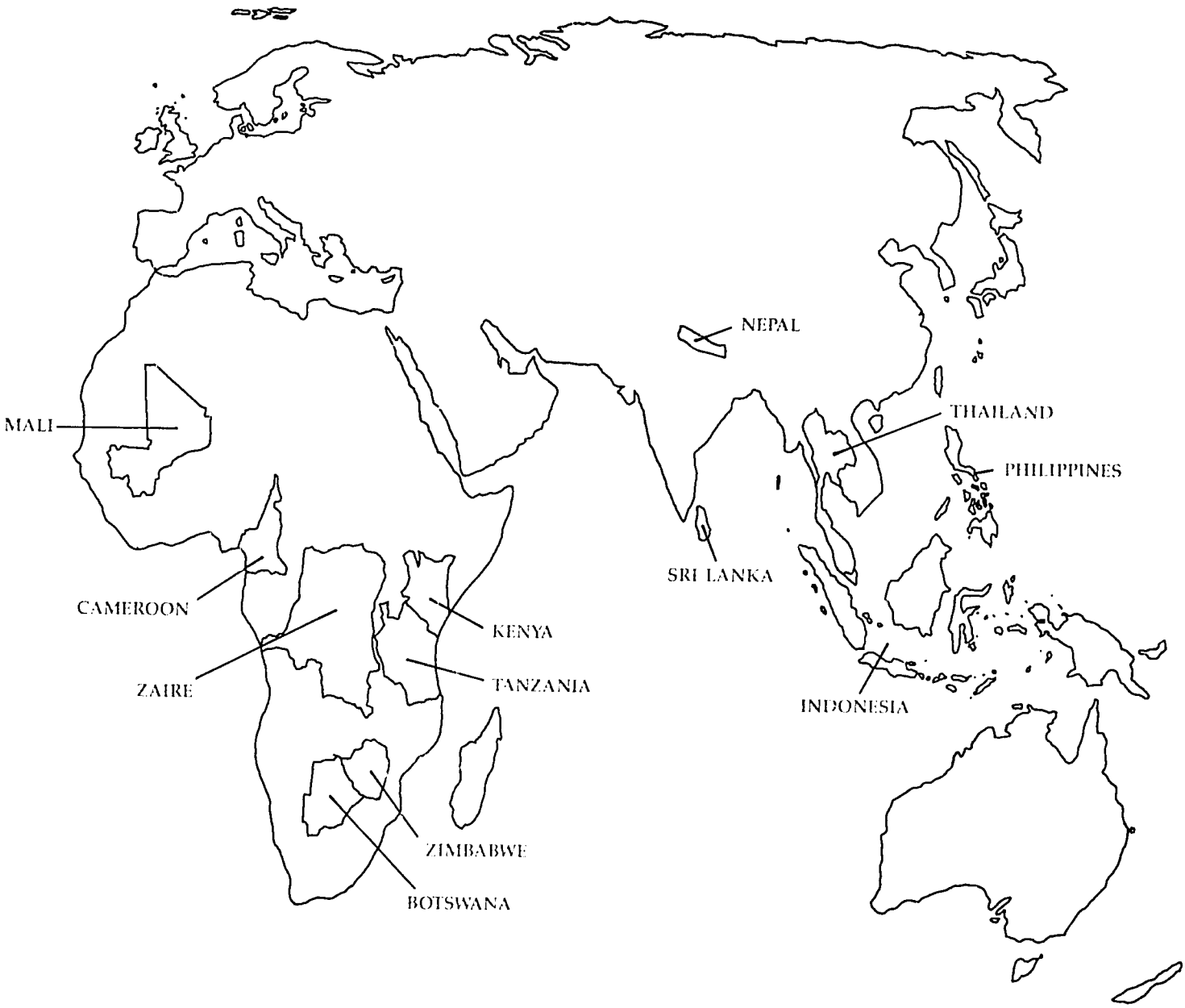


Appropriate Technology International is a private, non-profit, development assistance organization based in Washington, D.C. and operating in Africa, Asia, Latin America and the Caribbean. In collaboration with local organizations in developing countries, ATI develops and tests commercial applications of appropriate technologies in the fields of minerals utilization, agricultural products processing, and small farm equipment.

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 AID.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Technology for Small-Scale Industry

ATI's 1985 ANNUAL REPORT

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All photographs are from the files of ATI.

Introduction

Appropriate Technology International (ATI) is in the business of getting productive technology into the hands of poor people in developing countries. ATI's "product line," as it were, consists of *genuine* technology choices which can be made available to the rural and peri-urban poor. Choice is scarcely genuine if ownership or use of technology calls for resources which are not available to the poor. Thus, ATI's program identifies and promotes those productive technologies which can be mastered and controlled by the poor within the limits of their own resource endowment.

ATI is organized as a private, not-for-profit corporation, headquartered in Washington, D.C. with field projects in Africa, Asia, Latin America, and the Caribbean. ATI provides funds and technical assistance to test technologies or to support small enterprises which will act as catalysts for the subsequent establishment of private ventures which disseminate proven technologies. While ATI operates with host country government approval and support, ATI's project partners in most instances are private sector organizations and businesses committed to market place determinants of appropriateness and application of technology relevant to the poor.

In recent Annual Reports, ATI has used its year's experience to illustrate specific points:

- ATI's project experience in 1983 illustrated that the appropriateness of a technology is a function not of its size or complexity, but of its suitability for an intended purpose. For ATI, the principal delineations of a technology's appropriateness are (a) the commercialization of the technology within the resource endowment of the poor, and (b) the economic sustainability of the technology over time, so that its use and proliferation are not dependent upon subsidy.

- ATI's report on activities for calendar year 1984 was built around the theme of "appropriate technology as a strategy for development." ATI contends that policies and programs which consciously promote socio-economic development at the micro level can produce growth at the macro level equal to or sometimes greater than large-scale capital-intensive development efforts.

In this report on program activities for the twelve months ended December 31, 1985, Appropriate Technology International submits that there now exists an empirical basis, through field level demonstrations by ATI and partner organizations around the world, for widespread multiplication of the benefits observable in ATI's demonstration projects. ATI has sufficient experience to know that technologies relevant to the needs, capacities, and resources of the poor do not come equipped with a simple template for subsequent repetitions. The process of multiplication of benefits based on proven effectiveness of a technology in one set of circumstances requires competence and dedication no less demanding than the initial tests and demonstrations. In this Annual Report for 1985, ATI portrays its confidence that it is equal to the challenge of making the world a better place through the realization of cost-effective, people-oriented development.

PROGRAM IMPLEMENTATION

The ideas behind ATI's projects originate from discussions with local groups and individuals during project officers' trips abroad. ATI's rigorous project selection process begins with a concept review meeting, at which project officers meet with colleagues to present ideas for possible projects. These are screened for soundness of technology choice, potential commercial viability of the proposed enterprise, and likelihood of replication beyond the original project locale. If the concept is approved, the project officer returns to the field and formulates a detailed project plan in collaboration with the local project partners. Plans include detailed technical appraisals, market analyses, and thorough assessments of the assumptions underlying expectations for project success. Staff members from ATI's Evaluation and Technical Development Group also contribute to the preparation of project plans. Following in-house scrutiny, project plans are presented formally to the Project Review and Advisory Committee (PRAC) which is comprised of outside experts from the international development and scientific communities. Based on the recommendations of this Committee, project plans are submitted by the Executive Director to the Board of Trustees for approval.

In 1985, 24 concept papers were presented for review, 15 completed plans were submitted to the PRAC, and 14 projects were approved for implementation in the field. In order to develop these concept papers and project plans, staff in the Department of Field Operations made 65 field visits and travelled in 35 countries.

Once a project is formally approved and funds are committed, ATI staff members provide management and technical assistance on a regular basis to implement and monitor the project. Several times a year, project officers and evaluation and technical staff visit the projects and discuss progress and problems with project partners. During 1985, ATI established two review committees which meet monthly to supplement the efforts of field staff and project partners. The Project Administration Committee was created to facilitate the internal administration of project contracts and to ensure consistency in the handling of administrative issues and problems. The Replication Committee was created to guide the implementation of ATI's strategy for replicating its successful projects. This team approach to project selection and development is an integral part of the knowledge-building and knowledge-sharing ATI advocates.

Formalizing the Informal Sector: Problems and Promises

by Ion de Wilde, Executive Director

The Strength of Micro-Interventions

During recent years, Appropriate Technology International has built knowledge in order to assist private and semi-government organizations in materially poor countries with successful investments in commercial enterprises operated by village entrepreneurs, poor farmers, and other poor people. Micro-interventions assist small enterprises, which not only supply services to satisfy basic needs such as grain milling and oil pressing, but also provide employment and increase productivity in areas in which traditional development interventions have had little success.

In the early seventies, after two decades of disappointing results in international development efforts, experts determined that modern, often capital intensive, technology bypasses the large number of people who live in rural areas and who form the basis of the economy in developing countries. To address this problem, research was undertaken to develop and test intermediate technologies in an effort to add to the range of technologies from which people could choose. Additional efforts were directed towards the provision of information on the availability of small-scale technologies.

Three years ago, ATI departed from these general approaches to appropriate technology, focussing instead on actually getting technology into the hands of people in rural and peri-urban areas of developing countries. Development starts with the capacity of people to satisfy their basic needs in a sustainable way. Food must be produced, and income must be earned to purchase what cannot be grown or bartered for, such as shelter and safe drinking water. To this end, ATI concentrates on the establishment of commercially viable productive activities which add value to local resources. To do this in rural and peri-urban areas, often called the "informal sector" because of the lack of formal relationships between production factors (land, labor, and capital), calls for a wholistic multi-disciplinary approach to project development. In providing assistance to local organizations, ATI looks not only at the technological and financial aspects of establishing commercial enterprises, but also at the context in which enterprises must operate.

ATI supports commercial enterprises operated by village entrepreneurs, poor farmers, and other poor people

What are the types and quality of institutional support available? Are there services to repair equipment? Can spare parts be readily supplied? Is there a well developed market for the product? Is financing available to enable customers to buy products?

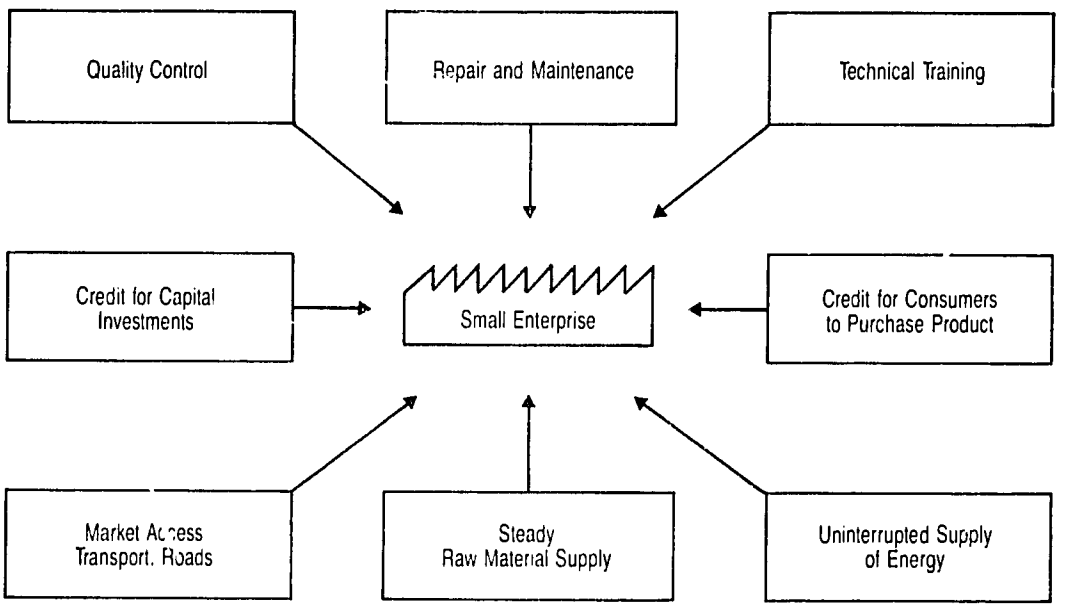
The assumption is too often made that services readily available in the formal sector are available in the informal sector as well. Successful rural enterprises, like their formal counterparts, require access to services such as credit schemes, training facilities, reliable sources of energy, and help with quality control. Feasibility studies which assume an uninterrupted supply of electricity are of no use in areas where electricity is available for only a few hours per day. Similarly, it is a mistake to assume unlimited access to the gasoline or diesel fuel needed to power the machines of production in countries where fuel is rationed due to foreign exchange shortages and the indebtedness of the national government.

Availability of services is not enough. It must also be determined that they function. Electricity is of no direct value to people who do not know how to use it. It is not enough to check if the local blacksmith has a lathe or a welding machine; the more important question is: can he repair his tools when they are broken? It is not enough to initiate a credit scheme if the lending conditions are not appropriate to the local situation. Rural poor people may be unable to provide collateral, unable to visit the bank during conventional business hours, and unable to complete complicated written credit applications. For example, in one instance, extending banking hours to include evenings and holidays determined which branch of a bank was most successful at reaching a particular target group. Similarly, a verbal agreement, supported by a letter that is thumb-printed in the presence of family and friends, can perhaps substitute for lengthy written contracts.

Step by step ATI demonstrates that with the right combination of technical focus and sound business planning, areas traditionally considered risky can in fact provide reliable investment opportunities for private capital — capital ranging from the savings of small farmers to credit from local banks! The projects ATI conceptualized in 1985 reflect lessons learned from projects begun in 1983 and 1984. At the same time, the earlier projects are now far enough along for us to make some careful statements about the success or failure of ATI's approach.

A current USAID evaluation of ATI, the final draft of which is awaited as this

INSTITUTIONAL INFRASTRUCTURE



Annual Report goes to press, confirms the success of several of our projects.

> "...[In] Asia, ATI has played very much a leading catalytic role. It was the first outside agency to fund several activities and organizations which later attracted support and/or inspired competition from other sources.[2]
>
> [In the Dominican Republic], the [swine feed] project appears to be achieving substantive progress toward goals...The project is developing the requisite infrastructure for documenting research and development of alternative combinations to swine feed ingredients, thus contributing to extant literature and encouraging the spread of this technology to other regions and developing nations...The project has successfully established a delivery system for pig feed ration inputs using existing networks of retail rural stores..."[3]

ATI's demonstration projects make a convincing case that small, profitable investments in rural areas are possible. The knowledge that ATI has gained is contributing to formalization of the informal sector.

The Limitation of Micro-Interventions: A Need for Macro-Policy Changes

While the concept of appropriate technology has gained increasing acceptance as an essential part of development strategies aiming to combine economic growth with equity, actual use of small-scale technologies has not been widespread. During 1985, ATI finalized a series of studies on the role of national policies in determining the establishment of productive activities suited to small farms, small businesses, and small incomes! The studies, coordinated by Dr. Frances Stewart of Oxford University, indicate that a major reason for the lack of large investments in appropriate technology has been the near exclusive focus on micro-interventions, i.e. demonstration projects. The point being that even when individual projects demonstrate commercially viable productive activities, overall development impact will remain small as long as the successes are isolated, representing only a small fraction of a country's total investment decisions. The studies suggest that changes in national or macro policies will have a significant effect on the use of appropriate technology in any given country.

Technology Choice: Are Choices Made?

One study, written by Jeffrey James of Boston University, focusses on technology choice in public sector industries in Kenya and Tanzania.[5] James argues that technology choices within parastatals are strongly influenced by the bureaucratic objectives of decision makers and a heavy dependence on foreign finance. This has led systematically to inappropriate technology choices. James defines as "appropriate" those technologies that will best achieve the objectives of rural development as determined by government policy. Invariably these objectives call for a high priority to be placed on increasing both labor productivity and employment opportunities. James further points out that if and when the private sector has been in the position to make a choice in production technology, the choice has been consistently for appropriate technology.

In the Dominican Republic, mixing leafy feeds with molasses and high protein supplements provides affordable, high quality swine feed. The feed supplements can be delivered to farmers using existing rural stores.

However, the choice of technology has most often been determined by government import policies.

Other studies confirm James' findings.[6,7] Most show the important role foreign aid donors play in technology decisions. On balance, the influence of the donor community is overwhelmingly in favor of inappropriate technology. Ashok Rudra traces the development of Indian agricultural policy over the last twenty years back to the advice and assistance given by the aid community.[8] Other studies describe how the influence of donors has led to improper technology choices for irrigation in Bangladesh,[9] industry in Kenya and Tanzania[10] and agricultural mechanization in Thailand.[11] With few exceptions, bilateral aid donors have systematically supported technologies exported from their own economies, technologies which are usually large-scale, capital intensive, and inappropriate to the needs and resources of developing countries.[12]

Some of the studies, which include concrete suggestions for policy changes, are described in greater detail elsewhere in this report. Taken together, the studies are persuasive that where there is real choice, appropriate technology is favored. However, in most cases, genuine choice does not exist. The reasons for this are complex and vary from case to case. Sometimes large-scale options are pursued because they create business for companies in donor countries. Sometimes government officials and/or donors are not aware that reliable small-scale options are available, or local officials may be under pressure to move large amounts of money, and small-scale alternatives involve too little capital. Sometimes labor-intensive options are rejected because decision makers are unable to assess reliably the management needs of such projects. The point is that neither local governments, nor donor governments and private donor agencies, employ a system whereby technologies are assessed according to their appropriateness for achieving the objectives of development projects.

The Cost of Development: Replication Challenges for 1986 and Beyond

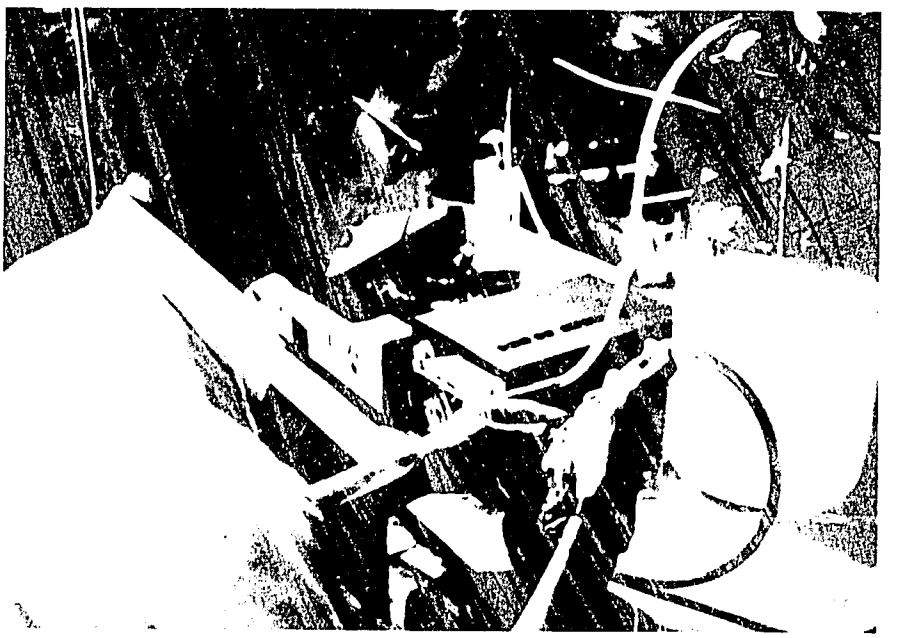
Our expectations for significant development profit in ATI projects are very high. Development profit is defined as the increased income of direct and indirect project beneficiaries over the life of the project, minus the direct cost of the project (i.e. costs of financial assistance, technical assistance, and ATI staff time required to develop and monitor the project). For example:

- In Thailand, ATI has granted $137,700 in financial assistance, plus staff time, for implementation of a project designed to introduce rhizobium, a natural bacterium that fixes atmospheric nitrogen in leguminous plants. After five years, use of rhizobium inoculant is expected to increase the soybean production of 16,000 small farmers, yielding annual net gains of some $3,000,000.
- In the Dominican Republic, ATI has provided $160,977, plus staff time, to establish a commercial system for the distribution of high protein feed supplements and veterinary supplies. After three years, over 2,000 small-scale swine farmers are expected to increase their annual income by a total of over $300,000.
- In Cameroon, ATI has granted $304,324, plus staff time, for the commercial production of improved palm oil extraction units. After five years, use of the improved units is expected to increase oil production for 5,000 farmers by 50 percent, with 50 - 70 percent reductions in processing time, yielding an income increase of upwards of $1,000,000 annually.

While the above examples demonstrate the potential development profitability of small-scale technology applications, in many rural areas projects need a much longer growth period to break even in terms of development costs. In general, projects can only pay off after the demonstration projects, in which the technical and commercial viability of a technology application are proven, are replicated on a wider scale.

Context of Replication of Appropriate Technology

Replication of appropriate technology is a contradiction in terms. The appropriateness of a technology is determined by the local conditions in which the technology functions: local resource endowment, local skills and human resources, market access and market size, etc. If a technology is transferred to a different environment, the change in geographic, social, or economic con-



Rhizobium is a natural bacterium that fixes atmospheric nitrogen in leguminous plants. An ATI project in Thailand will produce rhizobium inoculant for use by small soybean farmers.

ditions may well render it inappropriate. For example, the production of bricks using a labor-intensive technology, as is used successfully in ATI projects in Botswana and Kenya, would fail if transferred to the outskirts of Bogota, Colombia. Differences in size of market, market access, and transport facilities would make the technology inappropriate for the Colombian setting.

The types of products and productive activities that are classified under the label "appropriate technology" should not be confused ith products which might have worldwide sales, such as transistor radios, watches, motorcycles, sewing machines, or even shoes. The latter products are produced in the formal sector. They are bought and traded by people with money. These are products that go beyond basic needs. While poor people may want them, they often cannot afford them.

In the informal sector, poor people do not have money. Thus to sell something, a scheme must first be designed to give the poor access to money. At the same time, the scheme needs to include activities that will increase people's incomes so that they are able to repay loans. There is a popular saying, "it is better to give a man a net than a fish, so that he can catch his fish" It is better still if he can pay for the net with the profits from his catch.

Replication, a Market Strategy for the Informal Sector

The first priority in the informal sector is survival. The decision to purchase a product or to engage in a productive activity is determined by two factors. First, an assessment of the potential for the product to enhance survival. And second, the degree of risk entailed. In the rural informal sector, the decision to work in a small factory rather than farm the family plot can be a matter of life and death. By extension, the more familiar a person is with successful demonstration projects, the more likely it is that he or she will decide to buy or invest.

Appropriate Technology International experiments with a replication strategy that addresses these two issues. For a project to show that it enhances survival, and is therefore worthy of replication, it must first demonstrate that the productive activities entailed are commercially viable. For ATI projects, risks are assessed through financial analyses and market assessments carried out by local institutions with the help of ATI staff. These assessments in themselves do not eliminate risk, but they do provide insight into the nature and level of risk likely to be posed by a particular venture. And they assist in determining appropriate financial mechanisms. In ATI projects, such mechanisms include arrangements whereby in-kind contributions pay for leasing costs, as for oil presses and grain mills; venture capital mechanisms for products and production processes which are new, such as small-scale production of rhizobium inoculant or small-scale fermentation of cassava; and revolving loan funds for improved traditional technologies, such as small animal drawn planters or more efficient lime kilns.

To improve the replication potential of successful projects, ATI looks beyond the immediate boundaries of demonstration projects and identifies regions and institutions which are likely to have an interest in a particular product or productive activity. These are identified at the time when initial plans for a demonstration project are approved. As projects are implemented, ATI project officers visit these "outside" institutions and report on the design, progress, and commercial prospects of demonstration projects. Once a technology's viability has been demonstrated, ATI staff will help institutions draw up business plans to set up similar enterprises. ATI staff will also provide technical assistance for the adaptation of the technology to local conditions and will help negotiate with local banks and international donors for financing.

Productivity and Employment: The Role of Technology Development

Technologies, both large and small-scale, will be needed to address the immense problems that we will encounter in world development over the next fifteen years. Two serious imperatives are the simultaneous needs to produce food and productive employment for the world's growing population. In southeast Asia alone, 740 million new jobs will have to be created to employ people entering the labour force between 1985 and the year 2000. New developments, particularly in the area of micro-electronics and bio-technology, provide challenging opportunities for

solving some of these problems. However at the same time, these new developments will themselves pose enormous problems if they are not applied in a balanced way. For example, applications of bio-technology may enable increases in milk production of up to twenty percent, without additional feed requirements. Yet the industrial world already "overproduces" dairy products, and the dumping of surpluses in developing countries leads to artificially low prices and depressed local dairy investments. As a result, dairy farmers in developing countries cannot earn money to purchase goods, thus limiting the expansion of the world market in general.

Similar examples can be given for micro-electronics. Using a computerized cutting machine, a group of six workers can process an amount of fabric equal to that which two hundred workers can process without the machine. However, the high level of technical skill required to operate and maintain the machine render it inappropriate for operation in poorer countries. This will result in a shift in the location of the garment industry from developing to industrialized countries and the subsequent loss of hundreds of thousands of jobs.

Of course, the promise of the new technologies should not be minimized. Indications are that we have the technical capacity to feed the world's growing population. The issue becomes, how can we ensure employment for everyone? In this light, it is encouraging to note that the development of technology is becoming more and more scale neutral, allowing for small diversified production systems which encourage creativity, motivation, and satisfaction. As a result, the role of small-scale, appropriate technology will become more important.

Among the serious problems to be faced over the next fifteen years are the simultaneous needs to produce food and productive employment for the world's growing population.

Notes

[1] For a more detailed description and definition of business planning, see the article "Business Planning and Small Business" on page 14.

[2] Draft Mid-Term Evaluation of Appropriate Technology International. Volume IV, Asia Region Report. AID/PPC/CDIE, January 11, 1986, p. 4.

[3] Ibid., Latin America Caribbean Region Report, pp. 12-13.

[4] Frances Stewart, ed., *Macro-Policies for Appropriate Technology*, (Washington, DC: ATI, forthcoming).

[5] Jeffrey James, "The Choice of Technology in Public Enterprise: A Comparative Study of Manufacturing Industry in Kenya and Tanzania" in Stewart, *op. cit.*

[6] Stephen Biggs and Jon Griffith, "Irrigation in Bangladesh" in Stewart, *op. cit.*

[7] Gustav Ranis and Frances Stewart, "Rural Linkages in the Philippines and Taiwan" in Stewart, *op. cit.*

[8] Ashok Rudra, "Technology Choice in Agriculture in India over the Past Three Decades" in Stewart, *op. cit.*

[9] Biggs and Griffith, *op. cit.*

[10] James, *op. cit.*

[11] Bart Duff, "Changes in Small Farm Paddy Threshing Technology in Thailand and the Philippines" in Stewart, *op. cit.*

[12] A notable exception being the USAID supported MOSTI projects in Bangladesh.

Macro-Policies for Appropriate Technology

*adapted from publications by Dr. Frances Stewart**

In 1983, Appropriate Technology International commissioned a series of case studies to investigate the relationship between macro-policies in developing countries and the adoption of appropriate technologies in various sectors in these economies. The studies were undertaken by an international group of leading development economists and coordinated by Dr. Frances Stewart, of Oxford University. The studies explore not only how actual macro-policies influence the adoption of appropriate technology, but also identify the nature of macro-policies which would push all decisions regarding technology choice -- public and private, domestic and foreign — in a more appropriate direction.

Over the past two decades, the concept of appropriate technology has gained increasing acceptance as an essential part of any development strategy which aims to combine economic growth with equity. Yet although the need for appropriate technology (AT) is widely agreed upon, achievements in terms of actual use of appropriate technologies have been relatively small. There are, of course, numerous examples of successful ATs. But there are more examples of inappropriate technologies displacing appropriate alternatives, even in countries where the need for AT is explicitly recognized by government. In many countries, the problems of un- and under- employment remain acute, while continued growth of the population, with increasing numbers of people falling below the poverty line, further accentuates the need for AT.

The hypothesis which underlies the studies is that a major reason for the relative lack of appropriate technologies — in terms of actual on-the-ground investment — has been the focus primarily (and often exclusively) on micro-interventions, i.e., the development and introduction of specific ATs in specific contexts.

Actual decisions about technology often take place at the household level.

Unavoidably such interventions can only affect a very small proportion of total investment decisions, even when (as is increasingly the case) issues of dissemination and replication are pursued following implementation of a successful pilot project. Moreover, by looking exclusively at particular projects, no attention is paid to developments at the other end of the investment/technology spectrum, i.e., to the inappropriate technologies being introduced in the modern industrial sector, technologies which pre-empt resources, create inequalities and regional imbalance, and may undermine appropriate technologies.

The studies conclude that while micro-interventions have a role to play, widespread adoption of AT requires changing the *general context* or *macro-policies* within which individual decision-makers operate. Only then will the technology choices of all decision-makers reflect the more appropriate alternatives.

Technology decisions occur at the micro-level

Actual decisions about technology take place at the micro-level. That is to say, when an investment decision which embodies a particular technology is made, it is made by decision makers within a productive unit. The productive unit may be a large organization with worldwide activities, such as a multinational corporation, or it may be a very small unit, such as a family business or farm. Whatever the size of the unit, the level of decision making is defined here as micro, since decisions are made in light of the particular objectives and resources of individual units. However, while decisions are made at the micro level, they are strongly influenced by the external environment. Apart from direct interventions, governments can only influence technology decisions by influencing this external environment. Direct interventions tend to be confined to only a small number of technology decisions, especially in a mixed economy. Hence government's greatest potential influence on technology decisions stems from the adoption of policies which affect the decision-making unit's external environment.

One of the case studies which illustrates the impact of macro-policies on the nature of technology choice is a study by Gustav Ranis and Frances Stewart, "Rural Linkages in the Philippines and Taiwan."

This study analyzes rural linkages as a way of promoting appropriate technology. In order to identify policy changes which would increase the magnitude of rural linkages, the study explores the conditions which give rise to increased frequency of local linkages. To this end, the study compares developments in the Philippines and Taiwan over recent decades.

In the Philippines, a one percent increase in agricultural output led to a greater than one percent increase in rural non-agricultural employment. By

* This article is an adaption from the following publications: Frances Stewart, ed., *Macro-Policies for Appropriate Technology*" (Washington, DC, ATI, forthcoming) and Frances Stewart, "Macro-Policies for Appropriate Technology: An Introductory Classification," in *Technology, Institutions, and Government Policies*, Jeffrey James and Susumu Watanabe, eds., (London: Macmillan, 1985) pp. 19-20.

comparison, in Taiwan, at a time when agricultural output was similar for both countries, the rate of growth in rural non-agricultural employment was *more than twice* the rate of growth found in the Philippines.

There are a number of reasons for such a difference. First, in the Philippines, more capital-intensive technology choices in agriculture generated less additional consumption from employment and fewer rural backward linkages. This is because capital-intensive, highly-mechanized production methods usually rely on urban and imported inputs, while components of less mechanized technology can often be manufactured and serviced in rural areas. The high rate of large-scale mechanization in the Philippines was due to a set of price interventions, including subsidized credit which favored tractors, and to unequal land distribution. In Taiwan, the rapid growth of labor-intensive crops — mushrooms and especially asparagus — also enhanced consumption linkages and generated more employment in local canning factories.

In Taiwan, the processing of agricultural crops was generally more decentralized. A major reason for this was the presence of local small-scale processing companies, whereas in the Philippines processing was done by multinational companies in large-scale plants. The availability of infrastructure was generally more deficient in the Philippines, discouraging rural linkages.

In both countries, the evidence suggests that technologies adopted in rural activities have generally been *appropriate* as compared with urban industrialization. Rural technologies tend to be smaller scale and less capital intensive, to make more use of local materials and to produce more appropriate products. Local small-scale entrepreneurs have tended to adopt more appropriate techniques than either multinational companies or parastatals supported by aid agencies. Rural industry has tended to be more appropriate from the point of view of method of production (scale and labor-intensity). The study also found that the major gainers from policies which promote AT would be small farmers, the landless, and small rural entrepreneurs. The study concludes that strong rural linkages are a powerful mechanism for promoting AT and underlines the importance of policies which would strengthen these linkages.

A second example of the importance of macro-policy decisions on the choice of technology in LDCs is found in Jeffrey James' study, "The Choice of Technology in Public Sector Enterprise: A Comparative Study of Manufacturing Industry in Kenya and Tanzania."

James finds that the bureaucratic objectives of decision makers within parastatals have been an important element which, if combined with heavy dependence on foreign finance, has tended to lead systematically to inappropriate technology choices. This conclusion emerges not only from James' study, but also from more indirect evidence presented in some of the other studies ("Irrigation in Bangladesh" by Stephen Biggs and Jon Griffith, and "Rural Linkages" in the Philippines and Taiwan" by Gustav Ranis and Frances Stewart). Since parastatals account for a large proportion of investment in many countries, choice of technology within parastatals is of major significance for technology choice as a whole. An important area of policy choice is to determine policies which would change the operations of parastatals to secure more appropriate technology decisions. Examples include:

(i) Changing the economic environment in which parastatals operate so that they have to be more efficient in order to generate surpluses. Such changes might include: increasing overall competition within the industries in which parastatals operate by increasing domestic competition and or international competition: reducing price controls and or changing their form; and reducing the role of quotas and licenses in allocating resources. These changes would strengthen the relationship between efficient (which in many cases means more appropriate) decisions and profitability. Such changes would also help to improve technology decisions in the private sector.

(ii) Improving procedures for investment appraisal and investment decisions within parastatals. The James study reveals haphazard ; rocedures. Pending the availability of external financing, any project might be approved. In general, there have been no systematic technology searches and no appropriate technology considerations incorporated into the decision-making apparatus. This has resulted in a set of costly and arbitrarily selected projects which use inappropriate technologies and which operate at a low level capacity of utilization. A systematic appraisal procedure should include a technology search with an explicit AT element and a search for and appraisal of financial sources. Proper technology search and investment appraisal procedures would significantly reduce the influence of foreign finance on technology decisions.

The Macro-Policy Studies strongly support the view that government policies are critical to the success or failure of appropriate technology. The studies underline the fact that there are policies in developing country governments and in the international aid community that significantly inhibit or encourage the adoption of appropriate technologies. Well-chosen policies could lead to the introduction, on a much larger scale, of technologies which are more appropriate to local resources and needs, thereby promoting equitable and sustainable growth.

In January, 1986, ATI, in conjunction with the Overseas Development Council, sponsored a conference to bring to the forefront the importance of policy considerations in the dissemination and replication of appropriate technology. The case studies commissioned by ATI were presented at the conference. Later this year, these studies will be published in a book, *Macro-Policies for Appropriate Technology*, edited by Frances Stewart.**

** Case studies included in the book which are not referenced in this article follow: Ashok Rudra "Technology Choice in Indian Agriculture over the Past Three Decades"; Bart Duff, "Changes in Small farm Paddy Threshing Technology in Thailand and the Philippines" Raphael Kaplinsky, "Appropriate Technology in Sugar Manufacturing"; Philip Maxwell "Technological Change and Appropriate Technology: A Review of Some Latin American Case Studies", Yukihiko Kiyokawa and Shigeru Ishikawa, "The Significance of Standardization in the Development of the Machine Tool Industry: Cases of Japan and China."

ATI's Project Partners

ATI's relationship with project implementing organizations is a pivotal element in the endeavor to demonstrate that capital investment in "risky" rural enterprises can result in the replication of small, financially sound businesses which provide on-going economic benefits to the poor. ATI provides grant money as capital for projects that commercialize appropriate technology. ATI does not support expatriate field teams to implement these demonstration projects. Rather, ATI supports local, usually private sector, organizations which invest in ventures designed to benefit the rural poor.

The success of ATI's projects depends on the commitment, expertise, and professionalism of both ATI's Washington-based staff and the staffs of the organizations with which ATI works. The relationship between ATI and the implementing organizations is best described as a partnership, based on mutual objectives and complementary capabilities. To the partnership, ATI brings expertise in project design, technical assessment and adaptation, and business planning. Indigenous organizations offer an understanding of the local social, economic political, and environmental contexts in which productive technologies must operate. Because they themselves are part of the resource base of the poor, local institutions bring the capacity to actually implement projects in the rural and peri-urban areas of developing countries.

In order for demonstration projects to be successful, both technologies and management systems must be adapted to local conditions. What raw materials are available? What spare parts will be required? Are transportation systems adequate for the product in question? Is there a credit scheme that users can understand and of which they are not afraid? Are there quality control measures to inspire confidence? Together, ATI and project implementing organizations assess the risks involved in establishing particular productive activities and estimate the effect of enterprises on the income of poor people.

ATI's project partners are committed to working directly with the rural poor for the commercial application of appropriate technology. Pictured above are staff members of Centro de Investigaciones Básicas y de Tecnología Apropiada, responsible for ATI's annatto processing project in Peru.

During 1985, ATI worked with more than 100 organizations to develop new projects. Final plans were approved for fourteen field projects. ATI's portfolio of project partners is comprised of a range of institutions, including private businesses, associations of small enterprises, social service organizations, farmer cooperatives, and community development organizations. Included are institutions which focus on a particular technology or social objective and multifaceted institutions which address a broad array of problems related to economic development. The organizations range in size from Thusano Lefatsheng in Botswana with a staff of three, to Thailand's Population and Community Development Association with a staff of over eight hundred. What they all share is a demonstrated commitment to work directly with the rural poor for the commercial application of technologies which satisfy the demands of the marketplace and, at the same time, increase productivity and employment.

Bagging lime, Costa Rica

Business Planning and Small Business

The challenge of building an enterprise has become a totem for success in the '80s, as evidenced by the new titles that crowd the business bookshelves: *In Search of Excellence, A Passion for Excellence, How to Achieve Excellence, Business Plans That Win $$$*. Each one caters to the recently revitalized public interest in business by documenting the history of successful "emerging growth companies."

Each of these books emphasizes the importance of business planning. Whereas it was once sufficient to grow a business by "ninety percent perspiration and ten percent inspiration," judging by today's success stories, a budding entrepreneur better have a thorough plan before he or she starts hawking goods.

Some people question whether the small businessman can actually afford the time and effort required to plan his business. Large corporations usually have large planning departments which analyze new ventures. A small businessman may have to struggle just to keep up with the day's events before even considering planning for the future.

But even when resources are stretched to the limit, the small business cannot afford to ignore planning. Operating with scarce working capital and constrained resources, any changes, planned or unplanned, will be more dramatic than they would be in a large firm.

ATI's projects are typically small business ventures situated in rural communities of developing countries, one of the world's most difficult business environments. The rural poor are among the most conservative consumers, with traditional habits and customs established over generations. Disposable income and literacy are often low. Limited resources make any purchase a significant risk, especially if it involves a new product or an unknown company. If goods and services fail to meet their needs, poor consumers will not become repeat purchasers, thus jeopardizing the firm's future.

Most ATI projects involve the introduction of innovative technologies or business concepts into this threatening business environment. Business planning can help avert the major pitfalls that frequently await such ventures. Business plans submitted to or developed by ATI seek to avoid problems by answering some fundamental questions regarding an enterprise's potential before any investment is ever made.

Business planning can help avert the pitfalls that frequently await small businessmen. This yoko-loner manufacturer must consider factors such as quality control, inventory, and marketing if his business is to succeed.

These fundamental questions are answered through the development of a concept. Before a business or new venture can really get going, it needs a focusing idea, the concept around which the entire effort will develop. A common mistake is to confuse a product with a concept. This is especially so in development projects where the focus is often established by development experts rather than by participants themselves.

Competent business planning is always centered around a well conceived concept. ATI's business planning outline stresses this by first asking four basic questions:

What is being proposed?
Why get involved in this enterprise?
Who is the intended consumer?
What need will this enterprise meet?

These questions are intended to ensure that the proposal entails not only a product, but that it has a strong concept behind it. For example, while on mission in a developing country, an ATI project officer noticed that numerous water-pumping windmills were not functioning properly. Installed by the government as part of a multilateral water project, the windmills were to provide water for human and animal consumption. These $10,000 machines were literally spinning their wheels, while women returned to drawing water by hand.

The opportunity is clear; establish a private enterprise to repair and service the windmills on a profit-motivated basis. Whereas a grant could get the water flowing again, each breakdown would require another infusion of money. A private enterprise supported by the fees paid by the villagers could continue to operate in the future without external support.

Yet this windmill repair business is really a product and not a concept. The concept is broader; providing repair and maintenance services to all rural water supply systems that are currently unattended. Fixing broken windmills may be an obvious entree to the market, but providing an on-going service to fill an unmet need defines the concept.

Once the concept is well defined, the business planner must move on to more mundane areas such as objectives, structure, finance, production, market research, investors, management, and marketing.

Several of these areas are quite straightforward, but market research and marketing remain to many people the astrology of the business world. This is no less true when considering a venture targeted at the rural poor. Whereas in developed consumer economies, taste tests, surveys, focus

groups, and direct mail are all ways to test markets, these are often thought to be poorly suited to consumer groups that may not be literate, exposed to advertising, or quick to accept new products and ideas.

The truth is that even the small business cannot avoid doing market research. In the past, it was sufficient for many projects to move forward because an expatriate expert had "studied the market." The developing world is mottled with the deteriorating shells of businesses begun on exactly such development experts' studies.

The market for a new product cannot just be studied, it must be tested. The sophistication of the tests depends on the level of financial and program risks involved. Contrary to some beliefs, such procedures as taste tests, focus groups, and advance orders can provide quick, cheap and relatively reliable tests of market potential. Once adequate market research data is in hand, the business can then decide what marketing strategy will best exploit the market's potential. The alternative to doing market research, even on the small scale, is to "wing it," and thereby risk time, money, and perhaps the whole venture.

An example from a previous ATI project may help to show the need for both a solid concept and thorough market research. Several years ago, ATI supported the establishment of a business to produce a sauce from winged beans. This sauce was intended to compete with soy sauce, a product used by virtually every household in the country. The idea was that winged beans would become an easily cultivated crop providing new income for farmers. The sauce would be sold at a discount compared with soy sauce and give the poor consumer a price break on a staple item.

After several years of production, this product has yet to achieve its planned market penetration. Hindsight shows that the concept, which stressed providing income to winged bean farmers, was flawed. Farmers certainly had a need for increased income, but the product was tied to a consumer market which was extremely difficult to penetrate. The marketing strategy of price discounting was not sufficient to lure consumers away from their established brands. More rigorous business planning, which could have included more extensive product testing, might have revealed that consumers, however poor, may not switch away from a favorite label just to save a few cents.

Of course, all the business planning in the world cannot avoid some surprises. Just as the oil price shocks of 1973 and 1979 caught America's major corporations unprepared, thousands of financial, political, and organizational planners failed to anticipate the recent dramatic decline in oil prices. For that matter, many appropriate technology projects in energy conservation have seen their products' competitiveness disappear with the decline in prices which occured during the first few weeks of 1986.

Such worldwide trends are difficult for anyone to predict. And business planning is not an exercise with a crystal ball. It is a discipline of thinking about needs, markets, and products. It is practice in developing and distributing resources effectively. It is contemplating the "What ifs."

Big business can sustain huge changes in market conditions. Many small businesses cannot. The discipline imposed by business planning can benefit any business, big or small, by saving tremendously on unnecessary waste of money, time, and personal commitment. At ATI, business planning is a critical part of every project. In developing our portfolio of projects, many are eliminated as questions raised during the process of thorough planning reveal inadequate potential. Some believe that business planning makes a business or organization more conservative and less entrepreneurial; this is not so. What business planning does is ensure that each expenditure of limited resources is more likely to result in a successful business venture.

ATI's Participation in the ARIES Project

One important element of ATI's program in "replication" is collaboration with other development assistance agencies as a means of bringing the insights and experience gained from ATI's work to bear on their efforts. In that spirit, during 1985 ATI undertook to work together with Robert R. Nathan Associates, Inc., the Harvard Institute for International Development (HIID), and the Control Data Corporation (CDC) to carry out the ARIES (Assistance to Resource Institutions for Enterprise Support) Project on behalf of the Agency for International Development.

The ARIES project seeks to strengthen organizations and programs working with small and micro-businesses in developing countries in order to provide necessary technical and business development assistance to an increasing portion of entrepreneurs, and to enhance the quality and value of that assistance.

The project has three major components, each of which will draw upon and inform the other two. These are:

- research and case study development
- development of training materials and methods
- technical assistance

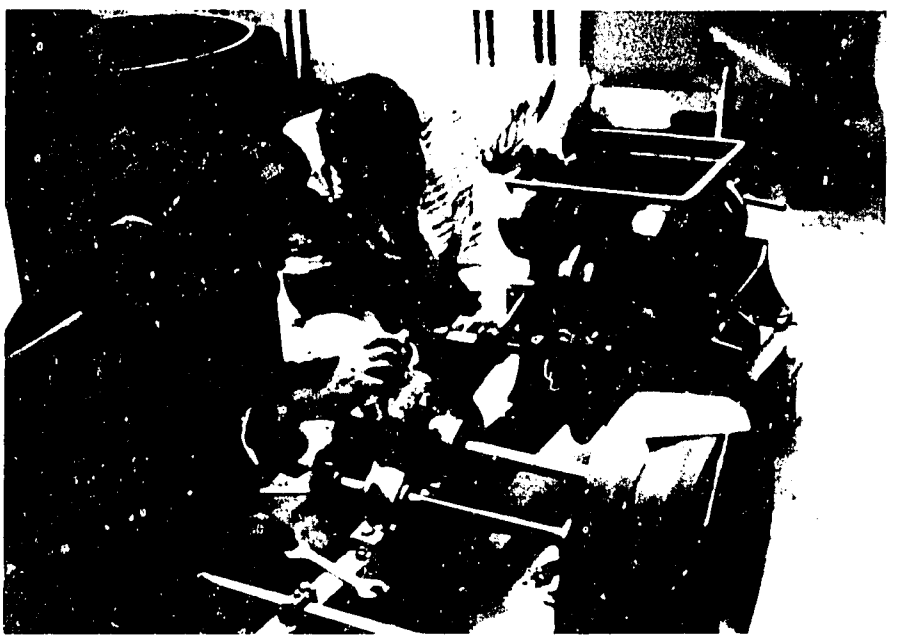
ATI will be involved in each of these areas. ATI's staff is richly endowed with people holding a multiplicity of language and technical skills valuable to each aspect of the ARIES project. In particular, ATI staff members' considerable experience working directly with small and micro-entrepreneurs — and organizations serving them — will be key to the success of the project. Finally, ATI's emphasis on and expertise in the actual productive work forming the basis of most enterprises is a useful complement to the expertise in the areas of credit administration, training, program development and program evaluation represented by the other parties to the project.

The Purpose of Monitoring and Evaluation

Monitoring and evaluation systems for development projects often collect too much, too little, or the wrong type of data. Furthermore, reports are often produced too late to be useful to project management. To avoid these pitfalls, ATI has developed a flexible framework for data collection and analysis. Monitoring and evaluation activities focus on the performance of technologies and commercial viability of the enterprises which use them. Special attention is paid to the effectiveness and efficiency of the project's activities. Project strategy, cultural context, and social impacts are also examined so that the replication potential of the project can be determined.

Evaluation activities are not only scheduled at the end of ATI projects. Some monitoring and evaluation information is gathered on a continual basis, while other types of information are obtained at regular intervals throughout project implementation. ATI's system for monitoring and evaluation is based on the collaborative efforts of cooperating organizations in LDCs, ATI's project officers, and the staff of ATI's Evaluation and Technical Development Group (ETDG). The system is comprised of three parts: 1) a standard format for financial reporting, 2) a general information framework (checklist) called the Project Monitoring and Evaluation System (PMES), and 3) a project-specific Supplementary Data Requirements List.

Project officers in ATI's Africa, Asia, and Latin America/Caribbean programs have primary responsibility for management and monitoring of projects. The staff of these regional programs visit each project about three times per year, often accompanied by ETDG staff. In general, ETDG staff meet with project officers prior to field travel and discuss issues which should be considered in data collection and analysis and reviewed with cooperating organizations. After their return from the field, project officers hold debriefing meetings with ETDG staff. As much of the monitoring and evaluation data as possible is obtained from progress and financial reports submitted quarterly and annually by the implementing organizations. Project visit reports prepared by ATI's regional program staff and ETDG staff are an important supplement to the information submitted by project partners.



ATI's system for monitoring and evaluation depends on the collaborative efforts of project partners. Some information, such as performance data for this mechanized Colin press in Cameroon, must be gathered on a regular basis.

The PMES

The PMES is used by the evaluation staff in their discussions with both project officers and implementing organizations as a checklist of the factors to be considered during monitoring and evaluation. Basically, the PMES converts criteria used in appraising and planning projects into targets for use in project evaluations. Thus, the PMES is a structured way of asking the questions that are important in determining a project's performance. To the extent possible, the questions in the PMES are quantitative. Likely responses to questions involving qualitative variables have been anticipated, but other responses are specified and explanations added, where needed. ATI recognizes that planning targets established in advance of project implementation are often arbitrary and should evolve over time in response to changing conditions. Thus, non-attainment of a target established during planning does not necessarily indicate a failure. What is more important is understanding the reasons for both accomplishments and shortfalls, in order to determine whether changes in the targets are necessary. Answers to the questions in the PMES provide information for monitoring, interim evaluation, and post-project evaluation. Sections of the PMES address: the nature of the technology, organizations and participation, inputs, project activities, credit and equity financing (if relevant), outputs, and markets. Sections of the PMES intended primarily for ex post evaluation cover impacts, policy issues, and replication. The central questions in the PMES concern:

- Technology: Is the technology efficient and cost-effective under actual operating conditions in small enterprises?
- Commercial viability: Are the enterprises profitable enough so that they can continue on their own once established?
- Economic sustainability: Do the enterprises increase the net value added in the economy after accounting for opportunity costs?
- Institutional performance: Are the implementing and intermediate organizations carrying out their activities efficiently and effectively?
- Benefits: Are the promotion and extension activities of the project securing the participation of the intended beneficiaries? Is the project producing positive effects on employment and the distribution of income?

The Supplementary Data Requirements List

Although the PMES has broad applicability, certain project-specific factors may not be fully covered. After reviewing the project plan and discussing information needs with the project officer, evaluation staff compile the Supplementary Data Requirements List. This list addresses particular geographic, socio-economic, and institutional conditions of the project as well as the origins and evolution of the technology and/or dissemination strategy. Some of the questions in the Supplementary Data Requirements List can only be answered over time, as project implementation proceeds. ATI's project officers, ETDG staff, and the staff of cooperating organizations share responsibility for obtaining this information. Evaluation staff then record and analyze the findings.

Traditional placer mining, Peru

ATI's evaluation system addresses particular geographic, socio-economic, and institutional conditions as well as the origin and evolution of technologies.

Shea nut butter extraction, Mali

How Findings are Used

First and foremost, the PMES is used as a tool to learn systematically from "experimental" projects. The process of business planning and careful monitoring and evaluation provide both project partners and ATI staff with substantive knowledge that goes beyond simply ascertaining whether certain technical outputs are met.

Monitoring and interim evaluations are used to track the progress of projects, make mid-course corrections where necessary, and document the results. Those projects that have a first stage involving development, testing, or adaptation of a technology are designed with decision points at which the desirability of proceeding further with the project is reconsidered.

Post-project evaluations are used in formulating program objectives and dissemination strategies, and in assessing the project's replication potential. They may also influence government policy makers, other donors, development assistance banks, and commercial banks.

ATI's approach to monitoring and evaluation integrates three crucial concerns:

- Project management concerns of project officers and regional programs;
- Monitoring, management, and reporting requirements for project implementing organizations; and
- Evaluation and documentation needs of ATI for demonstrating and replicating the successful commercialization of appropriate technology.

This integrated approach has proven to be an efficient and effective means for collection and analysis of data and information about projects and productive activities. Although most of ATI's projects are still in the early stages of implementation, findings based on information gathered using the above systems appear very encouraging. As of December 31, 1985, the PMES was being used to track 36 projects. At that time, these projects had approximately 40 productive activities in commercial operation. Several technologies have been demonstrated successfully and prospects for commercial viability of many of the businesses are encouraging. It is still too early to determine the economic benefits that will accrue as a result of these projects. In time, ATI will produce a consistent body of information across its entire portfolio of projects.

The Technology in ATI's Projects

ATI's field program is carried out in three technical areas: a) agricultural products processing and utilization of agricultural wastes, b) local mineral resource development, and c) equipment and support for small farms.

Examples of activities which ATI supports in each of these areas include:

A. Agricultural Products Processing and Utilization of Agricultural Wastes
- small-scale pressing and extraction of edible oils;
- processing of cereals and staple foods;
- production of animal feed from agricultural wastes;
- processing of fruits and vegetables.

B. Local Mineral Resource Development
- small-scale production of cement and cementitious material;
- small-scale production and use of lime;
- production of ceramics, bricks, and tiles, as well as the improvement of ovens and kilns;
- production and use of stabilized earth blocks.

C. 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 feed.
- manufacture of hand tools;
- production and marketing of rural transport equipment and animal-drawn implements;
- production and marketing of small farm implements developed by international research centers.

The decision to apply a technology in a particular project is based on several criteria. The technology must have passed the research and development stage, and its performance potential must be proven. The technology must have a clear advantage over alternative technical options available in the project area. This advantage must be apparent in terms of the cost-effectiveness of the technology, and its suitability to the physical infrastructure and local conditions where it will be used.

In addition to technical considerations, there are numerous "soft" technology factors which must be taken into account during technology selection. For example, the skills and educational level of those who will use the technology must match its operation, management, maintenance and repair requirements. This often requires the incorporation of training and education components into the project. In addition, loans to producers and users of the technology often must be made available. This means that appropriate cost-effective financial arrangements must be devised to support even relatively small investments. It is also essential to establish reliable means of ensuring quality control, to develop marketing strategies which address local conditions and constraints, and to consider carefully all consequences, such as labor displacement effects, which may result from use of the technology.

Beginning in the last quarter of 1983, and through calendar year 1985, ATI implemented 36 field projects within the technical areas outlined above. Each project contains a balance between technical component requirements, and "systems" requirements which enable people to use the chosen technology.

The technology components of the field projects undertaken by ATI during 1985 are described on pages 25 to 33. For illustrative purposes, more detailed descriptions of the technologies in ATI projects follow.

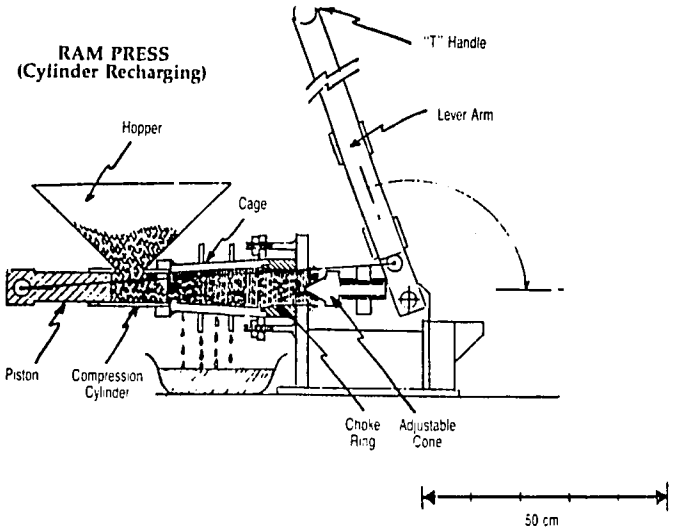
Village Oil Processing: Tanzania and Cameroon

The year 1985 was marked by significant technical achievements by ATI's project partners in Tanzania and Cameroon. Dramatic improvements in the cost and performance of sunflower processing equipment being produced in Tanzania, and two generations of design modifications to the Colin palm oil press in Cameroon, translate directly into increased benefits for a greater number of future beneficiaries. These developments are the result of collaborative efforts by ATI project partners, ATI's technical staff, and both in-country and international experts.

Themi Farm Implements Company of Arusha, Tanzania, is now producing two lines of oil-processing equipment for village-level processing of locally grown sunflower seed. The first is based upon a manually operated batch press developed by the Institute of Production

Palm nuts ready for pressing.

Innovation (IPI) of the University of Dar-es-Salaam, and includes ancillary equipment that greatly increases the hourly capacity and oil extraction efficiency of the press. The addition of a centrifugal impact dehuller and seed crusher was suggested by an independent evaluation of the IPI press, commissioned by ATI and conducted by the Royal Tropical Institute of the Netherlands. Prototypes designed by IPI and built by Themi Farm Implements have demonstrated that correct processing of the seed prior to pressing can result in a three-fold increase in the output of the press with only a marginal increase in capital outlay. The complete manually operated village oil plant can produce approximately 60 liters of oil per day from 200 kg of seed, while providing full-time employment for seven persons. The



utilization of modern machine tools provided under commercial terms to Themi enables the company to manufacture approximately two such plants per month, while maintaining its full output of ox carts and other agricultural equipment.

Collaboration between Themi's engineers and ATI's Farm Equipment Specialist resulted in the invention of a press that may significantly reduce the minimum capitalization required for efficient village processing of sunflower oil. This device, illustrated above, resembles the conventional motorized expellers inasmuch as it extracts oil during the continuous flow of seed under pressure. It differs, however, because the extraction pressure is applied by a reciprocating ram, rather than a rotating screw. Since there is no relative motion between the ram and the compressed seed, there is little friction, and the device may be easily operated by a single person using a long lever. Furthermore, the device is relatively unsusceptible to wear, even when fabricated from mild steel and when used to press undehulled seed. Workshop trials indicate that between 1.2 to 3 liters of oil per hour and 17 liters per 50 kg bag of seed may be obtained. Results of field tests begun in December, 1985, have been very encouraging.

Meanwhile, in Cameroon, significant strides have been made by the Association for the Promotion of Community Initiatives (APICA) and its subsidiary, Tools for the Community, to reduce the cost and increase the availability of the Colin-type palm oil press. The Colin press is a low pressure expeller, having two six-inch diameter co-axial counter-rotating screws, that was imported into Cameroon from France from the 1930s through the 1960s. Early in 1984, APICA perceived that farmers were unable to pay the high cost of reconditioning their worn-out Colin presses, but were also unwilling to sell these once-productive machines at a price that APICA could afford to pay. To escape this dilemma, APICA sought technical assistance to design a simplified version of a Colin press that could be manufactured locally. A small non-profit French firm, Bureau d'Innovation Technique, designed a single-screw version of the Colin machine which, despite a 50 percent reduction in cost, is only slightly less efficient and productive than its predecessor. Technical assistance by ATI's Farm Equipment Specialist enabled APICA to develop production technologies suited to the capability of a small cooperatively owned machine shop that is now manufacturing the presses in Douala, Cameroon.

Annatto Production, Peru

The purpose of this project is to establish a cooperatively-owned small industrial plant in the city of Cuzco to extract export-quality annatto from achiote seed.

Annatto is a natural food dye which is used primarily by the dairy industry for coloring cheese, margarine, and other dairy products. It is extracted from the seeds of the achiote tree *(Bixa orellana)*, which grows naturally on the steep slopes of the high jungle on the eastern side of the Andes mountains. At present, achiote is gathered and husked by farmers, then sold to intermediaries who ultimately sell the seeds to four processing plants in Lima. Over 10 percent of the colorant is lost during husking and up to an additional 30 percent is shaken loose and lost during transportation to Lima.

This project illustrates how the rural poor can benefit from establishing small-scale food processing plants near the source of crop production. This approach enables increased savings, improved product quality, and improved access to the raw material. By constructing the plant in Cuzco, significant savings will be achieved by reducing the costs of transporting the raw material. The dry, cool climate of Cuzco, located some 11,500 feet above sea level, allows for extended storage of the annatto without fear of product deterioration. Furthermore, the loss of colorant which occurs when the seed is transported to Lima will be avoided. Finally, the participation of 23 cooperatives in the project area will guarantee a steady supply of raw material.

Annatto, a natural food dye, is extracted from achiote seed, which are traditionally gathered, dried, fermented, and husked before being sold to processing plants.

The processing technology consists of washing the achiote seeds in a one percent solution of sodium hydroxide, which suspends the colorant in the alkaline solution. Once sulphuric acid

is added, the colorant settles at the bottom of large precipitating vats, forming a clay-like paste, which is then filtered and pressed to remove excess water. Warm air dryers reduce moisture content to four percent before final grinding and packaging for export.

Technical studies financed by ATI during the course of project development resulted in important improvements in the annatto extraction technology. These are summarized below:

- introduction of environmental safeguards for disposing of the used seeds and processing chemicals;
- addition of two washing cycles which enable improved extraction efficiencies;
- introduction of new quality control mechanisms at various processing stages;
- development of an innovative manual husking device, which will be distributed to the 23 cooperatives where the achiote seed is collected; and
- introduction of new cultivation and harvesting techniques.

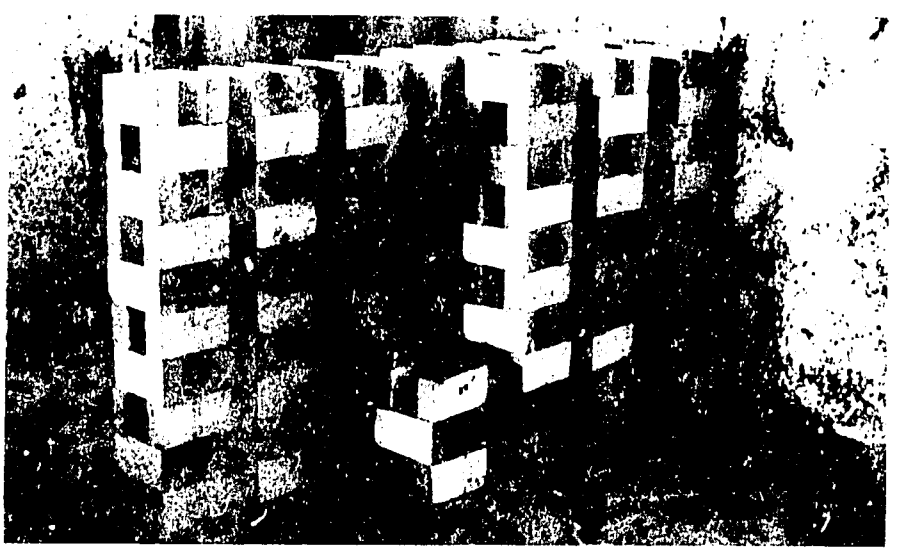
Through the ATI grant, the Center for Tropical Studies and Appropriate Technology (CITTA), will provide financial, technical, and marketing assistance to the Agrarian Cooperative of Lares. The Cooperative provides centralized marketing and agro-processing opportunities to the 23 member cooperatives located in the area. It is expected that with the improved extraction efficiencies, reduced transportation costs, and better quality control, the 1,800 Cooperative members will increase their income by a minimum of $150 per year.

Given the growing international demand for annatto, prospects for project replication in achiote-producing countries such as Kenya, Zimbabwe, Costa Rica, Jamaica, Ecuador, and India appear very promising.

Brick-Pressing Technology, Tanzania and Botswana

Brick-making in Africa is usually done either by traditional slop molding (molding of wet clay in a wooden mold) or through extrusion and wire-cutting. Slop molded bricks tend to be of poor quality since they are usually underfired, are of low density, and become deformed as a result of being deposited onto uneven floors. Wire cut bricks can only be made in large factories, often located near capital cities, and are usually expensive since they are produced by monopoly suppliers. In addition, the machinery required for this type of brick production is often misused.

Hand-operated brick presses have a number of advantages over the above methods. Pressed bricks can be made with very little moisture, permitting handling of the bricks directly from the mold. Moreover, bricks produced in this manner can be stacked to dry, which neither wire-cut nor slop molded bricks can tolerate. This enables great reductions in drying-space requirements. Since the bricks have a comparatively low moisture content, they are less likely to crack during drying, and have a crisp, regular appearance that neither alternative technique can achieve. This in turn makes them highly marketable, and permits the use of smaller amounts of cement in construction. The major advantage of brick pressing, however, is that the technology is portable and may be used in a wide variety of locations by unskilled labor. This makes high quality brick-making a viable option for village enterprises, enabling village producers to fill the demand of urban markets for good quality building material. In addition, pressing enables the use of soil-cement mixtures in areas of high demand where the clay or fuelwood needed to make ceramic blocks may not be available.



Pressed bricks can be stacked to dry, enabling great reductions in drying-space requirements.

ATI is testing three presses and clay preparation systems in Tanzania: two presses from Belgium (Terstaram made by Fernand Platbrood of Couvin and the Ceraman H made by CERATEC of Ploegsteert) and one from England (I.T. Workshops Type E). The Southern Rural Development Association/Minerals Holding Trust (SRDA/MHT) in Botswana is using the Terstaram, while a project in Kenya, to be implemented in 1986, will make use of the Ceraman H. A small experimental project in Zaire is also using the Terstaram. Initial results from Tanzania and Botswana indicate that the Ceraman H and the Terstaram presses (essentially similar machines) produce the best quality brick at a rate of 1,500 units per day using a team of four people. Because of lower moisture content, bricks produced with these

presses can be stacked to dry. In addition, the Ceraman H and Terstaram presses can be used to produce soil-cement bricks, and have interchangeable molds which permit the manufacture of blocks and tiles of varying types and sizes.

The project in Kenya will respond to a keen interest on the part of that country's private sector to make use of this technology, since it enables the manufacture of bricks which are of higher quality than those produced with any other equipment, either mechanized or traditional. The two Belgian brick-pressing technologies can be upgraded. Both manufacturers produce automatic presses weighing 1 1/2 tonnes which are able to produce between 1,400 - 2,000 bricks per hour, drawing their power from a five h.p. diesel engine. This provides the opportunity for brick plants which are capitalized at very low levels to compete favorably with large mechanized plants, while taking advantage of small localized clay reserves, and small localized markets. ATI's approach is to integrate these technologies into existing traditional private manufacturing plants, and offer recapitalization to those that take best advantage of the technology. Those enterprises that significantly expand their market share will be offered the opportunity to upgrade their equipment to the diesel powered models.

The use of these presses requires an entirely different form of work organization and use of space; more of the latter is devoted to material preparation and storage, and less to drying. At the same time, material and product handling require a different approach. In contrast to other techniques, pressed bricks do not need to be laid out individually to dry and may be transported en masse by cart, from press to drying area and, in turn, from drying area to kiln. This has the advantage of reducing handling losses and labor requirements.

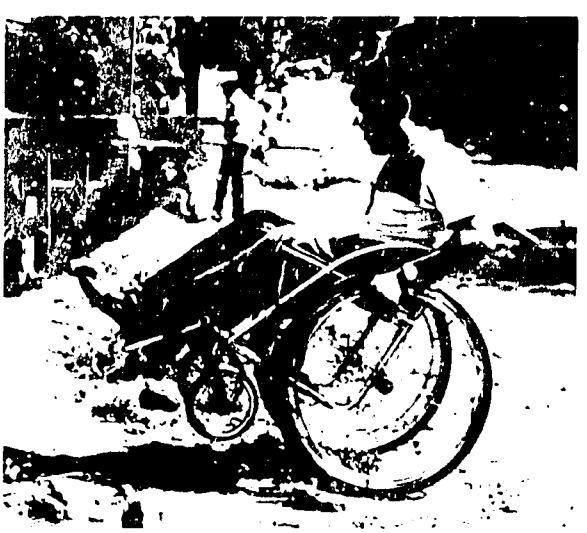
SRDA/MHT has worked with ATI on the development of an improved coal-fired kiln for burning pressed bricks which, while used intermittently, employs the Hoffman heat transfer principle. This uses exhaust gasses to preheat unfired brick, and combustion air to cool brick already fired. The kiln was designed by SRDA/MHT's engineer, and the firing and loading configurations were developed with ATI engineering assistance. The system can be adapted for wood firing. This kiln is comprised of two chambers, each of which is capable of firing 80,000 bricks in twelve days. It permits unloading of bricks while the fire is still burning, which reduces fuel requirements and improves labor efficiency. Another advantage of this kiln is that pressed bricks that have been allowed to dry for only one day can be loaded for firing, since only 1/3 of the kiln in the primary heat zone requires dry bricks. This further reduces the amount of drying area required. Estimates indicate that less than 1/4 of the area required for drying slop molded bricks may be needed.

In two years time, ATI hopes to develop packages of machinery, kiln designs, and plant layouts for a variety of users, both ceramic brick makers and producers of soil-cement materials. Experience obtained from the various projects mentioned above will be of great value in developing such packages.

Wheelchair Production, Latin America

The ATI-Hotchkiss wheelchair, developed and tested under an earlier ATI grant, is a lightweight folding wheelchair uniquely adapted for production and use in developing countries.

The current project, which represents ATI's first effort to support the production of an appropriate technology on a regional scale, has helped to establish twelve small-scale wheelchair manufacturing enterprises in Peru, Colombia, Brazil, Guatemala, Honduras, and the Dominican Republic. Production capacity at these enterprises ranges between 100 to 300 wheelchairs per year. ATI, in collaboration with the local project partners, provides training, technical, financial, and marketing assistance to the participating enterprises.



The ATI-Hotchkiss wheelchair is lightweight, can be folded to fit in crowded living conditions, has good traction and stability, and is maneuverable enough for travel over rough terrain.

Ralf Hotchkiss, the inventor of the ATI-Hotchkiss wheelchair, developed the design over a period of three years in collaboration with wheelchair users and small metalwork shops in Nicaragua, Mexico, and the Philippines. What Hotchkiss achieved with this design is a lightweight folding wheelchair that is extremely well-balanced, adaptable to individual fittings, and of simple but rugged construction. The chair has 26 fewer welds and 82 fewer fasteners than standard designs. At the primary points of stress -- the rear wheel hubs and axles and the

front wheel forks and bearings -- the Hotchkiss design employs heavier components than standard prescription designs. The wheelchairs can be folded to fit in crowded living conditions, have good traction and stability, and are light and maneuverable enough for the wheelchair rider to travel over rough ground. The ATI-Hotchkiss wheelchair is composed almost exclusively of materials and components that are available locally in Latin America.

The production technology is in part based on the results of several training workshops held by Ralf Hotchkiss in Latin America with mechanics and engineers whose shop skills range from minimum to excellent. The production process requires that key workers be skilled in oxy-acetylene welding and have average mechanical skills. Production is labor intensive, requiring between 25 and 40 hours of work per wheelchair. Since a batch production mode is employed, production can be interrupted without adversely affecting costs. This is a great advantage for very small shops that do not want to dedicate themselves exclusively to wheelchair manufacture.

A basic tool kit is either sold or loaned to participating enterprises. A detailed production manual has just been published in English. The employment of a standard tooling system, combined with the procedures codified in the production manual, have maintained the integrity of the design in the twelve work places enrolled in the project.

The ATI-Hotchkiss wheelchairs are manufactured in local metal workshops in several Latin American countries.

The ATI-Hotchkiss chair is currently being sold in Latin America for between $175 to $240. This compares with a price range of $225 to $300 for other locally produced wheelchairs of similar quality. The combined annual production capacity of the twelve enterprises is 2,500 chairs.

Although the basic design of the frame is fixed, the production manual indicates the adjustments that are required to adapt to three different sizes of rear wheels. The X-frame welding jig provides for six adjustments in chair height. Two folding footrest designs, bent tubing or standard cast aluminum, are available. There are four front wheel and tire options. It is anticipated that additional design and component options will be developed as producers react to materials and component constraints in their individual situations.

Rural Industrial Investment Companies: Indonesia, Thailand, and the Philippines

Rural entrepreneurs have enormous potential for changing the economic conditions under which they live, a potential which is most often left dormant because they are either unaware of the means for changing, or they do not have access to necessary support systems -- financing, and technical and business management assistance. ATI has supported the establishment of rural investment companies in Indonesia, Thailand, and the Philippines, which promote the commercial application of technologies in rural areas, and provide assistance packages tailored to the needs of small-scale industries and entrepreneurs in rural areas.

The assumption underlying ATI's support of these companies is that significant benefits can be achieved due to the following advantages of this approach.

Each investment company offers equity rather than loan financing. A small business, especially during the precarious initial stages of operation, has a much better chance of surviving and succeeding if it is able to pay dividends to its investors when profits are earned, as opposed to diminishing its cash flow in order to repay fixed-term loans.

Secondly, ATI's partners in these projects are large, sophisticated PVO's with long and successful histories of working among the rural poor in their respective countries. They bring business management, marketing and technical services to the investment companies and, due to their shared interest in the success of the businesses supported by their investments, provide this essential expertise to their business partners. Thus, these investment companies provide both capital and required

business support services to rural entrepreneurs who would not otherwise meet the eligibility requirements of formal sector financing institutions, and who could not afford to pay for needed services.

Thirdly, the business partnerships formed through this mechanism will lay the foundation for long-term self-sufficiency of the rural enterprises established. In addition, the investment companies themselves are expected to become self-financing based on earnings from their investment portfolios.

Examples of some of the businesses already in operation are: processing coconuts into oil and other by-products, production of fresh and dried mushrooms, bamboo grass plait manufacture for export to Korean seaweed growers, and a shrimp fry hatchery.

From a programmatic standpoint, another advantage of this approach is that AFI's support of these investment companies has enabled the provision of assistance to a number of rural entrepreneurs who might otherwise not have been reached through usual project identification and development channels. Simultaneous support of these three companies operating under different conditions in each country will inform future decisions regarding the replicability of this approach on a wider scale.

Bamboo grass plait manufacture is one of the first small businesses financed through the rural industrial investment companies in Thailand

ATI's Replication Strategy

During 1985, ATI began to lay the groundwork for promoting future replication of its successful projects. ATI's replication strategy resulted from the recognition that (1) if results of successful appropriate technology projects which demonstrate technical, commercial, and economic viability are made known, the incidence of adoption or adaptation of the technologies by others will increase; (2) investments in projects which prove successful will be maximized by promoting the support of similar projects by others; and (3) significant economies can be achieved in terms of planning and implementing projects which have been proven successful.

Many projects are successful only under certain conditions. ATI's replication strategy supports careful monitoring and documentation in order to establish what works, under what conditions. This documentation takes the form of technology prospectuses, project technical reports, technical bulletins, and interim evaluation reports. These reports help to inform decisions regarding the replication potential of a particular project. In addition, they serve to keep others who are interested in the project, and who are potential replicators of the project, informed as to performance and progress. Some of the documents are used to generate interest on a more general level.

Basic responsibility for implementation of ATI's replication strategy rests in the Department of Field Operations. A Replication Committee meets monthly to review and decide on actions to be taken regarding replication for all projects, depending on the stage of each individual project. This Committee exercises the function of determining, based upon final project evaluation, the level of ATI's engagement in subsequent replication activities.

In addition to the above, the Office of the Executive Director has undertaken work in the area of policy and research in support of ATI's replication strategy. A number of studies and seminars are planned for 1986:

An ATI project in Kenya has initiated production and marketing of fuel efficient, ceramic-lined jikos (cladding manufacturer left). Field tests are underway to assess the feasibility of transferring the technology to Haiti.

Appropriate Technology as a Strategy for Development

ATI has undertaken further research along the lines of the high impact studies published early in 1985, and described in last year's Annual Report. This line of research identifies issues underlying successful replication efforts. The more recent studies, to be published in 1986, illustrate examples of application of formal sector marketing strategies in the informal sector.

Policy Dialogue

Macro-policy studies on appropriate technology were completed in 1985, for presentation at a January 1986 conference hosted jointly by ATI and the Overseas Development Council. These studies will be published during 1986. Later in the year, two or three regional seminars are planned with local government officials from Asia, Africa, and Latin America, to discuss the findings and conclusions of the studies. These regional meetings will generate separate publications.

Macro-Policies and Micro-Interventions

Two case studies – one in Africa and the other in Asia – will be undertaken to research the particular macro-policy changes required to facilitate widespread replication of ATI demonstration projects initiated two years ago.

Replication Research

ATI is supporting a study of the factors that affect the replication of successful appropriate technologies. A conceptual examination of replication and a survey of the literature and findings on replication will inform ATI's own efforts to effectively replicate successful appropriate technologies.

Small-Scale Technology Atlas

Awareness about the role and importance of small-scale technology in development is the first step toward informed decision-making. ATI will publish an atlas which describes both macro- and micro- changes which have taken place as a result of small-scale technology interventions. ATI is working with one of the authors of the highly successful "Third World Atlas" to produce a "Development Atlas", to be published by ATI, intended to serve as an educational tool not only for development professionals but for the general public as well.

Field Program Activities - 1985

Africa Projects

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, over 280 grapple gatherers will increase their incomes by as much as 25% over current levels as a result of higher prices paid by TL 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 consumer packaged and exported. This represents the first processing for export of this type in Botswana.

Anguh Maize Mills, Cameroon

Project Partners:

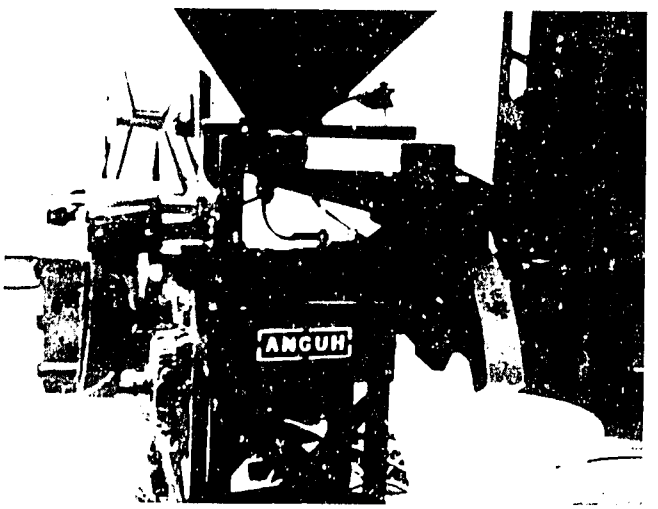
Association pour la Promotion des Initiatives Communautaires Africaines (APICA), B.A. Anguh Agricultural Tools Manufacturing, Northwest Development Authority (MIDENO), Northwest Cooperative Association, and Peace Corps.

Purpose:

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

Expectations:

Over a three year period, over 85 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 in approximately 8,500 households will increase, due to significant reductions in labor time and arduousness relative to traditional hand grinding and hand milling methods. In addition, over 85 new jobs will be created in rural areas.



Relative to the traditional hand grinding method, use of the mechanized plate mill will increase labor productivity of rural women.

Technology:

This project will manufacture a modified version of a locally available diesel-powered maize plate mill. 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.

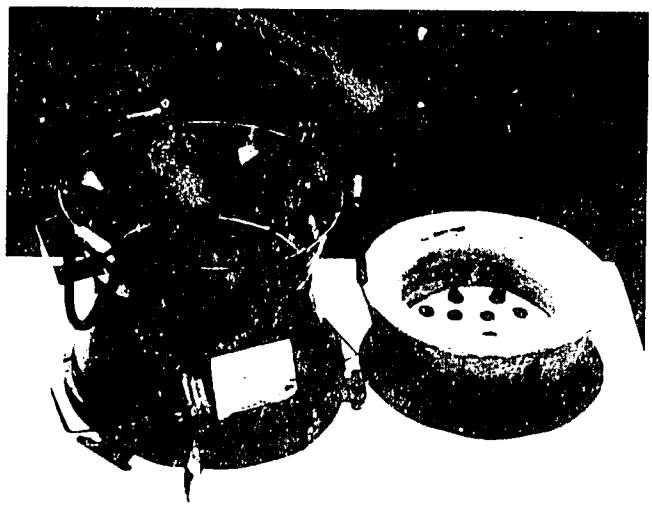
Ceramic-Lined Jikos, Kenya

Project Partner:

Kenya Energy Non-Governmental Organizations Association (KENGO)

Purpose:

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



The addition of ceramic liners to metal jikos will reduce fuel consumption.

Expectations:

It is anticipated that manufacture of ceramic-lined jikos by 20 geographically dispersed manufacturers will lead to a high rate of adoption of the technology among the estimated 1,000 metalworking artisans who at present devote at least one third of their working hours to the manufacture of jikos. The major benefits will be cash savings to consumers; the aggregate household savings will total $470,000 over a two year period. Assuming a market share of 10%, national fuelwood savings could avoid the clearance of the equivalent of 11,250 hectares of natural forest and plantations. In addition, if successful, this project will generate annual gross profits of $64,000 in the informal manufacturing sector, and an additional $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 and is well-suited to local manufacture by small artisans who can market the jikos in small townships and trading centers.

Shea Butter Extraction Units, Mali

Project Partners:

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

Purpose:

To 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:

As a result of this project, approximately 850 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

Improved shea butter extraction technology employs simple solar driers, a manual or motor driven decortication screwpress, an animal- or motor-driven shea nut grinder (left) and a centrifuge.

dramatically reduce the use of firewood and the arduousness of work for rural women, the primary producers of shea butter. Two commercially viable shea butter extraction units will be established, and the groundwork laid for wider dissemination of the improved extraction units. There is the potential for the installation of at least 100 of these units in West Africa over the next five to ten years.

Technology:

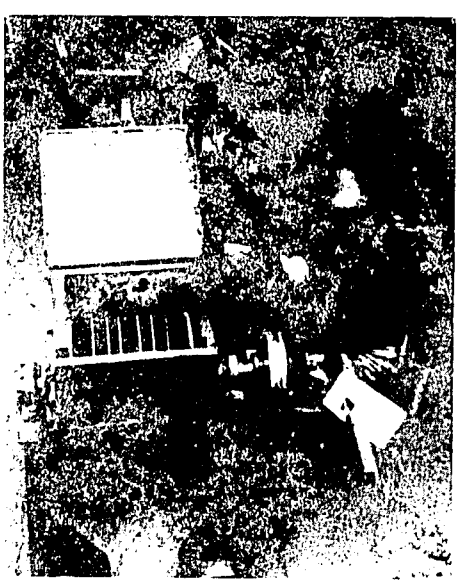
The project will test two shea butter extraction processes developed and tested by CEPAZE, one motor-driven and the second hand- or animal-driven. The latter is better suited to

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. The improved technology reduces the use of scarce firewood and labor time required to process shea nut butter and can be manufactured locally.

Mini-Dehullers, Mali

Project Partners:

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



Maize sorghum millet dehuller to be adapted for use in Mali

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 $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, which involve 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, a locally modified version of the IDRC dehuller, is considerably less expensive than the majority of mechanized dehullers in use. In addition, its energy consumption is lower than the alternative mechanized equipment. The modified mini-dehuller is the first grain processing equipment to be manufactured locally in Mali. Its simple design will facilitate production in other regions of Africa where millet, sorghum, and maize are grown.

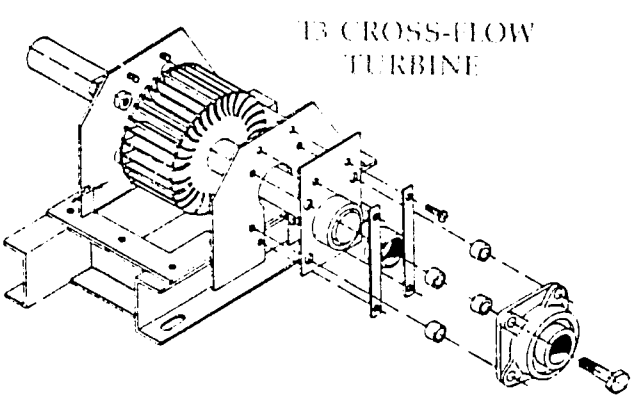
Hydro-Powered Grain Mills, Zaire

Project Partner:

Societe de Developpement Rural de Zaire (SODERZA)

Purpose:

To introduce hydro-powered grain milling using crossflow 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 milling projects is expected to provide indirect income and consumers surplus benefits to peasants from family sales of milled cassava totalling $12,480 per year, if only 17% is marketed. In addition, each project should result in time savings of 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 $107,060 will be created in rural areas.

Technology:

This project will test the use of hydro-technology as a power source for milling through direct drive, a technology which has not been extensively developed or applied in rural areas of the country. The technology employed in this project is a combination of a hammer mill linked to a cross-flow turbine. A hammer mill was chosen due to an existing local familiarity with this type of technology. 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. If the technology proves commercially and technically viable, it will have positive implications for energy use in the region.

Asia Projects

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, to 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 $14 - $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 $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 agriculture 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 establishing a single source of dolomite and rock phosphate minerals, the quality of which will be monitored through chemical analysis.

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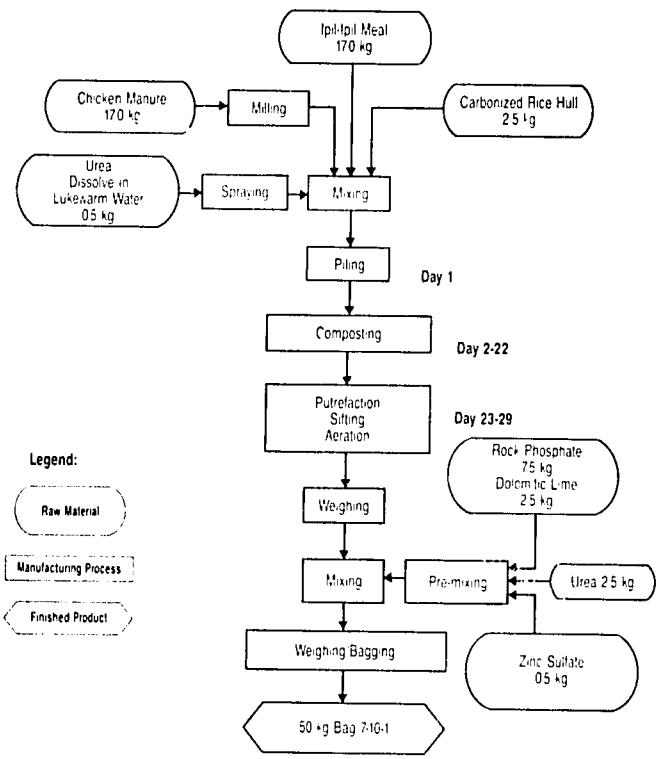


Industrial Salt Production, Philippines

Project Partner:

Filipinas Foundation, Inc. (FFI)

Purpose:

To demonstrate that small producers, using improved solar salt production techniques, can substitute costly imports with locally produced, high quality salt products and basic chemical by-products for household and industrial consumers.

Expectations:

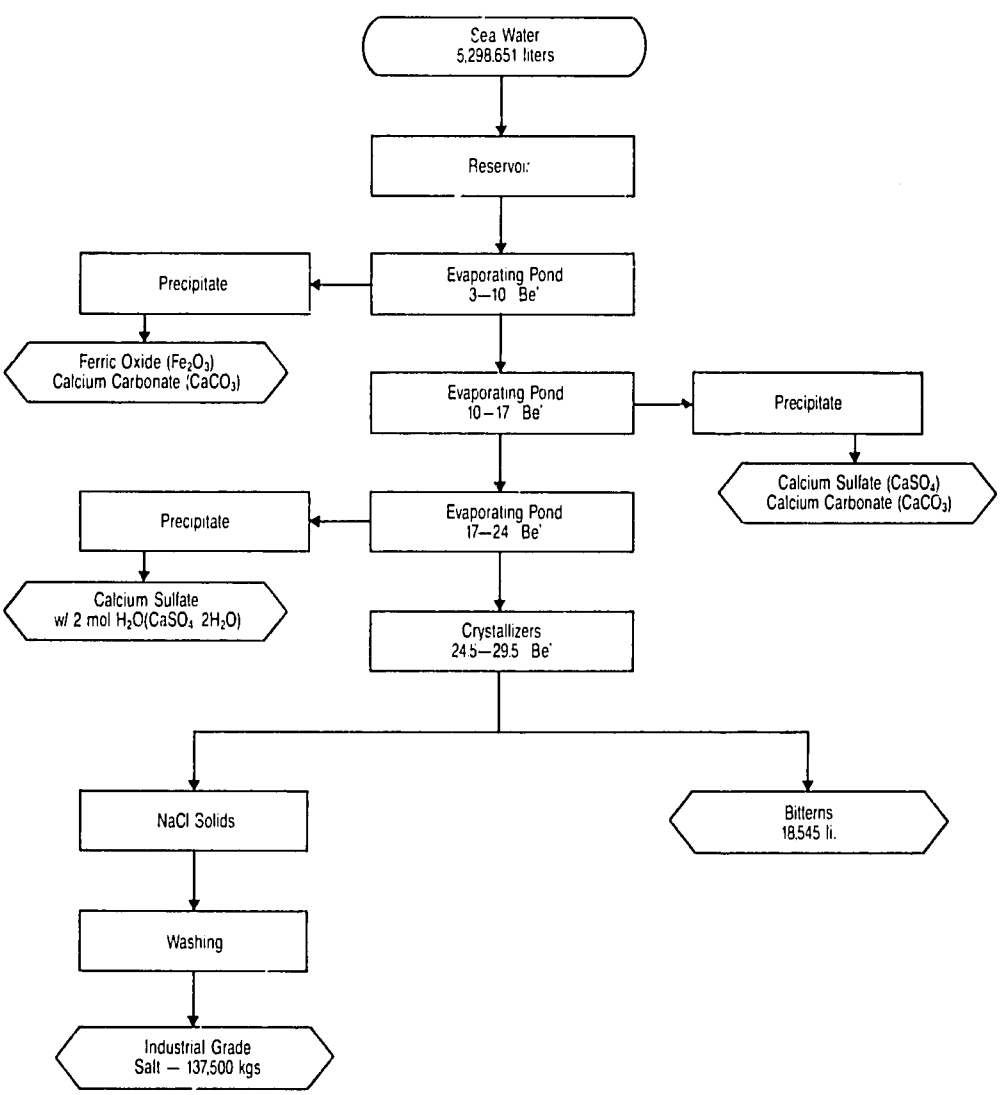
This project will demonstrate the potential foreign exchange savings to be gained from development of the local solar salt industry in order to produce local products which can

substitute for imports. The yield per hectare of salt works will increase from 15 to 27.5 tonnes/hectare. Incremental income increases to industrial salt producers are expected to be about $1,280 per hectare, assuming a price difference of $1.60 per 30 kg bag between crude and industrial salt, and about a 50% per hectare yield increase. Two additional jobs can be created for each hectare used in industrial salt production due to anticipated higher yields per hectare. In addition, the costs and benefits of processing marine chemicals from waste bitterns will be examined.

Technology:

This project will introduce an improved method of small-scale salt-making into the Philippines. Both the traditional and improved methods involve simple operations and do not require sophisticated technical skills. However, the improved method is more economical and results in a salt product which is cleaner and more dense. In addition, compact crystals with a purity of 95% and above are achieved. Major differences between the improved method versus traditional methods include: (1) a rigid process control in which the flow of water is channelled through successive ponds so that the salt concentration rises in controlled stages, thereby reducing the percentage of magnesium and potassium salts in the final product; (2) the use of the more economical "multiple irrigation system," i.e., the repeated flooding of brine onto the crystalizers to make up for evaporation loss and the release of bittern at regular intervals; (3) the release of brine onto the crystalizers at deeper levels (5-6 cms. vs. 1-2 cms.); and (4) the possibility of processing marine chemicals from waste bitterns.

PRODUCTION OF INDUSTRIAL GRADE SALT



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 technological elements and which 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 $2.00 in direct and indirect economic benefits for every $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 actively 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.

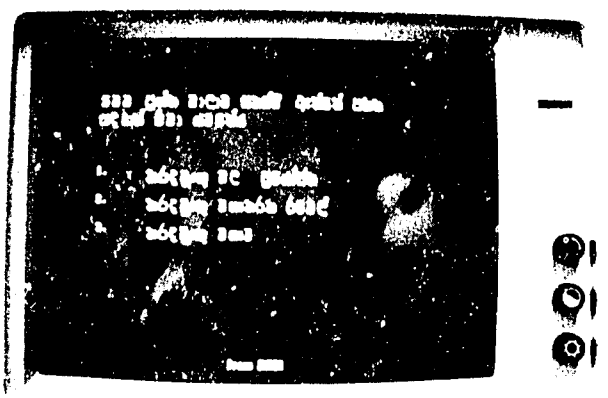
Computer-Video Training, Sri Lanka

Project Partner:

Dasuna Enterprises, Ltd.

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 the incomes of small-scale spice growers in 10 rural villages in the Matale, Kegalle, and Kandy districts.



This project will use a series of training videos and computer-based lessons which teach basic skills in spice cultivation, harvesting, and drying.

Expectations:

This applied research project will test the effectiveness of computer- and video-based training in increasing the technical skills and income-earning capacity of the rural poor. 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 over 3,000 rural families by increasing their ability to produce higher yields and better quality spices. A spice trading scheme will also increase the incomes of small-scale spice growers from spice cultivation and processing.

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 collaborate in order 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 which teach basic skills in spice cultivation, harvesting, and drying. This methodology 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.

Latin America/Caribbean Projects

Farm Support Enterprises, Mexico

Project Partners:

Centro de Ensenanza, Investigacion y Capacitacion para el Desarrollo Agricola Regional (CEICADAR) and Colegio de Postgraduados de Chapingo.

Purpose:

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

Farmer mixing low cost protein supplement of poultry waste products, molasses, and micro-nutrients.

Expectations:

Ten feed distribution enterprises will be established that will provide a high protein feed to small farmers engaged in milk production. Each enterprise will serve an average of thirty 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 four hundred 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 $82,000 in profits will be generated annually by the 21 micro-enterprises.

Technology:

This project links together an effort to develop and disseminate improved farming systems with the rural based enterprises required to sustain these systems. The five categories of rural 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.

High protein feed for milk cows: the Colegio has developed a high protein feed for cows normally fed on rations with high corn stover content. This feed uses molasses and inorganic carriers of nitrogenous waste materials, such as chicken manure or ammonia, as protein substitutes. The supplement reduces feeding costs by $.45 per cow per day relative to traditional rations.

Annatto Production, Peru

Project Partner:

Centro de Investigaciones Tropicales y de Tecnologia Apropriada (CITTA)

Purpose:

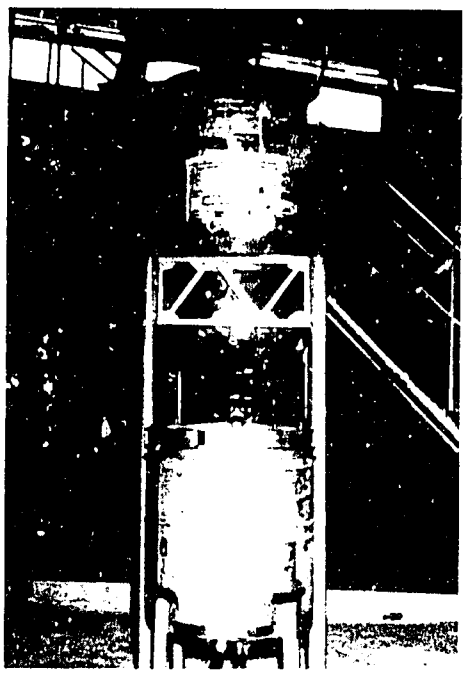
To (1) establish a commercially viable achiote processing plant that produces export-quality annatto food colorant, (2) introduce new techniques for cultivating achiote trees from which annatto is obtained, and (3) introduce a newly developed technology for hulling achiote seeds for processing.

Expectations:

By the third year of the project, over 1,800 small farmers in Cuzco will increase their yearly incomes by approximately $150 through a 35% increase in the prices paid for raw achiote seed. By the third year, profits generated should total approximately $330,400 which will be available for reinvestment and payment of additional income in yearly dividends 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 by CITTA to establish a fund to promote subsequent economic development projects with the rural poor in the Cuzco-Puno region.

Technology:

This project introduces an achiote processing technology into the Cuzco region of Peru which will bring direct benefits to the rural poor by increasing their incomes. Relative to proc-



A series of chemical precipitation vats are used to separate annatto colorant from achiote seeds.

Scaled-down versions of trommels (above), sluices, riffles and monitors have been designed to meet the mining requirements of the project area.

essing 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.

Placer Mining Equipment, Peru

Project Partner:

Centro de Investigaciones Tropicales y de Tecnologia Apropiada (CITTA)

Purpose:

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

Expectations:

This project will enable the mining cooperative to process five times its present capacity of ore per day. The 65 members of the mining association will increase their incomes by an average $225 per year from increased wage payments and dividends. The project will also create up to 60 new jobs in mining within the Cooperative. CITTA will establish a Technology Assistance Fund, composed 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, initially developed in the United States, that have 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 by five-fold. Improvements will also be made in the Cooperative's hydrological infrastructure. This technological package will be tested and disseminated to other parts of Peru through technical personnel supported by the project.

Potato-Based Foods, Peru

Project Partner:

Centro Ideas

Purpose:

To demonstrate the commercial and technical feasibility of producing potato-based foods for low-income urban consumers through small-scale, rural enterprises.

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 opera-

Commercializing potato processing technology will lead to higher incomes for potato producers.

tion, each plant will generate profits of approximately $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 enable low income urban consumers to save approximately $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 $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. It can be used in the preparation of puddings, desserts, soups, stews, and beverages.

Cutting ramie, Dominican Republic

APPROPRIATE TECHNOLOGY INTERNATIONAL PORTFOLIO OF PROJECTS ACTIVE IN 1985

Region: AFRICA

Country	Grant Obligation	Implementing Organization	Project Purpose
BOTSWANA	$108,000	RIP/RIIC	Program for demonstrating viability of animal driven pumps to lower cost of water provision to low-income rural families.
	90,400	SRDA/MHT	Upgrade brickyard at Moshaneng and establish a brickyard at Ntlhantlhe.
	95,000	SRDA/MHT	Establish a commercially viable, small-scale limeyard at Segeng.
	37,100	TL	Establish a profitable enterprise producing grapple products for export.
CAMEROON	$131,139	APICA	Establish appropriate technology research and development and dissemination service.
	304,324	APICA	Institutional mechanism and program for diffusion of palm oil extraction technology through small-scale rural enterprises.
	164,084	APICA/CATMI	Manufacture maize mills for sale to groups and individuals.
KENYA	$254,097	KENGO	Initiate production of ceramic-lined charcoal burning stoves and field test a ceramic-lined portable wood burning stove.
MALAWI	$51,435	LADD	Provision of extension services, training, capital, and improved production techniques for rural industries.
	75,083	GOVT MALAWI	Ferro-cement fishing boat production and financing program.
	33,000	MALINDI	Establish vocational training program and increase production capacity of small-scale pottery organization.
MALI	$97,846	CILCA	Introduction of improved tools and techniques for rainfed cereal and vegetable production.
	81,088	ADAUA	Dissemination of low-cost housing technologies.
	13,445	GRAT	Biomass digestors for animal vaccine refrigeration.
	52,070	CEPAZE	Manufacture two types of shea butter extraction equipment and test the commercial and technical viability of such equipment.
	132,318	CMDT	Test the technical and commercial viability of a modified mini-dehuller and locally manufacture it for sale in southern Mali.
PAPUA NEW GUINEA*	$33,726	SPATF	Fund for small village income-generating agriculture and rural enterprises.
	81,750	SPATF	Establish self-supporting trading company to provide technical assistance, credit and supplies to small industries and rural artisans.
SIERRA LEONE	$62,200	GOSL	Rice cultivation in community-developed swamps.
TOGO	$74,821	SOTOPRODER	Commercial viability assessments of labor intensive aquaculture technologies.
TANZANIA	$112,276	CAMARTEC/THEMI	To manufacture hand-operated oil presses for use in villages.
	97,512	CAMARTEC/SDS	To make possible the commercial supply of fire bricks, kiln furniture and glaze materials to small village potteries in northern Tanzania.
	142,676	IWR	To establish and maintain small-scale sunflower oil extraction industries using locally manufactured hand-operated presses.
	156,452	CAMARTEC/MERU	To introduce new technology for the manufacture of high quality bricks.
VANUATU*	$98,000	DEV BANK	Capitalize and administer the Industrial Development Trust Fund.
ZAIRE	$282,580	SODERZA	Introduce hydro-powered grain milling in eastern Zaire.
ZIMBABWE	$224,500	FEP/ZIMFEP	To establish cooperative-based agro-processing industries.

Region: ASIA

Country	Grant Obligation	Implementing Organization	Project Purpose
EGYPT*	$ 30,000	SCF	Program promoting agro-processing, small-scale manufacturing/farm technologies.
INDIA	$312,605	ATDA	Design, construction, commercial feasibility assessment of small cement plant.
	99,457	SRC	Service center for technical and marketing assistance and production training for small-scale rural ceramics industries development.
	8,330	KGSN	Planning for village industries.
	68,546	SEWA	Strengthen association of self-employed women.
	96,820	CORT	Establish information and dissemination center serving Indian appropriate technology organizations.
	48,577	DEV GROUP	Establish technology unit providing services to rural entrepreneurs.
INDONESIA	$47,795	WAHLI	Establish small project fund for consortium of indigenous appropriate technology organizations.
	17,430	YOD	Training and funding for village appropriate technology projects.
	290,824	YDD	Establish small-scale manufacturing industries using appropriate technologies developed by YDD, and financed by a venture capital company.
MALAYSIA	$47,570	IMB	Research, demonstration of technical, environmental, and economic benefits of traditional house building technologies.
NEPAL	$20,754	DYC	Develop and support integrated cropping systems and small-scale livestock programs.
	11,185	YSD	Strengthen textile and handicrafts enterprise.
	165,144	ACP	Develop and provide wool spinning technology to small producers and supply high-quality yarn to hand knotted carpet industry.
	29,959	NEW ERA	Test the commercial and technical feasibility of a locally designed and manufactured turbine driven heat generator to be employed in a community-owned agro-processing enterprise.
PHILIPPINES	$367,440	FFI	Set up manufacturing enterprises employing appropriate technologies by FFI and financed by a venture capital mechanism established by the project.
	107,957	FFI	To provide, through small production units, organic fertilizer to small farmers.
	151,791	FFI	Demonstrate the commercial feasibility of developing improved solar salt technologies for local use.
SRI LANKA	$25,294	ATG	Establish professional appropriate technology service.
	240,076	DASUNA	Test the feasibility and effectiveness of computer video training as a tool to transfer technical skills in rural areas of developing countries.
	350,000	MASL	Promote investments in small and medium-scale industries within the borders of the Mahaweli Development Zone.
THAILAND	$72,780	SVITA	Provision of services for small business development.
	137,700	SVITA	Introduce rhizobium inoculant, a natural bacterium that fixes atmospheric nitrogen in leguminous plants.
	310,733	PDA	Establish a small finance and technical assistance company which will make investments in rural small-scale industries using improved production technology.
	210,300	PDA	Develop and commercialize a bio-technology for the production of stock feed by enriching the nutritional content of cassava.
REGIONAL	$37,500	ACHAN	Establishment of structure to coordinate network of Asian community health practitioners.
	180,000	APPROTECH	Core funding and small project fund for consortium of Asian appropriate technology groups.

Region: LATIN AMERICA/CARIBBEAN

Country	Grant Obligation	Implementing Organization	Project Purpose
BARBADOS	$37,000	DWA	Development and strengthening of fruit drying and preservation enterprises.
BOLIVIA	$69,232	PARTNERS	Promotion and dissemination of low-cost technologies for rehabilitation of the physically handicapped.
COLOMBIA	$80,000	SCF	Prototype waterwheel pump and drip irrigation system for small farmers.
	11,200	CCHLG	Research, development and testing of micro-hydro technology.
	92,456	SERVIVIENDA	Establish research and development unit for organization specializing in appropriate housing technology.
	54,774	SINTRA	Research, development and marketing of spinning and weaving technologies and products.
COSTA RICA	$144,514	ITCR	Improve traditional lime production using an innovative, vertical shaft kiln permitting continuous firing, and create a fund to finance the application of the new technology.
DOMINICAN REPUBLIC	$90,600	CIMPA	Establishment of small-scale milk production units.
	78,392	UCMM	Development and demonstration of micro-hydro turbine.
	21,474	CIAVIVIENDAS	Research, development and demonstration of housing construction technology.
	160,977	CIMPA	Develop and test a commercially viable technology delivery system for small farm hog production.
GRENADA	$30,042	NSTC	Research and development of energy technologies for rural cooperative enterprises.
GUATEMALA	$28,672	HODE	Transfer of a prefab housing technology for rural low-cost housing.
HAITI	$86,821	SAVACAMPE	Determine the commercial viability and replication potential of a small-scale cassava processing plant.
MEXICO	$90,000	ADMIC	Technical training, credit, and organizing support to micro-entrepreneurs.
	221,000	COLEGIO	Establish twenty-one rural microenterprises to provide equipment, supplies, and services for improved production technologies.
NICARAGUA	$93,250	INRA/CITA	Provide funding and assistance to establish CITA, an appropriate technology center.
	46,182	INRA/CITA	Production and dissemination of agricultural tools.
PERU	$161,691	CITTA	Establish a commercially viable achiote processing plant for annatto production, and introduce new cultivation and hulling-techniques.
	177,376	CITTA	Introduce new placer mining technologies, and improve the mining infrastructure of the Mining Cooperative Santiago de Ananea.
	312,982	IDEAS	Demonstrate the commercial and technical feasibility of providing potato-based foods through small-scale rural enterprises.
REGIONAL	$38,887	UNM	Conduct housing construction conference in Peru.
	126,259	Various	Wheelchair design finalization, production, dissemination and regional training courses in the local manufacture of the ATI-Hotchkiss wheelchair.
	18,200	SCF	Distribute the Linares Pump in Latin America, and test its suitability for supplying water for irrigation, livestock, and domestic use.
	300,800	Various	Promote the dissemination of the ATI-Hotchkiss wheelchair technology in Latin America.

* ATI no longer has programs in the South Pacific or the Middle East. In addition, this portfolio includes projects funded prior to ATI's focus in the priority technical fields outlined on page 18.

Appropriate Technology International

Publications

Appropriate Technology as a Strategy of Development for Rural Areas in Developing Countries.
Eric L. Hyman.
ATI, 1986.
Paper presented at the *American Planning Association Conference*, Los Angeles, CA., April 1986.

Ferrocement Fishing Boats: Their Potential for Small-to-Medium Scale Fishing in Lake Malawi.
Eric L. Hyman.
ATI, March 1986.

The Experience with Improved Charcoal and Wood Stoves for Households and Institutions in Kenya.
Eric L. Hyman.
ATI, 1985.

Biotechnology and Community Development for Food Production: A Case Study.
John Slavics and Marshall Bear.
ATI, 1985.

Upgrading Traditional Rural Technologies.
Jeffrey James (consultant).
ATI, 1985.

Independence Through Mobility: A Guide to the Manufacture of the ATI-Hotchkiss Wheelchair.
Ralph Hotchkiss (consultant).
ATI, 1985.

The Strategy of Decentralized Production and Distribution of Improved Charcoal Stoves in Kenya.
Eric L. Hyman.
ATI, 1985.
Presented at the *Conference on Sustainable Development of Natural Resources in the Third World*, Columbus, OH., Ohio State University, September, 1985.

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

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

The Uses of Evaluation in Appropriate Technology Projects.
Thomas C. Corl.
ATI, May 1985.
Presented at the *Workshop on Evaluation and Training*, sponsored by CILCA and Colegio de Postgraduados, Puebla, Mexico, August 1985.

ATI's Projects, Purposes and Technologies.
Ton de Wilde.
ATI, 1985.
Presented before BOSTID's Advisory Board, April 1985.

Appropriate Technology International: Long Term Strategy.
ATI, March 1985.

A System for the Monitoring and Evaluation of Appropriate Technology Projects.
Eric L. Hyman and Thomas C. Corl.
ATI, February 1985.

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

High Impact Appropriate Technology Case Studies.
Thomas Fricke.
ATI, 1984.

Wheelchairs for the Third World.
Ralph Hotchkiss et al.
ATI, December 1984.

The Monitoring and Evaluation of Appropriate Technology Projects.
Eric L. Hyman.
ATI, 1984.
Paper presented at the *Evaluation '84 Conference*, Evaluation Research Society, San Francisco, CA., October 1984.

An Information Framework for the Monitoring and Evaluation of Appropriate Technology Projects.
Eric L. Hyman and Thomas C. Corl.
ATI, September 1984.

ADAUA Earthen Construction Techniques.
Carlos R. Lola.
ATI, 1983.
Published in **Adobe Today: The Journal of Earthbuilding Skills**, Issue 43, 1985.

Macro-Policies for Appropriate Technology: An Introductory Classification.
Frances Stewart (consultant).
ATI, 1983.
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, November 1983.

Forthcoming

Macro-Policies for Appropriate Technology.
Frances Stewart, editor (consultant).

The Strategy of Decentralized Production and Distribution of Improved Charcoal Stoves in Kenya.
Eric L. Hyman.
Accepted for publication in **World Development**.

The Economics of Improved Charcoal Stoves in Kenya.
Eric L. Hyman.
Accepted for publication in **Energy Policy**.

Starting a Local Pottery Enterprise: An Example from India.
Arleen Richman.
Accepted for publication in **Frontlines** (USAID).

Franchised Tea Kiosks in India: Local Enterprise Development.
Arleen Richman.
Accepted for publication in **Frontlines** (USAID).

Appropriate Technology and Rural Industrialization in Thailand.
Alyssa Postlewait.
Accepted for publication in **VITA NEWS**.

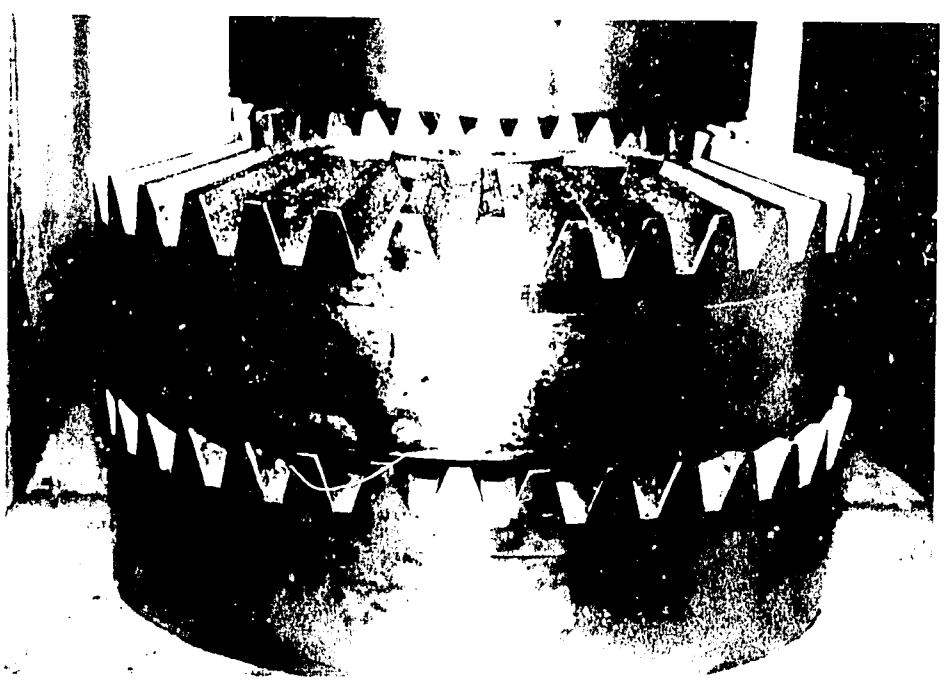
Appropriate Technology Bulletins

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

No. 1. Palm Oil Extraction in Cameroon.
No. 2. Delivery of Appropriate Technology: Venture Capital in Indonesia.
No. 3. Improved Design for Lime Kilns in Central America.
No. 4. Protein Enriched Cassava for Pig Feed in Thailand.
No. 5. Annatto Production in Peru.
No. 6. Shea Butter Extraction in Mali.

Film and Video

During 1985, ATI produced **Small is Powerful**, a 30-minute documentary depicting specific projects in Africa, Asia, Latin America and the Caribbean. The film illustrates how the application of appropriate technologies in small-scale rural businesses offers a promising approach to economic development. Copies of the film are available in English, French, or Spanish in 16 mm and VHS video cassette formats. An accompanying study guide is available in English only. There is also a ten-minute version of the film in English. In addition, ATI produced several shorter films for use by ATI project partners. These are: **Plan Puebla** (Mexico); **Ya Pek** (Thailand); and **Los Hornos de Cal** (Costa Rica).



APPROPRIATE TECHNOLOGY INTERNATIONAL
1985 Summary
Services to the Field

FINANCIAL ASSISTANCE

Region	Country	Project Name	Amount
Africa	Botswana	Grapple Processing	$ 37,100
	Cameroon	Anguh Maize Mills	164,084
	Kenya	Ceramic-Lined Jikos	254,097
	Mali	Shea Butter	52,070
		Mini-Dehullers	132,318
	Zaire	Hydro-Powered Grain Mills	282,580
Asia	Philippines	Organic Fertilizer Production	107,957
		Industrial Salt Production and Chemical By-Products Recovery	151,791
	Sri Lanka	Computer-Video Training	240,076
		Mahaweli Rural Industries	350,000
Latin America & Caribbean	Mexico	Farm Support Enterprises	221,000
	Peru	Annatto Production	161,691
		Small-Scale Placer Mining Equipment	177,376
		Potato-Based Products	312,982
Miscellaneous Grants Made in 1985 ($5,000 and Under)			40,526
1985 Activity-Grants Made Prior to 1985			(163,352)
Total Financial Assistance			2,522,296
Project Development and Monitoring			776,913
Technical and Evaluation Services			265,054
Other Project Support			313,010
Total Services to the Field			$ 3,877,273

PEAT MARWICK

Peat, Marwick, Mitchell & Co.
Certified Public Accountants
1990 K Street, N.W.
Washington, D.C. 20006

The Board of Trustees
Appropriate Technology International:

We have examined the balance sheet of Appropriate Technology International as of December 31, 1985, and the related statements of revenues, expenses and changes in fund balance and of functional expenses for the year then ended. Our examination was made in accordance with generally accepted auditing standards and the standards for financial and compliance audits contained in 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.

In our opinion, the accompanying financial statements referred to above present fairly the financial position of Appropriate Technology International at December 31, 1985, 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.

Peat, Marwick, Mitchell & Co.

February 12, 1986

APPROPRIATE TECHNOLOGY INTERNATIONAL
Balance Sheet
December 31, 1985

ASSETS

Cash (note 3)	$ 128,132
Grants receivable (note 4)	6,315,745
Fixed assets, at cost, less accumulated depreciation and amortization (note 6)	187,413
Advances	22,105
Deposits	54,470
Other	24,988
	$6,732,853

LIABILITIES AND FUND BALANCE

Accounts payable and accrued expenses	$ 144,309
Project grants payable	4,591,482
Deferred grant revenue (notes 4)	1,995,352
	6,731,143
Fund balance	1,710
Commitments (note 8)	
	$6,732,853

See accompanying notes to financial statements.

APPROPRIATE TECHNOLOGY INTERNATIONAL
Statement of Revenues, Expenses and Changes in Fund Balance
For the year ended December 31, 1985

Revenues	
AID grants	$5,243,284
Other	224
Total revenues	5,243,508
Expenses	
Services to the field	
Financial assistance	
Agricultural product processing	1,431,098
Local mineral resources	543,191
Equipment and support for small farms	283,150
Other	264,857
	2,522,296
Project development and monitoring	776,913
Technical and evaluation services	265,054
Other project support	313,010
Total services to the field	3,877,273
Policy and information services	420,549
Total program services	4,297,822
Supporting services	
Nonprogram costs	527
General and administrative	945,518
Total expenses	5,243,867
Excess of expenses over revenues	(359)
Fund balance, beginning of year	2,069
Fund balance, end of year	$ 1,710

See accompanying notes to financial statements.

APPROPRIATE TECHNOLOGY INTERNATIONAL

Statement of Functional Expenses

For the year ended December 31, 1985

	Program Services										
	Financial Assistance	Project Development & Monitoring	Technical & Evaluation Services	Other Project Support	Total Services To The Field	Policy & Information Services	Total Program Services	Nonprogram Costs	Total Direct Costs	General & Administrative	Total Expenses
Financial Assistance (note 5):											
Field operations	$2,522,296	—	—	—	2,522,296	—	2,522,296	—	2,522,296	—	2,522,296
Policy	—	—	—	—	—	(15,729)	(15,729)	—	(15,729)	—	(15,729)
Total financial assistance	2,522,296	—	—	—	2,522,296	(15,729)	2,506,567	—	2,506,567	—	2,506,567
Operating Expenses											
Salaries	—	402,818	145,199	205,209	753,226	199,938	953,164	—	953,164	248,058	1,201,222
Benefits	—	86,149	27,904	36,979	151,032	40,552	191,584	—	191,584	47,879	239,463
Other payroll costs	—	35,924	13,400	20,219	69,543	17,363	86,906	—	86,906	22,011	108,917
Consultants	—	54,283	16,081	16,781	87,145	112,535	199,680	—	199,680	—	199,680
Travel	—	196,407	61,649	30,322	288,378	51,377	339,755	—	339,755	15,729	355,484
Occupancy costs (note 8)	—	—	—	—	—	—	—	—	—	238,126	238,126
Communication	—	—	—	—	—	—	—	—	—	103,986	103,986
Materials and supplies	—	—	—	—	—	—	—	—	—	22,544	22,544
Copying and printing	—	1,332	821	—	2,153	13,345	15,498	—	15,498	24,157	39,655
Publications	—	—	—	—	—	—	—	—	—	17,963	17,963
Recruitment and relocation	—	—	—	—	—	—	—	—	—	3,165	3,165
Professional services	—	—	—	3,500	3,500	—	3,500	—	3,500	68,838	72,338
Insurance	—	—	—	—	—	846	846	—	846	8,678	9,524
Miscellaneous	—	—	—	—	—	322	322	527	849	11,011	11,860
Equipment maintenance and rental	—	—	—	—	—	—	—	—	—	56,092	56,092
Depreciation	—	—	—	—	—	—	—	—	—	57,281	57,281
Total operating expenses	—	776,913	265,054	313,010	1,354,977	436,278	1,791,255	527	1,791,782	945,518	2,737,300
Total expenses	$2,522,296	776,913	265,054	313,010	3,877,273	420,549	4,297,822	527	4,298,349	945,518	5,243,867

See accompanying notes to financial statements.

APPROPRIATE TECHNOLOGY INTERNATIONAL
Notes to Financial Statements
December 31, 1985

(1) Organization

Appropriate Technology International (the Organization) was incorporated on December 10, 1976 as a private, nonmembership, nonprofit corporation for the development and dissemination of technologies appropriate for developing countries. The Organization obtains its funding primarily from the Agency for International Development (AID) under Section 107 of the Foreign Assistance Act of 1961.

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

(2) Summary of Significant Accounting Policies

(a) **Basis of Accounting**

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

(b) **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.

(c) **Fixed Assets**

Fixed assets are recorded at cost and depreciated and/or amortized on a straight-line basis over the shorter of their estimated economic life or the lease term.

(d) **Financial Assistance (Grants Awarded and Policy Projects)**

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 grantee projects costing less than originally budgeted, are recorded as a reduction of expense and liability in the period the deobligation occurs.

(e) **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 on a specific identification basis.

(f) **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.

(3) Pledged Assets

The Organization has $60,000 on deposit in an interest-bearing account pledged as collateral for a grantee's line of credit of $54,000 plus interest. Management is of the opinion that the grantee will service the line of credit satisfactorily.

(4) AID Grant Awards

Since its inception, the Organization has been awarded grants by AID totaling $37,800,586, of which $3,900,000 was awarded during the year ended December 31, 1985. The Organization's current funding award from AID extends through September 29, 1986 and provides additional funding of $3,171,000 pending the availability of the funds and mutual agreement with AID. AID's current plans are to extend the Organization's grant for two additional years from September 30, 1986 to September 30, 1988, however, Congressional approval extending funding beyond September 29, 1986 is presently pending.

AID grant awards received as of December 31, 1985 have been disbured or obligated as follows:

Grants awarded to projects:	
1984 and prior	$ 13,559,116
1985	2,506,567
	16,065,683
Operating expenses:	
1984 and prior	17,002,834
1985	2,736,717
Grant expenses to date	35,805,234
Deferred revenue as of December 31, 1985	1,995,352
Total AID grant awards received	$ 37,800,586

In addition, since 1980 the Organization has been awarded grants from various other enterprises totalling $188,112. No such awards were received in 1985.

(5) Financial Assistance

Financial Assistance obligations and deobligations in 1985 were as follows:

	Obligations	(Deobligations)	Net obligations (deobligations)
Field operations	$ 2,806,226	(283,930)	2,522,296
Policy	13,566	(29,295)	(15,729)
	$ 2,819,792	(313,225)	2,506,567

(6) Fixed Assets

At December 31, 1985, fixed assets consist of the following:

Furniture	$ 71,540
Equipment	171,254
Leasehold improvements	67,680
	310,474
Less accumulated depreciation and amortization	123,061
	$ 187,413

(7) Retirement Plan

The Organization maintains a noncontributory defined-contribution retirement plan. Employer contributions are equal to fifteen percent of each participant's annual salary base. All full-time employees participate in the plan upon employment and are fully vested after 3 years.

Pension expense included in the accompanying financial statements approximated $156,000. It is the Organization's policy to fund retirement plan costs as they accrue.

(8) Lease Commitments

The Organization leases office space under two five-year leases which expire in February 1986 and April 1989, respectively. The agreements provide for annual adjustments of the rental amounts based upon a consumer price index. Such amounts include costs and expenses for utilities, insurance, janitorial and cleaning services, maintenance and repairs and real estate taxes.

The Organization also leases equipment under operating leases. Following is a summary of operating lease commitments net of sublet rentals, at December 31, 1985:

	Gross commitment			
	Office space rentals	Equipment rentals	Sublet rentals	Net commitment
1986	$ 248,000	35,000	46,000	237,000
1987	202,000	18,000	—	220,000
1988	208,000	14,000	—	222,000
1989	71,000	14,000	—	85,000
1990	—	14,000	—	14,000
	$ 729,000	95,000	46,000	778,000

Occupancy costs in 1985 are net of $277,406 of sublease income.

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