BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Administrator Agency For International Development

Use Of A Capital Saving Technology Approach In AID's Development Assistance Program

During the past decade, high unemployment and short supplies of capital in developing countries created a need for labor intensive development methods and capital saving tools Recognizing this need, the Congress enacted section 107 of the International Development and Food Assistance Act of 1975 which authorized the Agency for International Development (AID) to support a new and expanded private effort to develop and disseminate capital saving technologies appropriate for developing countries

AID acted to implement the congressional directive in the late 1970s but has not maintained its earlier emphasis on promoting this technology as one approach to development Staff uncertainty over the importance AID gives capital saving technology in relation to its other key initiatives may result in its missing opportunities to apply this concept

GAO believes that, since AID continues to endorse capital saving technology as one approach to development, it could take a number of actions at little cost which would re-emphasize the role of capital saving technology in developing countries and facilitate application of the concept by Agency staff

GAO/NSIAD-84-142
JULY 26, 1984

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NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

B-215612

The Honorable M. Peter McPherson
Administrator, Agency for International
Development

Dear Mr. McPherson:

This report presents the results of our review of the Agency's capital saving technology activities. It suggests ways to facilitate and reinforce application of a capital saving approach to development.

We initiated this review to assess the Agency's use of a capital saving approach in an environment of high external debt, balance-of-payment difficulties, and other economic problems in recipient countries. AID's comments on the report are at the appendix.

The report contains recommendations to you on pages 18 and 32. As you know, 31 U.S.C. §720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the Agency's first request for appropriations made more than 60 days after the date of the report. We would appreciate receiving copies of your statement to the committees.

We are sending copies of the report to the Chairmen of the four above committees, interested House and Senate authorization committees, and the Director, Office of Management and Budget.

Sincerely yours,

Frank C. Conahan

Frank C. Conahan
Director

U.S. GENERAL ACCOUNTING OFFICE
REPORT TO THE ADMINISTRATOR,
AGENCY FOR INTERNATIONAL
DEVELOPMENT

USE OF A CAPITAL SAVING
TECHNOLOGY APPROACH
IN AID'S DEVELOPMENT
ASSISTANCE PROGRAM

D I G E S T

Increasing unemployment and short supplies of capital since the early 1970s created a need for more labor intensive, capital saving tools and methods in developing countries. Recognizing this need, the Congress enacted section 107 of the International Development and Food Assistance Act of 1975, which authorized the Agency for International Development (AID) to support a new and expanded effort in the field of capital saving technology (CST) appropriate for developing countries.

AID has defined CST as technology which

--requires little capital per worker,

--is efficient on a small scale and replicable in numerous units,

--is easily serviced and maintained and does not require high levels of education and training to operate, and

--involves the local community and uses locally available resources.

GAO reviewed AID's current use of CST to determine whether application of the concept could be improved.

AID implemented the CST concept in the late 1970s by developing a strategy to increase the Agency's CST activities and creating a private, nonprofit organization, Appropriate Technology International, to independently carry out CST activities. AID missions were to apply the CST concept in their country programs and Appropriate Technology International was to help them design, test, and implement the technologies.

AID's automated Development Information System provides missions with information on previous uses of CST as an aid in designing and implementing projects. AID also has arrangements with the Department of Commerce's National

Tear Sheet

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Technical Information Service to help disseminate CST information to developing countries.

AID reports to the Congress annually on CST as one of its special interest areas. It has reported that CST projects are found in all of its development sectors; for fiscal year 1984, AID estimated that CST projects accounted for approximately $158 million of $1.3 billion in development assistance obligations.

AID'S APPLICATION OF CST CONCEPT

Many of AID's staff told us they were unfamiliar with AID's capital saving efforts. They are receptive to the CST concept and consider such technology logical for some development projects. The use of CST may be limited to the more apparent applications and appears to depend largely on individual staff interest and experience with the concept.

Staff may be unfamiliar with AID's CST efforts because the Agency has not reinforced its endorsement of CST. Program guidance to missions contains little specific reference to CST. Management at the regional and program bureau levels is not actively encouraging the CST approach, and the need for such technology is not specifically reinforced as part of AID's training programs.

One of AID's key initiatives is technology transfer to developing countries, but staff are unclear as to the role of CST in this initiative. They also believe that AID emphasis on a private sector initiative may subordinate CST. These uncertainties may affect the extent to which CST is used.

INFORMATION AND TECHNICAL ASSISTANCE ACTIVITIES

AID has found that effective information and technical assistance mechanisms are useful for implementing the CST concept. Information on previous AID projects and technologies can assist staff in designing and implementing CST projects. Technical assistance is often required for testing, adapting, and disseminating capital saving tools and techniques. See appendix I for examples of AID application of CST.

AID's Development Information System, arrangements with the National Technical Information Service, and the Appropriate Technology International project together have the potential for filling CST information and technical assistance needs. Although AID has allocated resources to these CST support mechanisms, lack of substantial marketing and promotion may be limiting awareness and use of the services among AID staff and other target groups. Consequently, these efforts may not be meeting their potential as support mechanisms for CST activities.

AID staff are generally unfamiliar with the Development Information System and opportunities appear to exist for greater use of the system. Mission staff are also unaware of the role and potential services of Appropriate Technology International in providing CST technical assistance. An AID evaluation of the project found that lessons learned from the activities have not been widely shared with AID, and the Agency has gained little from the project.

AID's projects with the National Technical Information Service are intended to widely disseminate CST and other technical information in developing countries. Although the information system is effectively used when accessed, the lack of marketing and promotion may be limiting the scope and effectiveness of the projects in reaching the target population.

AID recognizes many of the problems with its information and technical assistance mechanisms. GAO believes that AID can take certain actions which can increase the effectiveness of these systems in support of its CST activities.

RECOMMENDATIONS

Since AID continues to endorse CST as one approach to development, GAO recommends that the Administrator of AID:

--Re-emphasize the role of CST, perhaps through more explicit inclusion in technology transfer and private enterprise policy papers.

--Define the role and priority of CST through annual program guidance to missions and existing training programs.

--Follow through on actively marketing the services of the Development Information System.

--Promote increased cooperation between Appropriate Technology International and AID.

--Closely monitor Agency agreements with the National Technical Information Service to ensure that CST information is effectively marketed. (See pp. 18 and 32.)

Other recommendations appear on p. 18.

AGENCY COMMENTS

AID did not take issue with GAO's recommendations but commented on one specific aspect of the recommendation concerning re-emphasizing CST. GAO had suggested that one way of doing this was through the sector councils but AID said that these councils do not consider project design in sufficient detail. AID suggested that the most efficient way to emphasize CST in project design would be to explicitly include a section on CST in both the technology transfer and private enterprise policy papers. GAO's recommendation was revised to reflect AID's suggestions.

AID's detailed comments are in appendix II. GAO considered these comments and revised the report as appropriate.

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ABBREVIATIONS

AID	Agency for International Development
ATI	Appropriate Technology International
CST	capital saving technology
DIS	Development Information System
GAO	General Accounting Office
NTIS	National Technical Information Service
PVO	private and voluntary organizations

CHAPTER 1

INTRODUCTION

Since the early 1970s, high unemployment and short supplies of capital in developing countries have created a need for more labor intensive, capital saving tools and methods. Recognizing this need and endeavoring to target development projects for the "poorest of the poor," the Congress enacted section 107 of the International Development and Food Assistance Act of 1975. This section authorized the Agency for International Development (AID) to support a new and expanded private effort to develop and disseminate technologies appropriate for developing countries, particularly for agriculture, rural development, small business enterprise, and energy.

AID adopted the term "capital saving technology" (CST), and defined it as tools, production processes, and delivery systems that use relatively little capital per work place created or beneficiary reached and that:

--are compatible with the local cultural, economic, environmental, political, and social context in which they are imbedded and with which they interact;

--involve the local community or otherwise are physically and financially accessible to the poor;

--can be maintained and repaired by relying on locally available labor skills, spare parts, and organizational capacity;

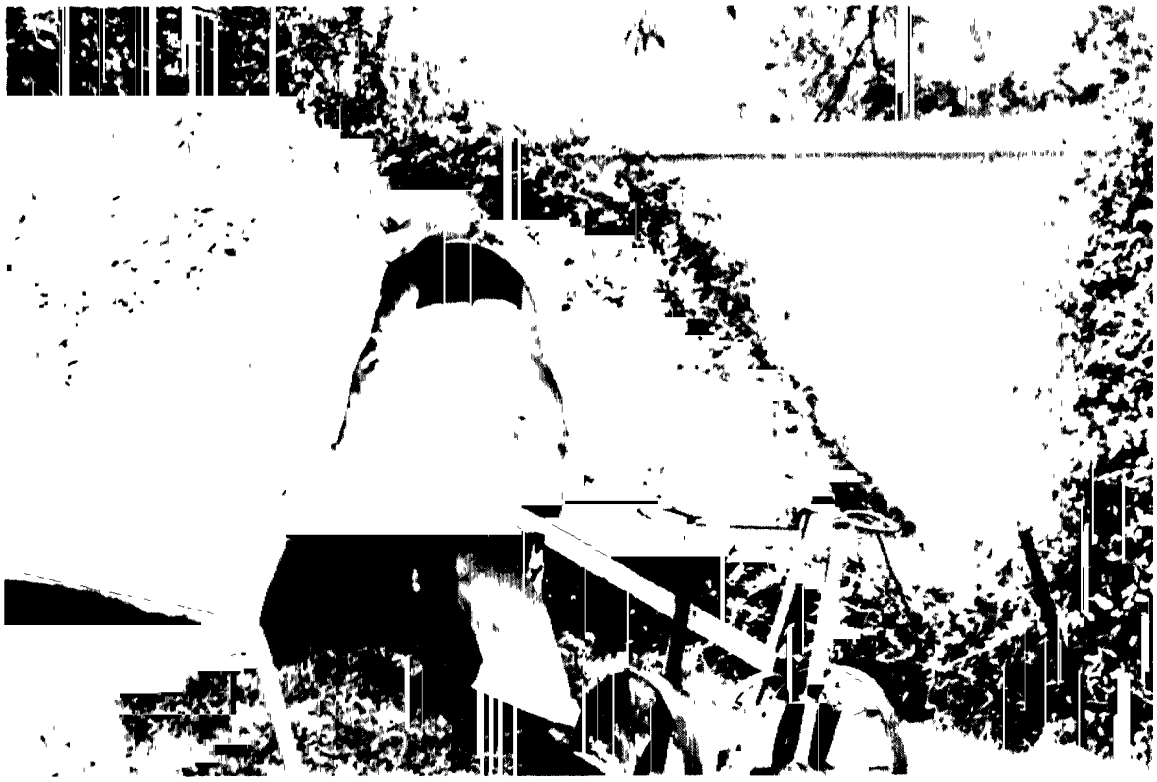
--are widely replicable; and

--are economically efficient.

CST includes not only hard technologies but also "software," such as management, financial, and accounting systems which help to develop indigenous organizations. In commenting on a draft of this report, AID noted that development practitioners emphasize different aspects of CST in their definition and that, as an example, capital saving can also be thought of as labor-intensive.

CST STRATEGY AND OBJECTIVES

AID's CST strategy included emphasizing capital saving activities in its own development programs as well as establishing an independent CST organization. In 1976, AID proposed the creation of Appropriate Technology International (ATI), a private nonprofit organization, to help carry out the section



Plow used in Ecuador is labor intensive and can be easily serviced and maintained

Construction of bio-gas tank in Ecuador uses locally available resources

107 program. Established in 1978, ATI receives an annual grant from AID from which it awards subgrants to private groups in less developed countries for CST projects. ATI is also intended to provide technical assistance to AID missions in designing, testing, and implementing capital saving technologies and processes and in identifying projects which could benefit from a CST approach. A 1978 congressional committee report urged AID and ATI to "maintain close working relationships to promote a cross fertilization of ideas, and to permit each Agency to learn from the other's experiences." ATI's role in AID's CST activities is discussed in chapter 3.

AID did not intend ATI as a substitute for its own efforts in CST. In a 1976 proposal, AID stated that it expects to continue to be a "creative actor" in CST and that the creation of ATI does not absolve the Agency from this responsibility. AID's bureaus and offices were to continue to develop CST projects and activities.

In 1978, a congressional committee encouraged AID to further develop its in-house CST program and to disseminate CST knowledge throughout the Agency and its missions. Following up on AID's internal efforts, a 1979 report by the House Committee on Appropriations requested AID to "develop a comprehensive strategy aimed at accomplishing a quantum leap in the delivery of capital saving technology to the world's poor within 5 years." The Committee's July 1980 report, in describing AID's CST strategy as envisioned by the Congress, stated that:

> "The comprehensive strategy should not just focus on any one set of technologies or even a particular sector (i.e., small scale enterprise), but should be seen more broadly as a capital saving, employment-income approach to development which has as its targets the landless, the small farmer, and the small businessman. . ."

Although AID has not established a CST program office, it did develop a concept which it reported as promoting CST through regional bureau and mission project activities and Agency training programs. AID's internal application of the concept is discussed in chapter 2.

Information sharing and technical assistance in designing and implementing projects are also part of AID's CST strategy. AID's automated Development Information System can provide information on projects to AID missions, private and voluntary organizations (PVOs), and others in the development community to assist them in designing and implementing CST projects. Two of AID's regional bureaus also have projects with the Department of Commerce's repository for government-sponsored research, the National Technical Information Service (NTIS), to disseminate CST information to developing countries. AID's information and technical assistance activities are discussed in chapter 3.

According to its fiscal year 1984 Congressional Presentation, AID's CST objectives are to:

--Increase incomes and employment opportunities for the poor, particularly in agriculture and nonfarm labor intensive businesses.

--Provide improved health care, population planning, and education services to the poor at prices they can afford.

--Strengthen the ability of public and private decisionmakers to select, develop, adapt, and disseminate useful capital saving technologies.

In recent congressional testimony, the Administrator of AID stated that AID intends to be a leader in supporting the development and dissemination of inexpensive new technologies. AID's key initiatives in the areas of policy dialogue, private enterprise, technology transfer, and institution building are to provide the broad policy context for the CST program.

AID estimated that CST projects accounted for $164 million and $158 million in fiscal years 1983 and 1984, respectively, of approximately $1.3 billion in Development Assistance obligations for each year.

OTHER DONORS AND THE CST CONCEPT

Other donors and development organizations also encourage the use of CST to foster development. The U.N. Development Program emphasizes the need to link a developing country's traditional technology approaches with modern methods for workable and acceptable solutions to development problems. This grassroots approach to technology transfer reflects AID's definition of CST by including end-users or "target groups" in making decisions.

The U.N. Development Program believes that there will be no demand for technological innovation and development unless there is knowledge that the technology exists. Therefore, the first step in promoting CST is to create interest and awareness through disseminating information. The Program has a special unit, Technical Cooperation Among Developing Countries, to promote the concept of technology sharing. Although the unit's efforts have not been fully developed, Program officials believe that the concept has been successfully demonstrated. For example, African countries have been able to draw upon India's development experiences.

The Inter-American Development Bank encourages development projects that it finances to use capital saving technologies that are consistent with the aspirations, goals, and conditions of member countries in the Latin American region. The Bank's

commitment to CST is evident in its approach to technology choice. In recent years, it has established criteria and mechanisms for analyzing technological alternatives within its projects so that proper consideration is given to including CST in project design stages. An advisory committee reviews all Bank projects in which CST might be applied.

The use of inexpensive capital saving technologies is also a natural part of PVOs' development philosophies due to their limited funds and desire to obtain the greatest return for money invested. In addition, the use of locally available resources for CST projects is part of the PVO philosophy of promoting indigenous self-sufficiency.

PVOs also emphasize involving the end-user in making decisions on CST projects, especially during project design when technology needs are first identified. Properly articulating the priorities and needs of indigenous groups is a fundamental concern to PVOs working with CST projects.

OBJECTIVES, SCOPE, AND METHODOLOGY

We made this review to assess AID's current use of capital saving technology as one means of carrying out development activities and to determine whether its application of the concept was consistent and effective.

We reviewed the ways that several donor organizations applied the concept. Beyond that, we focused on AID's development assistance program and its objectives for using a CST approach and the degree and nature of CST application at the mission level. We did detailed work at AID missions in six countries--Burundi, Botswana, Panama, Ecuador, Thailand, and Indonesia. AID's fiscal year 1984 programs in these countries range from $3.7 million in Burundi to $64.1 million in Indonesia.

The six countries represent a wide spectrum of development levels and problems.

--Burundi, a small, densely populated country in central Africa, is ranked as one of the poorest countries in the world. AID is using basic technological approaches to help Burundi increase food production and improve delivery of health and family planning services.

--Botswana lacks the skilled people needed to fill government and industry leadership positions. AID's strategy in Botswana emphasizes developing human resources to alleviate this shortage.

--Panama, recognized as a center of trade and finance, has achieved a well-established social service structure but is having increasing difficulty providing jobs and equitable economic growth. AID's program is focused on stimulating economic growth and generating employment.

--Ecuador, despite modest oil resources, is one of the least developed countries in South America. AID strategy has been to provide basic social services to the poor, with future projects planned to strengthen public and private institutions.

--Thailand, an emerging middle-income country, has the potential for achieving "AID-graduate" status within the next decade. AID's present program in Thailand has used a CST approach on some projects, but the mission is beginning to focus on the country's capability and need to absorb and have access to more sophisticated technology.

--Indonesia has the largest AID program of the six countries selected and made substantial development progress in the 1970s. Nevertheless, the country still faces difficult problems in rising from low- to middle-income status; unemployment is increasing, population pressures are expected to build, public health services are limited and Indonesian institutions are weak.

Table 1 provides some comparative statistics on these six countries.

Work was performed at AID, Appropriate Technology International, National Technical Information Service, various private voluntary organizations, and the National Science Foundation in Washington, D.C., and at the U.N. Development Program and 10 private voluntary organizations in New York. Three U.S. universities with CST-related activities were also contacted. A major part of the work was carried out at U.S. AID missions and embassies, host government agencies, NTIS distributors, U.S. and indigenous PVOs, and other donor organizations in the six countries we visited. We reviewed pertinent documents and studies and conducted extensive interviews with all of these organizations. Our audit work, carried out between June and November 1983, was conducted in accordance with generally accepted government audit standards.

Table 1

Country Development Statistics

Country	Population 1983 (000 omitted)	Per capita GNP[a] 1981	Life expectancy 1982 (years)	Urban population 1982 (percent)	Labor force in agriculture 1980 (percent)	Major exports 1981
Botswana	1,001	$1,010	51.1	26	78	Diamonds, cattle
Burundi	4,561	230	42.7	2	84	Coffee, tea, cotton
Ecuador	8,811	1,180	62.1	46	52	Petroleum, bananas, coffee
Panama	2,058	1,910	71.0	56	27	Bananas, petroleum, sugar
Indonesia	158,210	530	54.0	21	58	Petroleum, wood, rubber
Thailand	50,731	770	63.5	15	76	Rice, sugar, corn

[a]Gross national product.

Source: AID fiscal year 1985 Congressional Presentation and World Development Report 1983, World Bank.

CHAPTER 2

AID'S APPLICATION OF THE CST CONCEPT

The AID missions we visited are applying the capital saving technology concept in designing and implementing some of their projects. The extent to which they apply the concept may be limited to the more readily apparent applications and appears to depend primarily on individual staff interest and experience rather than being part of an Agency "CST program." AID's regional and program bureau and mission staff are largely unaware that AID considers CST as a special interest area in carrying out its development programs, and the Agency has provided little program guidance for missions on applying the concept in their development programs.

AID Washington and mission staff are also unclear as to the role of CST in the Agency's technology transfer initiative. Another general concern of Agency staff is that the present emphasis on AID's private sector initiative may subordinate a capital saving approach to development.

AID's lack of emphasis and guidance on the CST concept and the perceived conflict with the private sector initiative may be limiting Agency application of the CST concept. We believe AID could re-emphasize the importance of the concept by taking a number of actions at little cost which would clarify the CST role in its development activities and facilitate application of the concept.

AID'S INTERNAL CST ACTIVITIES

AID's "capital saving technology portfolio" includes projects managed directly by Agency staff, both centrally and at the mission level as well as projects that are managed through PVOs and other intermediaries. AID reported to the Congress that all of its development assistance accounts--food production, small-scale and micro-enterprise development, population planning, health, education, and energy--include CST projects.

Missions' use of CST approach

Missions in each of the six countries we visited had used a CST approach in designing and implementing some of their projects. Some projects, such as a rural road project in Burundi and a renewable energy project in Thailand, contained many of the elements of AID's CST definition (see app. I for a description of these projects). However, we could not always determine whether a CST approach had been incorporated into the project design; for example, many of the projects contained only one or two elements of the CST definition, such as involving the local community in the project planning. The six countries' CST applications based on our analysis and discussion with mission officials are described briefly below. In commenting on a draft

Work crews use simple hand tools to construct a rural road in Burundi.

Some mechanical equipment, such as a tractor loader, supplement labor intensive methods on the Burundi road project

of this report, AID stated that "Recognizing that the obverse side of capital saving is labor-intensive would have led the GAO to see many more activities as involving CST." Our analysis of mission programs did consider this obverse relationship, and some projects we classified as having CST elements do have generating employment as an objective.

CST-related projects were most often in the agriculture and rural development sector in three of the countries; in the others, projects with CST elements were found in most program sectors.

Thailand: 10 of 21 projects contained CST elements, with 7 of the 10 falling into the agriculture and rural development sector.

Indonesia: 8 of 42 projects contained CST elements and were designed primarily with a CST approach; 5 were in the agriculture and rural development sector and 3 were in health and population planning. Overall program emphasis is on institution building, which is the focus of over half of the mission's projects.

Ecuador: Approximately half of the 24 projects contained CST elements and they involved all sectors. Program emphasis is on providing basic social services to the poor through projects which strengthen public and private institutions.

Panama: 6 of 17 projects contained CST elements and were concentrated in the agriculture and rural development sector. The program is focused on stimulating economic growth and generating employment.

Botswana: The program consists of 17 projects representing all sectors; 2 projects were primarily CST projects, and most of the remainder incorporated some CST-related elements. The mission is currently trying to consolidate its program into fewer projects.

Burundi: 7 of 8 projects had CST elements with one, a rural road building project, fitting the CST definition the most closely. The program is small and has no particular sector concentration.

The number of projects with CST elements is not always adequate in describing country programs. The host-country environment and level of development are two important factors considered in designing a country development assistance program. In Burundi, where increasing food production is a top priority, mission officials said that the country's relatively modest resources make the CST approach all the more appropriate. In Thailand, viewed as an emerging middle-income country, some mission officials believe that there may be fewer

opportunities for future capital saving applications as the country's technology needs become more sophisticated.

An important consideration in analyzing mission application of the CST concept may be the staff's attitude toward the concept and their awareness of Agency emphasis on it. Some missions were generally unaware that AID continues to endorse the use of this technology as an approach to development. Mission officials told us that they do not design CST projects or even think in terms of the concept; rather, various officials said that they see the concept as a logical approach for some projects.

Project officers' application of the CST concept appeared to depend primarily on individual experience and interest in the concept. For example, in Ecuador we were told that several mission officials feel comfortable with the CST concept due to previous Peace Corps experience. In Thailand, mission officials indicated that any CST activity was due to the receptivity of individual project and program officers rather than to encouragement from AID Washington. Similarly, in Indonesia we were told the mission has designed and implemented CST projects because individuals view CST as a valid development concept and not because the mission is adhering to an explicit CST strategy.

It would be difficult to directly correlate the application of CST and project success. However, we did find that difficulties with some projects may have been alleviated with a more complete application of a CST approach to project design. In Burundi, for example, one project was to substitute peat for wood as a fuel for individual household stoves, thus relieving pressure on dwindling wood supplies. A project evaluation concluded that the cost and acceptability of peat to the end user had not been adequately considered in the project design, and a study is now being made to determine whether peat is a viable alternative fuel.

In an Indonesia rural development project, mission officials said that the implementing government agency was reluctant to coordinate the project design with local community leaders. The communities now are not receptive to the project and this may also affect mission replication efforts.

Problems of a CST-related nature have also been evident in AID projects previously reviewed by GAO. For example, project proposals for rural potable water and sanitation projects did not adequately assess the willingness of target communities to participate in the project and their ability to sustain the

operation and maintenance of the facilities.[1] Similar problems were noted with irrigation assistance projects.[2]

The concentration of CST-related projects that we found in the agriculture and rural development sector may indicate that missions apply the concept primarily when the opportunity to do so is readily apparent. In Panama, for example, we were told that CST was not considered in designing health and population planning projects, although one mission official noted that some application may be possible. There was a similar lack of CST application in Thailand's health and population planning projects. As noted above, most of Ecuador's current projects have CST elements; however, many new project proposals in the mission's development strategy did not appear to contain such elements.

Thus, it appears that missions may be missing some opportunities to apply the CST concept in project design and implementation. This may be related to the lack of AID communication on CST. From our discussions with mission officials, it was evident that there had been very little current emphasis on capital saving technology from AID Washington or mission management. In reviewing program guidance documents, we found that missions had received some guidance on technology transfer but there was very little specific mention of CST.

Mission officials also identified internal country constraints to applying the CST concept. For example, although unemployment is a recognized problem in Panama, its labor laws tend to discourage the intensive use of labor by requiring a high minimum wage and inflexible and costly employee termination procedures. In Ecuador, government tariff policies and subsidized credit provisions encourage the use of capital.

AID officials have stated that the Agency's key initiatives in the areas of policy dialogue, private enterprise, technology transfer, and institution building provide a broad policy context for its CST activities. Some mission officials said they engaged in policy dialogue with host country governments to try to alleviate constraints. However, mission officials did not always see the Agency's key initiatives as consistent with a continuing CST emphasis, particularly for the private sector initiative, which is intended to increase host country and U.S. private sector involvement in development activities. Some mission officials said they could foresee the private sector

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[1] Meeting a Basic Human Need: AID's Rural Potable Water and Sanitation Program. GAO/NSIAD-84-34 (Feb. 21, 1984).

[2] Irrigation Assistance to Developing Countries Should Require Stronger Commitments to Operation and Maintenance. GAO/NSIAD-83-31 (Aug. 29, 1983).

initiative possibly pushing the CST approach into the background. There was also some uncertainty about the technology transfer initiative, which encourages the development of new technologies and the adaptation of existing technologies for solving development problems. Some mission officials were not aware of the role that CST is to assume in the initiative.

AID/Washington

Some AID/Washington staff believe the Agency's key initiatives may have subordinated AID's capital saving efforts. Similar to some mission officials, some AID/Washington officials viewed the private sector initiative as potentially conflicting with the CST concept. This was especially evident in our discussions with AID's science and technology advisory bodies, the sector councils. Representatives of one council said staff is getting conflicting signals from top Agency managers as to the importance of CST. One official also noted that AID projects are reviewed for many things, including the four key initiatives, but not specifically for whether a CST approach has been appropriately considered.

AID/Washington staff also expressed confusion about CST strategy. Many of the officials we met were not aware that AID considers CST as a special interest area and were uncertain as to what the technology transfer initiative means. A draft policy paper on this initiative was circulated for comment within AID but is not yet finalized. One official viewed the policy paper as an opportunity to more clearly identify CST objectives. AID officials told us that the CST role in technology transfer policy was not clear. One official said that the Administrator may consider CST to be part of the initiative but that AID bureaus and missions do not perceive it as such. Others felt that CST should be more clearly identified as a part of the technology transfer policy.

CST's crosscutting nature also appears to complicate the problem of promoting the concept; no single unit within AID is responsible for it. As one official stated, the concept does not have a management home. However, the same official said that the real task is to make sure someone is paying attention to technology choice during AID's project design process rather than creating an organizational CST unit empty of content.

Some AID officials believe that sustained congressional interest is necessary for continued AID emphasis on CST; otherwise, new "initiatives" will push the old ones into the background. They pointed out that CST's crosscutting nature requires its application on a case-by-case basis. Many Agency officials said they would welcome a CST policy clarification and guidance which would better enable them to apply the CST approach as they deem appropriate.

CST COORDINATION

In a July 1981 progress report, AID informed the Congress that it intended to develop improved CST coordination mechanisms "with appropriately designated staff in each of the relevant bureaus." Although this has not been done, AID has established sector councils which, in addition to promoting Agency science and technology activities, could play a more significant role in promoting the CST concept.

Regional and program bureaus

None of the regional and program bureaus had designated staff as primarily responsible for CST coordination. Many officials we talked to thought there should be better coordination of CST activities within AID. One official observed that AID has put forth little effort in promoting or backstopping CST activities and disseminating CST information. Another said that a regional bureau staff member with at least part-time reponsibility for CST coordination could facilitate the flow of CST information among bureaus and between bureaus and missions. But few specified that bureaus should designate individuals to be responsible for CST activities. They were more generally concerned with the uncertainty among AID staff as to the importance of such activities relative to other priority areas.

Sector councils

AID established sector councils for agriculture, nutrition, population, health, energy and natural resources, and human resources within its Bureau for Science and Technology in November 1981 "to provide an orderly mechanism for advising the Agency and its bureaus on all science and technology matters." Core membership of the councils consists of the chief professionals in each sector from the four regional bureaus, the Bureau for Program and Policy Coordination, and the Bureau for Science and Technology. Members from other bureaus and offices have been added as appropriate to each area.

The councils advise AID on sector policies and strategies and program and project development. The councils are to provide technical advice at various stages of program and project development, including the Country Development Strategy Statement, Annual Budget Submission, Project Identification Document, and Project Paper.

Most council representatives believe the composition of the councils makes them a potentially effective forum for promoting CST activities. However, as one noted, the concept will have to be on council agendas more regularly than it has been if the councils are to be influential in CST efforts. Some representatives said it was not clear how important the CST concept is within AID and whether management agrees with the concept. One representative indicated that the councils must be careful not

to develop sector strategy which is inconsistent with Agency policy; he pointed out that until AID has a published CST policy, promoting the concept within the sector councils will be difficult.

INTERNAL TRAINING PROGRAM

AID's internal training program may be another means of instilling and maintaining staff awareness of the Agency's emphasis on CST within its overall development program. The five major components of AID's development assistance training program are the

(1) Development Studies Program

(2) International Development Intern Program

(3) Mid-Level Training

(4) Project and General Management Training

(5) Technical Training.

AID officials familiar with these courses said that the CST concept is not addressed as a separate subject, and in courses in which CST-related topics are mentioned in conjunction with other topics, the degree of CST emphasis depends on the individual instructor.

Generally, officials at the missions we visited said they had received no formal CST training through the internal training programs. Some pointed out that CST elements have been included in some courses, such as the International Development Intern Program. Many felt that more explicit inclusion of CST could be beneficial in helping to define the term and to enunciate AID's CST strategy.

ROLE OF PVOs AND U.S. UNIVERSITIES

For some projects in its development assistance programs, AID uses consultants and private organizations. These include PVOs and U.S. universities, both of which the Congress has specifically encouraged AID to use more effectively in carrying out its development programs.

Private voluntary organizations

PVOs have long been a part of the U.S. tradition of providing overseas assistance, including food and development assistance programs. Since 1973, the Congress has repeatedly urged AID to expand its use of PVOs in development activities. PVOs are generally thought to be well suited to CST activities, but we found that they are not often used for such activities in the countries we visited.

PVO officials we spoke to emphasized certain advantages they have over many donor organizations in carrying out CST activities, including

--well-established relationships with indigenous organizations;

--suitability for carrying out small projects and working with small organizations; and

--good knowledge of end-user social and economic needs.

Mission officials in Panama said they do not use PVOs extensively because PVOs are generally better suited to carrying out basic human need programs. The mission has three operating program grants with PVOs in support of its institutional development emphasis. However, some mission officials said they have not always found PVOs to be effective in providing technical assistance to strengthen institutions.

Some Thailand mission officials believe PVOs are a good vehicle for implementing CST projects. We found that 9 of over 30 PVO subproject activities incorporated some CST elements. The Indonesia mission draws extensively upon the services of both PVOs and consultants. It gives preference to PVO project proposals which demonstrate new, cost-effective approaches or technologies. Approximately one-third of some 40 PVO projects in Indonesia appeared to be CST-related.

In Burundi, mission officials generally agree that PVOs can be effective in implementing CST projects, but the government of Burundi needs time to become more accustomed to dealing with PVOs before the mission can use them to a greater extent. Botswana mission officials believe that PVOs are useful in implementing CST projects and some mission staff believe the mission should make greater use of PVOs. Nevertheless, the mission is currently trying to reduce the number of projects it is managing and does not intend to make any greater use of outside organizations for project implementation.

U.S. universities

U.S. universities have a long tradition of involvement in development abroad, particularly in projects related to agriculture. In 1975, the Congress directed AID to improve and strengthen the involvement of U.S. land-grant and other eligible universities in solving food problems in developing countries. We found that U.S. universities were generally not widely used in CST activities in the countries we visited.

There was a cautiously receptive attitude among some mission officials toward using U.S. universities on CST projects. For example, Ecuador mission officials said that, in their

experience, universities were well attuned to end-user needs; the contractor on the mission's Rural Technology Transfer System project is a U.S. university. Although the Thailand mission has used U.S. universities, one official observed that there is often some risk that universities might attempt to impose their own technological solutions to development problems. Botswana has also used universities in CST-related projects.

U.S. universities have been hesitant to commit themselves to CST education, research, and development, in part due to the past association of the "appropriate technology"[3] movement with alternative lifestyles. A low level of government funding for such activities has also limited university entry into the field. Nevertheless, there appears to be interest and potential for greater university involvement in some aspects of CST-related activities. We discussed the role of U.S. universities in CST activities with officials from three institutions currently involved in such activities.

The Georgia Institute of Technology, under AID contracts, has developed projects using hand water pumps in developing countries. A university official noted that U.S. universities might serve as one means of developing and testing appropriate technologies in developing countries, thus enhancing AID's supply of efficient, capital saving technologies which could be adapted to numerous situations.

The University of Pennsylvania offers advanced degrees in appropriate technology and energy use and management. Its educational approach, according to a university official, is unique in its focus on the social, political, and economic impacts of technologies in developing countries. One of the program's objectives is to offer courses with similar appropriate technology approaches in developing countries. University officials believe such programs would help to alleviate the capital-intensive bias that developing country students often receive in U.S. university training programs.

The University of Minnesota offers a course, developed with the assistance of AID, which focuses on appropriate technology in international development and instructs students on evaluating hardware devices appropriate to developing countries. The course is intended to prepare students to work with developing countries, both in government and private voluntary organizations, in evaluating low-cost, capital saving technologies. A university official believes AID's CST effort can be enhanced by training engineers and development professionals in the appropriate technology approach rather than in the traditional capital-oriented curriculum.

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[3]Appropriate technology is a term which includes capital saving technology but can also include technologies appropriate for developing countries where labor is scarce and capital is relatively abundant.

CONCLUSIONS

AID has endorsed a CST approach as one means of achieving development. AID considers its CST activities to be one of its special interest areas and views its four key initiatives, in the areas of policy dialogue, private enterprise, technology transfer, and institution building, as forming the policy framework for these activities. The missions we visited were largely unaware that AID emphasizes CST as one approach to development. AID staff in Washington were not familiar with the Agency's CST efforts and objectives.

The missions we visited are applying CST in designing and implementing some projects. AID Washington and mission staff are receptive to the CST concept and consider it a basically logical approach for some development projects. However, the degree of application appears to depend primarily on individual mission officer interest and experience with the concept and may be limited to the more apparent opportunities. Mission officials in some sectors had not considered a CST approach but acknowledged that some opportunities may exist. AID has issued little guidance concerning the CST concept.

Regional and program bureau emphasis on the CST concept appears to be limited to individual staff interest and experience. The concept is not being specifically included as part of AID's training programs. Although the Congress has encouraged AID to generally make greater use of PVOs and U.S. universities in development activities, the Agency does not appear to have emphasized using these organizations for CST activities.

AID Washington and mission staff were not clear as to what is intended by the Agency's technology transfer initiative or CST's role in the initiative. A draft technology transfer policy paper does not appear to clarify the matter. Agency staff also generally expressed concern that the present emphasis on AID's private sector initiative may subordinate a CST approach to development. The lack of awareness by AID staff that the Agency endorses the CST concept and the perceived conflict with the private sector initiative may be limiting Agency application of the CST concept. We believe that AID could re-emphasize the importance of the CST approach by taking a number of actions at little cost which would clarify the CST role in development activities and facilitate the application of the concept.

RECOMMENDATIONS

To better communicate and reinforce Agency emphasis on the capital saving technology approach to development, we recommend that the Administrator of AID:

--Re-emphasize the role of CST, perhaps through more explicit inclusion in the technology transfer and private enterprise policy papers.

--Define the role and priority of capital saving activities in annual program guidance to missions and through existing training programs, especially relative to new initiatives and priorities that arise.

--Coordinate CST activities and more explicitly consider potential CST applications in the project design process.

--Complement AID's efforts to make greater use of PVOs and U.S. universities by encouraging missions to give more consideration to using these organizations as vehicles for implementing CST activities.

AGENCY COMMENTS AND OUR EVALUATION

AID did not take issue with our overall recommendations. However, in the draft of this report, we proposed that the Administrator establish coordination of CST activities and more explicitly consider potential CST applications in the project design process in some manner, such as through the sector councils. AID commented that sector councils, as they presently operate, do not consider the design of individual projects in sufficient detail to function in this way. As an alternative, AID suggested that probably the most efficient way to emphasize the importance to those involved in project design would be to include a section on CST in both the technology transfer and private enterprise policy papers. We revised the recommendation by dropping the specific reference to sector councils and added the private enterprise policy paper in the first recommendation.

Concerning our statement that Agency staff were concerned that the present emphasis on AID's private sector initiative may subordinate a CST approach to development, AID noted that the private sector uses the most efficient mix of capital and labor available to maximize profits. Some AID staff did, in fact, state that the two should be entirely compatible but said that was not the way in which the private sector initiative was being presented and perceived in the field. AID staff view the private sector initiative as displacing other earlier emphases, such as CST, and this is likely to be reflected in their programs. We believe this perception could be corrected through re-emphasis of CST in the policy papers and in annual program guidance.

AID stated that where CST ranks in the hierarchy of priorities is an important determinant of how much attention it

receives in the project design process. We recognize this; however, since AID continues to endorse CST as one approach to development, we believe that the Agency may need to reinforce awareness of CST so that the concept will continue to be applied, as appropriate, together with other Agency emphases and initiatives.

CHAPTER 3

TECHNICAL INFORMATION AND ATI IMPORTANT TO CST EFFORTS

AID and others in the development community have found that information sharing and technical assistance in designing and implementing projects are useful mechanisms for successfully implementing the CST concept. Designers of development projects need information on previous CST experiences as well as on potential low-cost, labor-saving technologies and processes. Technical assistance is important to successfully test, adapt, and implement innovative capital saving tools and techniques.

AID has included such support mechanisms as part of its CST strategy. Its Development Information System assists the missions and PVOs through information searches and analyses of previous AID projects. Two of AID's regional bureaus have contracts with the Department of Commerce's National Technical Information Service to provide information to indigenous populations in developing countries at a subsidized cost. Appropriate Technology International gives technical assistance to missions in designing, testing, and implementing CST.

Although AID considers these technical information and assistance efforts a significant part of its CST activities, AID staff do not often use these services in designing and implementing projects. We believe that more actively promoting and using these technical information and assistance mechanisms among AID staff could lead to more effective implementation of the CST concept.

DEVELOPMENT PROGRAMS BENEFIT FROM EFFECTIVE INFORMATION TRANSFER

The value of technical information in designing and implementing projects has long been established by AID and others in the development community. Researching previous development efforts can help to identify, and perhaps avoid, project design and implementation problems as well as to improve on previously used techniques. Technical information is also valuable for successfully adapting previously applied CST to new projects. Project replication, an important aspect of the CST concept, also depends on the effective transfer of technology information.

AID encourages use of lessons learned

AID's emphasis on using previous project experiences is reflected in its operations handbook. The AID handbook states that there should be explicit consideration of alternative solutions to a problem and recommends that the way similar problems

were addressed in the past be considered in determining alternative solutions to a development problem. Although AID does not require project designers to analyze past experience, it encourages the use of its formal information system as a source of "lessons learned" from prior or ongoing development projects that can be of value throughout the design stage of a project.

AID's policy of consulting technical information sources when designing CST-related projects was originally highlighted in its 1976 CST program proposal. The report emphasized the need to gather and evaluate past and present CST experience and to provide information about selected low-cost technologies to groups interested in the CST concept. In a July 1981 progress report to Congress, AID re-emphasized its intention to use CST information to avoid the cost of duplicating the efforts of others.

PVOs emphasize need to share information

PVOs working with CST emphasize the importance of technical information in CST project design and implementation. PVOs also emphasize the need for effective information dissemination to indigenous populations so they can make some of their own development decisions.

Although several PVOs have large in-house information operations, others must rely on the information resources of the development community. Several PVO officials we spoke with were not familiar with AID's information resources; some of them have had difficulty obtaining adequate technical information to design CST projects. Several organizations expressed a desire for a centralized CST data bank, an idea which AID rejected as too costly and duplicative of information systems already available.

Information and project replication

Replication of previous CST efforts, which AID has included as part of its CST strategy, often depends on the effective transfer of technology information. A July 1980 House Appropriations Committee report highlighted the need for replication and suggested that it be incorporated into the design and selection of individual projects.

AID's original CST definition also states that technologies must be "replicable in numerous units." Adequate access to technology information and "lessons learned" is often necessary to implement that part of the definition. For example, mission officials in Ecuador believe that an inadequate flow of technology information among project implementing groups could result in projects which "reinvent the wheel," thereby limiting project replicability. In Thailand, mission officials believe that the greatest value of the Development Information System

(DIS) is in providing technical information from previous projects, which is necessary for technology replication.

FORMAL INFORMATION MECHANISMS

AID uses several formal methods of disseminating technology information to its staff. Its automated information system is the central source of previous project experiences. AID staff also use various Agency newsletters and other publications as mechanisms for sharing general technology information between regional bureaus and missions. Recently established newsletters from several of AID's sector councils are also considered by some AID staff to be good sources of sector-specific technology information.

DIS capabilities

DIS was established to provide information on alternative approaches to development and previous AID projects dating back to September 1974. DIS collects and stores final reports and evaluation documents on AID projects, research findings, and technical information from AID missions and regional bureaus. It has access to more than 3,300 such projects and 20,000 such reports. DIS researchers are available to assist AID staff, PVOs, and others in the development community by providing "lessons learned" from AID projects as well as searching other information sources to which the system has direct access. Part of the researchers' responsibility is to provide specific information on previously applied capital saving tools and methods to help project officers implement the CST concept. For DIS to operate effectively, staff must provide project information to the system and use that information when designing and implementing new projects.

In the past, DIS provided a general information package in response to information requests, but it now has the capability to analyze those requests and provide specific information to each requestor. In responding to a request, DIS researchers first examine the AID data base and then search outside sources for information. DIS also has access to several privately operated development information systems as well as the NTIS, Library of Congress, Department of Energy, National Library of Medicine, U.N. Development Program, and the Technical Assistance Information Clearinghouse, which captures information from PVOs throughout the United States and Canada.

DIS staff estimate that approximately 40 percent of all information requests are related to agriculture and 12 percent to energy, environmental affairs, and natural resources, areas which often contain CST elements. In addition, approximately 8 percent of DIS information requests deal specifically with CST.

AID staff use of DIS

AID management officials and project officers we talked to in Washington told us that they do not use DIS when designing and implementing projects, and they believe few AID officers use the system. Several sector council representatives and other AID officials said that DIS has not been very effective in disseminating technology information, and they concluded that little overall effort has been made in disseminating CST information throughout the Agency.

None of the staff members at the six AID missions we visited use DIS as a standard source for accessing technology information. At one mission, a few of the officers we interviewed had become accustomed to using DIS, but they often relied more on informal sources of information than on DIS.

DIS received 3,600 information requests from December 1982 through September 1983 as shown in table 2.

Table 2

Source of DIS Information Requests

User	Percent of Requests
AID Washington Offices	34
U.S. public (institutions and individuals)	24
AID contractors/grantees	6
AID field missions	11
U.S. government agencies	4
Developed countries (institutions and individuals)	6
International organizations	6
Less developed countries (institutions and individuals)	9

DIS staff believe that the missions' 11 percent use of DIS was much too low in comparison with other information requestors and that AID Washington's 34 percent use would be a "good target" for the missions. However, DIS staff noted that some of the information requested by AID Washington may be intended for mission use.

AID mission staff cited several DIS operational problems which may discourage staff from using the system. The most common problems cited were that DIS takes too long to provide requested information, data are not always complete or up to date, and information provided is not always directly related to the user's needs.

Our June 1982 report[1] identified similar problems with DIS and concluded that its effectiveness is limited, in part due to lack of staff knowledge of DIS and lack of user feedback on system problems. The report did note, however, that DIS is a potentially valuable and useful tool for AID staff to use in obtaining past experience and lessons learned.

Mission staff told us that they often rely more on informal sources of information than on DIS. For example, the Panama and Ecuador missions receive CST information through personal conferences and professional contacts. In Indonesia, information about project development and CST activities at other missions is obtained through contacts with project officers at other posts. Mission staff also use indigenous organizations as sources of CST information. In Thailand, for example, project officers contact agricultural universities, PVOs, and the Asian Institute of Technology.

Although informal information sharing can provide valuable CST information for AID staff, informal mechanisms are not always enough. For example, newly hired staff and foreign national hires have rarely developed as many informal professional contacts as the more experienced staff.

The Development Information Office, recently reorganized under AID's Bureau for Program and Policy Coordination, is planning several new initiatives to increase staff awareness of DIS and its services and to make it more effective support for the CST concept. Specifically, the Office wants all professional employees in Washington and contractors and direct hires in the field to attend briefings on DIS and its services. The Office would also like to help AID missions establish on-site libraries and to automate the DIS data base for direct access by missions.

DIS staff believe that these efforts, along with increased marketing of the system at AID missions, can increase awareness of DIS services and simplify mission access to information. Mission officials in Thailand, Indonesia, and Ecuador have encouraged such efforts to improve information linkages between their own libraries and DIS. In commenting on a draft of this report, AID noted that DIS is making a substantial effort to respond to the recommendations of our June 1982 report. In

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[1]Experience--A Potential Tool For Improving U.S. Assistance Abroad. GAO/ID-82-36 (June 15, 1982).

Project officers used both formal and informal information sources to choose these capital saving technologies for the Thailand Renewable Energy Project, The technologies include a solar rice dryer (lower left), solar still (center) and windmill water lift (upper right)

addition to the initiatives outlined above, DIS has obtained expanded coverage in the AID publications, Front Lines and Horizons to increase staff awareness of DIS and its services.

Efforts to increase staff awareness of DIS have already proved successful with one staff group, the International Development Interns. In reports to AID's Training Division, interns assigned to field missions indicated that they use DIS to obtain development information. The Training Division believes this illustrates the value of the classroom briefing that interns receive on DIS during orientation training in Washington.

Technical information sharing

Although some mission project officers said they shared information with staff at other AID missions, a June 1983 survey of technical officers by AID's Bureau for Science and Technology concluded that information sharing between missions is one of AID's weakest areas. Mission officials in Ecuador also noted that, although information flow within the Latin America Bureau is good, the flow of information between the regional bureaus is often a problem.

Mission officials in Panama and Ecuador told us that they receive a great deal of general technology information. For example, staff receive technical information through Agency

publications, such as Front Lines, Horizons, and Resources Report. However, several officers believe that sector-specific CST information would be more useful. Many of the technical officers surveyed by AID endorsed the idea of receiving technical information newsletters specific to their fields. AID Agriculture and Human Resources sector councils have recently published such newsletters and another council plans a similar newsletter.

Several mission officials indicated that technical, sector-specific information is most useful to them when working on CST projects. AID officials believe that the dissemination of this type of CST information, along with increased use of DIS, can contribute to more effective design and implementation of CST projects.

ATI ROLE IN CST ACTIVITIES

ATI was created as part of AID's response to the CST legislation to promote CST in developing countries. It operated under a series of AID grants, from August 31, 1978 through September 30, 1983, when a new cooperative agreement between AID and ATI became effective.

The original proposal called for ATI to encourage and support CST innovations, and to serve as a technical resource for AID programs. According to ATI's executive director, it was envisioned that ATI staff would also be involved in identifying the project activities of AID's field missions. A 1978 congressional committee report also urged AID and ATI to "maintain close working relationships to promote a cross fertilization of ideas, and to permit each agency to learn from the other's experiences."

Since its inception, ATI has provided over $11 million in financial and technical assistance through more than 200 grants to organizations worldwide. As of September 30, 1983, AID had provided $23.7 million in grants to ATI.

An interim AID evaluation in August 1982 concluded that ATI had been reasonably successful in strengthening client institutions, developing and disseminating CST, and influencing policy but less successful in drawing on this experience and sharing it with AID. ATI's CST activities had not been widely shared with AID, and the Agency had earned few benefits by modeling projects after ATI's successes. The AID project manager for ATI indicated that, since ATI had been acting independently during the grant period, AID had not always been kept informed about ATI activities.

Officials at the six missions we visited generally have had little or no experience with ATI and have obtained no real benefit from ATI activities. Some officials at four missions had no knowledge of ATI or its functions.

New agreement may improve ATI effectiveness

The new cooperative agreement between AID and ATI which became effective in September 1983 reflects the recognition that ATI has the potential to more effectively promote the CST concept. The agreement, which supports ATI with $16.5 million over a 3-year period, outlines the following cooperative efforts.

--Joint participation in identifying, designing, financing, and/or implementing pilot projects involving CST innovations.

--ATI assistance to missions in designing and implementing CST elements into projects whose primary objectives are unrelated to the CST concept.

--AID financing of the dissemination of innovations which have been successfully demonstrated through ATI activities.

To facilitate these efforts, ATI field staff will be required to provide prior notice to missions of ATI work in the missions' areas. ATI visits to missions will inform mission staff of, and hopefully involve them in, ATI activities. ATI will publish newsletters on successful projects and technologies for distribution to AID missions and bureaus. In commenting on a draft of this report, AID noted that its new cooperative agreement with ATI has already fostered closer relationships. In addition to the efforts cited above, AID has distributed a cable to its missions and bureaus describing the functions and services of ATI.

The cooperative agreement also reinforces ATI's employment and productivity activities, in addition to the hardware aspects of CST. This new focus leans heavily toward commercialization and widespread replication of technologies, which is consistent with AID's CST philosophy and program initiatives.

Most of the AID missions we visited were generally receptive to the idea of ATI providing technical assistance on projects. Mission officials believe that ATI could be a valuable resource and consultant, but they emphasized that any arrangements with ATI must be tailored to fit their particular needs. For example, Botswana mission staff stated that they may be able to use ATI only for low budget projects consistent with the mission's development strategy. In Burundi, mission officials told us that ATI would be considered useful only if it could operate with minimal demands on mission staff time. At all missions, it appeared that ATI would have to demonstrate its value and expertise before its services were wholeheartedly accepted.

SHARING TECHNOLOGY INFORMATION WITH INDIGENOUS POPULATIONS

As the largest single source of government-sponsored technical information available in the United States, the National Technical Information Service covers a broad spectrum, from sophisticated technologies to smaller, capital saving technologies. It has catalogued more than 3,000 reports classified as capital saving technology and has been adding between 50 and 100 new reports a month from developing countries. The technologies in these reports conform to the same criteria used in AID's CST definition.

AID currently has two active regional projects for disseminating NTIS information to developing countries. The objective of the projects is to broaden and maximize the use of appropriate science and technology information in solving development problems. The Science and Technology Information Transfer Project provides a $3.8 million grant to NTIS from fiscal year 1983 through fiscal year 1987 for Latin American information activities. The Regional Science and Technology Information Transfer Project, funded by the Near East Bureau, obligates $1.3 million from fiscal year 1983 through 1987 for NTIS activities.

Experience to date with the AID/NTIS technical information projects has shown that end-users are usually individuals in a professional or managerial capacity in private enterprise. Table 3 shows a profile of 4,000 regular users of NTIS technical information in developing countries; the high percent of business and industry users indicates that NTIS appears to be reaching its intended target group of entrepreneurs.

Table 3

Profile of NTIS Users

User	Percent
Business/industry/professional	79
Government	7
Individuals	5
Libraries	4
Universities	4
Other	1

The NTIS distributor in Panama believes that private enterprises are the best target of NTIS efforts, since they have a greater chance of understanding the technical information, which is generally in English. Distributors in Ecuador and Thailand find that government agencies and university students are generally the largest users of the service.

As part of its agreement with AID, NTIS established a network of cooperating organizations to distribute information in the developing countries. AID funds subsidize the cost of NTIS publications to the country distributors and the cost of shipping and handling NTIS documents. The distributors are responsible for promoting NTIS products and services, processing end-user information orders, and helping indigenous groups to put the technical information to practical use. To assist the distributors, NTIS and AID jointly publish informational bulletins about the service, which are distributed to potential users in developing countries. NTIS also publishes a bibliography of CST information, which highlights the CST-related document titles in the NTIS collection, as well as several weekly abstract newsletters.

NTIS information may not reach potential market

AID's Latin America Bureau funded an evaluation of the NTIS information program in Latin America which concluded that NTIS information, when accessed, contributes significantly toward technological change. Information gathered through personal interviews with end-users showed that 81 percent of those who accessed the NTIS system applied the information in a productive manner.

The study concluded that NTIS publications were actively promoted only in informational bulletins. Specifically, each distribution center had only one full-time person devoted to all NTIS activities, including marketing and order processing. As a result, many users remain unaware of the range of NTIS services and the universe of NTIS information.

NTIS distributors in several countries we visited also acknowledged that marketing and user awareness have been problems. For example, the distributor in Panama noted that no one in that country uses NTIS very extensively and cited a lack of funds as the reason for inadequate marketing. The Thailand distributor indicated that the NTIS service is not actively marketed. The Indonesia distributor, however, has marketed the service through pamphlets, abstracts, sales promotions, exhibitions, and newspaper advertising; nevertheless, the distributor is dissatisfied with the results, finding that marketing is costly and difficult.

An objective of one of the NTIS contracts is to involve AID missions by having them identify, contact, and evaluate potential distributors and target groups as well as alerting NTIS to potential CST materials or sources. Both NTIS contracts also encourage missions to use NTIS information. However, mission officials at the six AID missions we visited do not access the NTIS system or help to promote the projects. Some officials at one AID mission were unaware that there was an NTIS distributor operating in that country.

According to an NTIS official, the AID/NTIS information projects have been addressing system marketing problems by encouraging distributors to promote the service rather than just process orders. NTIS is presently developing local marketing tools, such as brochures in Spanish for Latin American countries and in Arabic for Near East countries. In addition, several in-country seminars are designed to introduce NTIS information to project target groups.

AID officials believe that the length of time required to fill an NTIS information request for indigenous groups (often 2 to 4 months) also may discourage potential users. To address this problem, NTIS has assigned additional staff to process requests from developing countries and will test the use of telex equipment to expedite information requests.

NTIS and AID officials in Washington acknowledge that system marketing and use are continuing problems. NTIS officials believe that the system may be reaching only 10 percent of the indigenous population that reads English, which is a fraction of the total population. In commenting on a draft of this report, AID noted that it is attempting to find more cost effective and efficient means of reaching NTIS' potential market. For example, the Latin America and Caribbean Bureau has developed an experimental program to test marketing strategies for NTIS information in Columbia, Costa Rica, and Jamaica.

CONCLUSIONS

AID has found that effective information and technical assistance mechanisms are useful in implementing the CST concept. Information on previous CST experiences can help AID project designers to replicate or improve on previously used technologies or capital saving approaches. Technical assistance may also be required to successfully test, adapt, and transfer innovative capital saving tools and techniques.

DIS, ATI, and NTIS information projects have all been designed to provide AID staff and indigenous groups with the information and technical skills necessary to design and implement capital saving development projects. Although AID has allocated resources to these CST support mechanisms, the projects do not appear to be achieving their potential. The absence of substantial marketing and promotion may be a significant reason for the lack of awareness and use among AID staff and other target groups.

We believe that DIS has the potential to fill internal information needs. However, little change appears to have occurred since our 1982 report which identified DIS use problems; AID staff remain generally unfamiliar with DIS services and opportunities appear to exist for greater use of the system.

Although some officials believe that missions should be required to use DIS, AID recognizes the system's problems and is attempting to address them through increased marketing and automation. We believe that these efforts may be effective in increasing the flow of CST information to AID project designers and field staff.

AID mission staff awareness of the role and service of ATI has also been minimal. Successful ATI projects have not been effectively shared with AID and this has limited AID's ability to apply ATI's knowledge to its own development projects. AID's new cooperative agreement with ATI has the potential for helping ATI to provide more effective support to AID's internal CST efforts. Although AID missions are generally receptive to the intent of the new agreement, ATI will have to prove its usefulness to missions through successful implementation of CST-related projects.

The NTIS international information network, supported through AID regional projects, is intended to widely disseminate CST and other technical information in developing countries. Although NTIS information is effectively used when accessed, the absence of marketing and promotion has limited the potential scope and effectiveness of the project. We believe that NTIS' plans to increase marketing efforts and that cooperation with AID missions may help NTIS to reach a larger segment of the target population and thus become a more effective part of AID's CST activities.

We believe that the DIS, ATI, and NTIS projects have the potential for making substantial contributions to AID's implementation of the CST concept. When used, these CST information and technical assistance mechanisms can be valuable tools which AID staff can use to help design and implement CST projects. Despite its recognition of the problems, AID has had difficulty instituting changes which can increase use of these projects and increase their effectiveness as support mechanisms for the Agency's CST activities.

RECOMMENDATIONS

To ensure that AID implements changes to improve these projects, we recommend that the Administrator:

--Follow through on proposals to actively market and improve access to DIS services.

--Promote increased ATI cooperation with AID by ensuring that the new AID/ATI agreement is effectively implemented.

--Closely monitor AID's agreements with NTIS to ensure that distributors are actively marketing CST information.

AGENCY COMMENTS AND OUR EVALUATION

AID did not take issue with our recommendations but noted some progress that the Agency is making in some of the areas addressed by the recommendations. With respect to NTIS, AID noted that the Latin America and Caribbean Bureau is testing promotional strategies for marketing technical information in three countries in the region. On DIS, AID said it is making a substantial effort to respond to recommendations in the 1982 GAO report and noted specifically the greater coverage DIS is getting in AID publications. With respect to ATI, AID suggested we distinguish more clearly in our discussion between the grant period and the cooperative agreement period which began September 30, 1983. We revised the report to reflect AID's comments.

CST PROJECT CASE STUDIES

AID projects in Burundi and Thailand illustrate several aspects of AID's CST definition.

BURUNDI RURAL ROAD 84

The Rural Road 84 project is intended to improve Burundi's economic and social welfare by linking Bururi Province's hilly, agricultural area to the Lake Tanganyika plain with an all-weather road. The project will also test labor-intensive construction methods for possible application in other Burundi road projects.

AID signed an agreement with the Republic of Burundi in July 1980 to finance reconstruction of Rural Road 84. Preliminary work began in January 1981, but actual road construction began several months later. The scheduled completion date has slipped from July 1983 to September 1984.

Several organizations donated time and money to the project. Total project costs are approximately $2.5 million, excluding salaries for two World Bank road technicians whose salaries are paid under an International Development Association highway loan. The United States is granting $1,346,000 in development assistance and $625,000 under the Food for Work program, making it the project's largest donor.

End-user participation

Consultation between the government, other donors, and area residents was limited. However, lack of consultation did not affect the project quality because the road location, which was the major design question, was almost entirely determined by the existing roadbed. Project officials said that the approximately 60,000 people affected by the road generally support the project and almost no one opposes it.

Technological alternatives

The mission did not consider building the road with more capital-intensive equipment, since it believed such an approach would cost more, provide fewer side benefits such as jobs, and be more difficult to maintain. Burundi does not produce most of the heavy equipment and materials needed for road construction, so trucks, heavy machinery, and cement would have to be imported at great expense. The difficult terrain and poor maintenance which, for example, limit a truck's life expectancy to only 2 years in Burundi, would add additional costs.

Potential replicability

One of the mission's goals for the project was demonstrating that labor-intensive road construction methods would work. The mission also wanted to develop government institutions to manage future rural road projects. Since subcontracting is a relatively new concept in Burundi, the development of road construction subcontractors will aid the government in replicating this project and maintaining its road system. Most project workers were initially paid daily wages but subcontractors are increasingly contracting on a piecework basis. Subcontractors have learned basic management skills, such as bidding jobs; hiring, training and disciplining employees; and meeting payrolls. In addition, project managers said that crews, such as the masonry teams, have improved their skills as they have gained experience. The mission expects the development of subcontracting to reduce startup costs on future road projects and to provide skilled road maintenance crews.

The mission is planning a follow-on project to reconstruct Rural Road 85, using a similar labor-intensive approach. This project, known as Rural Road II, anticipates using the Rural Road 84 workers and construction crews. The government is anxious to keep construction crews together by providing continuity between the two projects. As part of the Rural Road II project, six other roads will be surveyed for possible reconstruction. The mission anticipates financing one of these roads, with the government and other donors financing the remainder. These roads lie near Rural Road 84, and the same road building techniques and construction crews will be used.

Constraints

Unanticipated constraints delayed the project by 14 months. Difficulties in training workers was the first constraint encountered. In the beginning, workers did not know how to use simple tools like shovels and picks; 6 months passed before some crews began working effectively together. Erratic delivery of supplies also caused delays, since cement and dynamite were often in short supply.

The project also encountered construction problems. Project planners expected to find road surfacing material along the right of way, but instead project managers had to use trucks to haul surfacing material from quarries. Difficulty in keeping the trucks operating led to insufficient paving supplies. Managers also underestimated the amount of paving material needed. An engineering analysis made during road construction revealed that a greater paving depth than originally planned was needed to ensure the longevity of the road surface.

Project benefits

AID's primary project objective was to improve the economic and social welfare of the region. Specific benefits anticipated were increased (1) cash flow into the construction area, (2) agricultural producer profits due to cheaper transportation costs, and (3) available social services and trade opportunities. Although not yet completed, the road is passable by truck throughout its length and, we were told, benefits have already begun to accrue.

Conversations with project officials indicate that the effects of improved access to the area and more cash in the local economy have been noticeable. These officials identified increased construction along the road and more huts with tin roofs as evidence of an accelerating cash economy and improved transportation of construction goods. Other benefits cited include:

--Better access to health and education services. Because of better lakeside market access, interior schools and medical dispensaries receive more supplies.

--More activity in formerly dormant markets along Rural Road 84. The markets are receiving goods that have not been available since the old road deteriorated.

--Improved diet for the interior population. Trade between the Lake Tanganyika villages and the interior population provides fish and palm oil--sources of protein and fat.

--More revenue for cash crops and produce. Farmers are selling more cash crops, such as coffee and bananas, to the coastal markets and have increased cash crop production.

THAILAND RENEWABLE NONCONVENTIONAL ENERGY PROJECT

The Renewable Nonconventional Energy Project is intended to assist the Thai government in reducing imported energy resources, arresting environmental degradation due to deforestation, and creating increased income opportunities in rural areas. This will be carried out through

--developing Thai institutional capacity to plan and sustain energy policy;

--introducing and testing renewable energy technologies in rural areas; and

--developing and testing techniques for disseminating such technologies.

AID is providing a $5 million grant to the 5-year project, which began in fiscal year 1979. Other donors include the Asian Development Bank and the U.N. Development Program.

End-user participation

Thailand's overall energy needs are increasing annually, with urban Thais consuming the bulk of petroleum-based energy. Rural energy demands are presently met by wood and charcoal for cooking and kerosene for lighting. However, the demand for wood and charcoal has already seriously affected forest areas and threatens the ecological system. Unless rural energy demands can be met by developing local renewable nonconventional energy sources, Thailand will need to increase its already growing dependence on petroleum imports.

Search for technological alternatives

During the project planning phase, the project officer contacted a number of indigenous Thai sources and researched several other sources. All information obtained was reviewed, and renewable nonconventional energy technologies deemed appropriate for Thailand were considered. As the project progressed, technologies found to be inappropriate or impractical were either modified or dropped, while other alternative technologies seemingly more appropriate were added. For example, the solar technology alternative, which was initially thought to be of marginal value based on the available data, was demonstrated to be practical.

Information availability, access, and use

The extensive search for information involved a literature search for material available from AID missions and indigenous organizations. One source was AID's "Philippines--Nonconventional Energy Development" project, which preceded the Thai project by a year. It was composed of 10 subprojects designed to explore the development of alternative renewable energy sources appropriate for use in the rural Philippines.

The project officer, because of his extensive personal knowledge of sources and his network of professional contacts,

found the needed technical information readily available and easily accessed.

Potential replicability

A major project component involves testing, adapting, and disseminating of renewable energy technologies. Once these energy alternatives are tested, the data and institutional applications are to be used as the framework for a broader Thai energy policy. One component of this project has already been replicated in a later AID project, the Micro/Mini Hydroelectric Project. The original nonconventional energy project included studies and pilot efforts in a number of energy areas, including micro hydropower.

Another example of a project component that proved successful and is now planned to be extensively replicated is the village woodlot. This component was a $0.5 million segment of the project in which government land was reforested with fast-growing trees to be harvested for cooking fuel. Because this segment proved so successful, the Thai government plans to commit $50 million for future village woodlots.

Constraints

The project officer was unaware of any constraints that presently affect the project. There was, however, a law that prohibited the harvesting of reforested trees on government land. If the Thai government had not repealed this law, the Thailand Forest Reserve Act, the woodlot component of the project would have been scrapped, since villagers would have been unwilling to plant trees on government land if they could not harvest and use those trees for fuel.

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

MEMORANDUM May 18, 1984

TO: Frank C. Conahan, Director
National Security and International Affairs Division
General Accounting Office

FROM: Leonard Yaeger, S&T
Acting

SUBJECT: GAO Draft Report, "Capital Saving Technology in AID's Development Assistance Program: Opportunities for Increased Use," GAO Assignment Code 472027.

Please find attached A.I.D.'s response to subject GAO Draft Report.

Attachment: a/s

cc: IG/PPP, L. LaMotte

Clearances:

ST/RD/ESE, M. Farbman	
ST/HR, N. Nicholson	
ST/RD, E. Chetwynd	(Draft)
A/AA/LAC, M. Brown	(Phone)
DAA/ASIA, E. Staples	(Phone)
AA/NE, E. Vinson	(Draft)
AFR/TR, L. Holdcroft	(Phone)
AAA/PPC/E DIU, W. H. North	(Draft)
AAA/PPC/PDPR, E. Hullander	(Phone)
PRE/PPR, L. Brown	(Phone)
S&T/PO, F. Campbell	(Phone)

Drafted by: E. H. Smith, ST/RD/ESE

GAO Note: The page numbers have been changed to reflect their current position in the final report.

Agency for International Development Comments on GAO Draft Report, "Capital Saving Technology in AID's Development Assistance Program: Opportunities for Increased Use," GAO Assignment Code 472027.

Definition

There is no agreement among development practitioners on the definition of capital saving technology (CST). This should be pointed out at the beginning of the GAO Report. On the one hand, one can define CST activities expansively as including all projects or activities which actually or potentially involve the choice between two technologies, one of which uses less capital and/or more labor than the other. On the other hand, one can define CST activities more narrowly as activities having an explicit capital saving and/or labor intensive element.

Whatever definition the GAO uses, it should decide what elements are necessary and what elements are sufficient for an activity to be considered a CST activity and use the definition selected consistently throughout the Report. The definition of CST set out on page i of the Report is probably adequate for the GAO's purposes. However, the Report should point out that the obverse side of the "requires little capital per worker" element is "requires more labor for a given amount of capital." Recognizing that the obverse side of capital saving is labor-intensive would have led the GAO to see many more activities as involving CST. For example, it would have led to the description of the Thailand Seed Development Project as a project with CST elements.

The page i definition of CST is not used consistently throughout the Report. For example, on page 11, the Report describes a project as having problems of a CST-related nature because community participation in the project was not obtained. However, "involves community participation" is not listed as one of the elements of CST in the page i definition.

The Report uses two different definitions to assess the CST content of mission programs. The Report discusses CST in Indonesia, Ecuador, Panama, Botswana and Burundi in terms of "CST elements." It describes CST in Indonesia in terms of projects "designed primarily with a CST approach."

The distinction between CST and appropriate technology is not described accurately in the Report. A footnote on page 17 states: "Appropriate technology is an earlier term which also includes capital saving technology." Appropriate technology is a term currently in use which includes technologies appropriate for developing countries where labor is scarce and capital is relatively abundant, such as the Yemen Arab Republic, as well as CST. This should be pointed out explicitly in the Report.

2. Promoting Increased Use

A major purpose of the Report is to promote increased use of CST in the design of A.I.D. projects. In pursuit of this objective the report recommends that A.I.D. "more explicitly consider potential CST applications in the

Project design process in some manner, such as through the sector councils." The sector councils are not a good choice to implement such an initiative. Except for S&T Bureau projects, they do not consider the design of individual projects in sufficient detail to function in this way.

The idea that A.I.D.'s private sector initiative may subordinate CST, which is presented on page iv of the Report, embodies a mistaken idea of private sector decision-making. Entrepreneurs maximize profits by using the most efficient mix of capital and labor available for their planned scale of operation.

Nevertheless, probably the most efficient way for A.I.D. to raise the consciousness of those involved in the design of projects to the importance of CST, is to revise both the technology transfer and private enterprise policy papers to explicitly include a section on CST. Any further new, freestanding intervention in the project design process at this time is not warranted and might produce negative results.

The rank of CST in A.I.D.'s hierarchy of priorities is an important determinant of how much attention it receives in the project design process. In the Africa Bureau, for instance, a high priority has been assigned to the need for fewer,larger projects to improve management efficiency. Pursuit of this objective will probably decrease the number of Africa Bureau projects including CST elements.

3. National Technical Information Services (NTIS)

The Report should indicate that it was a LAC Bureau evaluation which first pointed out the need to market more effectively NTIS services. It should also mention the experimental strategy which the LAC Bureau has developed to test innovative promotional strategies for marketing technical information in Columbia, Costa Rica and Jamaica.

4. Development Information and Utilization (DIU)

The Report should point out that DIU is making a substantial effort to respond to the recommendations of the 1982 GAO Report. These efforts include: (1) expanded coverage in "Front Lines" and "Horizons," (2) training of regional bureau staff, increasing their ability to directly access the Development Information System, (3) technical assistance to missions in establishing mission information centers, thereby linking the field to the project and technical documentation contained in the Development Information System and, (4) addition of a research service staff to provide more timely, focused responses to information requests from missions.

5. A.T. International (ATI)

Each time ATI is discussed, the Report should make it clear whether the statement made refers to the Grant period (31 August 1978 to 30 September 1983) or the Cooperative Agreement period (30 September 1983 to date). The

signing of the new Cooperative Agreement marked a major watershed in A.I.D.'s relationship with ATI. If focuses ATI's activities and promotes a more cooperative relationship between ATI and A.I.D. The fruits of this greater cooperation are beginning to manifest themselves. Closer relationships with the regional bureaus are being developed through ATI presentations and with the missions through (1) prior notification of ATI travel, (2) an AWIDE cable, (3) a periodic communication and (4) efforts to promote and facilitate direct cooperation.

ATI is principally involved in technical assistance. Information dissemination is a subsidiary activity. The Report should be changed to reflect this fact.

6. Thailand Seed Development Project

The discussion of this Project in the Report is inaccurate and misleading in a number of respects and the conclusions drawn are not warranted. A recent evaluation of the Project indicates that it is both commercially viable and easily replicable. In fact, the project idea has already been extensively replicated in Thailand. Capital equipment is necessary for the success of the Project and this equipment is not available in Thailand.

7. Additional comments on the Report were provided to the GAO at a meeting held at 2:30 p.m., Thursday, 16 May 1984. Copies of all written comments received were transmitted to the GAO under cover of a separate memorandum.

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