

PD-AAU-642

EVALUATION REPORT OF THE  
DEVELOPMENT AND APPLICATION OF  
INTERMEDIATE TECHNOLOGY (DAPIT) PROJECT

(Project No. 641-0084)

Prepared for:

The Government of Ghana, Accra  
and the  
USAID Mission to Ghana, Accra

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# DAPIT PROJECT EVALUATION REPORT

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## GLOSSARY OF ACRONYMS USED IN CONNECTION WITH DAPIT PROJECT

AAPC	Afro American Purchasing Corporation
ADB	Agricultural Development Bank
AESC	Architecture and Engineering Service Corporation
AT	Appropriate Technology (synonymous in Ghana with intermediate technology)
BRRRI	Building and Road Research Institute
CIDA	Canadian International Development Agency
CP	Conditions Precedent
CRI	Crop Research Institute
CRS	Catholic Relief Services
CSC	Christian Service Community
CSIR	Council for Scientific and Industrial Research
CUSO	Canadian University Service Overseas
DAPIT	Development and Application of Intermediate Technology (AID project being evaluated herein)
EPF	Evangelical Presbyterian Farms (Yendi)
DS/DIU	Development Information and Utilization Service in AID/Washington
FLO's	Farm Loan Offices of the Agricultural Development Bank
FPRI	Forest Products Research Institute
FRI	Food Research Institute
GEDEC	Ghana Enterprise Development Commission
GGADP	Ghanaian-German Agricultural Development Project (Tamale)
GGIF	Ghanaian-German Implement Factory (Tamale)
GOG	Government of Ghana
GRRM	Ghana Rural Reconstruction Movement
IDU	Information and Documentation Unit
IRI	Industrial Research Institute
ITTU	Intermediate Technology Transfer Unit (TCC Branch facilities at Kumasi and Tamale)
LOP	Life of Project
MFEP	Ministry of Finance and Economic Planning
MIDAS	Managed Inputs and Delivery of Agricultural Services (USAID Project)
MIIST	Ministry of Industry, Science, and Technology
MOA	Ministry of Agriculture
NBSSI	National Board for Small-Scale Industries
NCWD	National Council on Women and Development
NTIS	National Technical Information Service (U.S. Department of Commerce, supported by AID)
OIC	Opportunities Industrialization Center (for vocational education)
PACD	Project Assistance Completion Date
PC/G	Peace Corps/Ghana
PCV	Peace Corps Volunteer
PGA	Project Grant Agreement
PIL	Project Implementation Letter
SATIS	Socially Appropriate Technology Information System
SCC	State Construction Corporation
STIC	Scientific and Technical Information Center
TCC	Technology Consultancy Center
VSO	Voluntary Service Overseas (U.K.)

## 1.0 EXECUTIVE SUMMARY

This report evaluates a project financed by the Agency for International Development and the Government of Ghana called, Development and Application of Intermediate Technology (DAPIT), Project No. 641.0084.

The DAPIT Project started in August 1979, with the approval of a Project Grant Agreement obligating \$2.8 million of AID funds; this was later increased to \$3.8 million. Approximately \$1.8 million remains to be disbursed.

The main thrust of the DAPIT Project is to develop, produce, and deliver to the rural populace small-scale AT equipment such as: cassava graters, soap-making equipment, "minimum tillage" planters, beehives, solar driers for pepper or cassava, groundnut shellers, or corn mills. By using such equipment, the rural populace can raise their productivity and incomes.

The DAPIT Project is divided into two phases. During Phase One, AID financed the import of capital equipment (e.g., drill presses, lathes, sheet metal cutters, powered hacksaws, welders, printing equipment, supplies, and vehicles).

This equipment was delivered to the following four participating agencies: (1) Industrial Research Institute (IRI), (2) Food Research Institute (FRI), (3) Information Documentation Unit (IDU), and (4) Technology Consultancy Center (TCC). The first three are located in Accra and are constituent institutes of the Council for Scientific and Industrial Research (CSIR). The fourth agency, the TCC, is located in Kumasi and is a semi-autonomous unit of the University of Science and Technology.

Much of the capital equipment financed under Phase One has been installed, but most is not fully operational because accessory equipment (e.g., chucks, drills, clamps) were not included in the original orders.

Phase One is almost completed, but much work remains to be done in Phase Two, specifically the planning and executing of sub-projects for the manufacture and delivery of AT equipment. This will involve the training of people from private industry and the careful planning and monitoring of production. Much of the work to be accomplished in Phase Two consists of:

- Strengthening Project management at the operational and policy levels.
- The selection and implementation of sub-projects for producing and delivering AT products to the rural populace. We are suggesting that the participating agencies consider the practice of the TCC, namely, arranging for private industry to produce equipment such as beehives, soap-making equipment, and the "minimum tillage" planter.

There is a large amount of proven appropriate technology in Ghana. We believe that the hitherto prevailing emphasis on R & D should be shifted to the production and delivery of AT equipment.

There is a substantial unmet demand for AT equipment in Ghana. Evidence of this is the production and sale of over 65,000 hoes (finished and unfinished) by the Ghanaian-German Agricultural Development Project in Tamale, and the manufacture and sale of more than 10,000 pieces of heavier AT equipment by the Agricultural Engineers, Ltd. (AGRICO) of Accra, plus millions of hand tools which must be imported for farmers. This suggests that the economic and social need for the DAPIT Project is probably greater than ever before.

Many of these needed tools and various types of equipment can be produced in Ghana by private industry under the guidance of the TCC, IRI, and FRI.

We are recommending that residual funds in the DAPIT Project be used for (a) sub-projects that will produce and deliver AT equipment to rural areas, (b) that some funds be used for a generator to power a central workshop in Tamale (ITU/Tamale), (c) that any undelivered accessories

for the capital equipment be financed, (d) that the services of two technicians (Medicus Washington, Tool and Die Expert, and Frank Robertson, Electrical Engineer) be continued for the life of the Project, (e) that additional Peace Corps involvement in DAPIT be encouraged, (f) that technical assistance be extended to the DAPIT Secretariat to help in the preparation and processing of sub-projects, and (g) that technical assistance be provided to IDU to improve information storage and retrieval.

We recommend that such assistance be continued until September 30, 1986, but should be contingent on improvements in the Project Management at the policy and operational levels.

## 2.0 INTRODUCTION AND ACKNOWLEDGEMENTS

### 2.1 Introduction

This report evaluates an AID/GOG project entitled, Development and Application of Intermediate Technology (DAPIT), Project No. 641-0084.

Funds for the DAPIT Project were initially approved by a Project Paper dated June 16, 1979. The U.S. dollar funding was originally envisaged as \$4,760,000 and GOG funding was expected at a level equivalent to \$3,256,000, a combined total of \$8,016,000 over a four-year period ending FY 1983. The life of the Project has been extended to September 30, 1984.

The U.S. dollar component of the financing for the DAPIT Project was broken down as follows (in thousands of U.S. dollars):

Commodities	\$1,274	27%
Technical Assistance	1,225	26%
Training	177	4%
Other Costs	542	11%
Contingency	231	5%
Inflation	358	7%
Sub-projects (R & D)	<u>953</u>	<u>20%</u>
TOTAL	\$4,760	100%

The Project Grant Agreement, dated August 31, 1979, obligated U.S. dollar funding of \$2,756,000; this amount was to finance the first phase of the Project, that is, the importation of capital equipment, largely machine tools, vehicles, and supplies. These commodities have been imported and distributed to the participating institutes of the Project shown in Figure 2.1 later in this section.

The second phase of the Project was to consist of the selection, development, testing, production, and delivery of appropriate technologies to farmers and entrepreneurs.

The objective of the Project was as follows (see page 9 of the Project Paper of June 18, 1979):

"The purpose of the project is the establishment of an effective national mechanism to identify, develop, test, produce and deliver to the end-users appropriate technological processes and equipment... The Intermediate Technology Secretariat within the Ministry of Economic Planning will insure that the fruits of intermediate technology are brought to the ultimate beneficiaries: "the rural farmer and small entrepreneur." (In September 1979, the Secretariat was moved from the Ministry of Economic Planning to the Ministry of Industry, Science and Technology.)

The organizations participating in the DAPIT Project, shown graphically in Figure 2.1 on the next page, were to have been coordinated by an apex agency, the Intermediate Technology Secretariat, now located in the Ministry of Industry, Science and Technology (MIST). Operating agencies, responsible for the development, testing, production, and delivery of AT products and processes, are as follows:

- Industrial Research Institute (IRI)
- Food Research Institute (FRI)
- Information and Documentation Unit (IDU)
- Technology Consultancy Center (TCC) of the University of Science and Technology (UST) in Kumasi

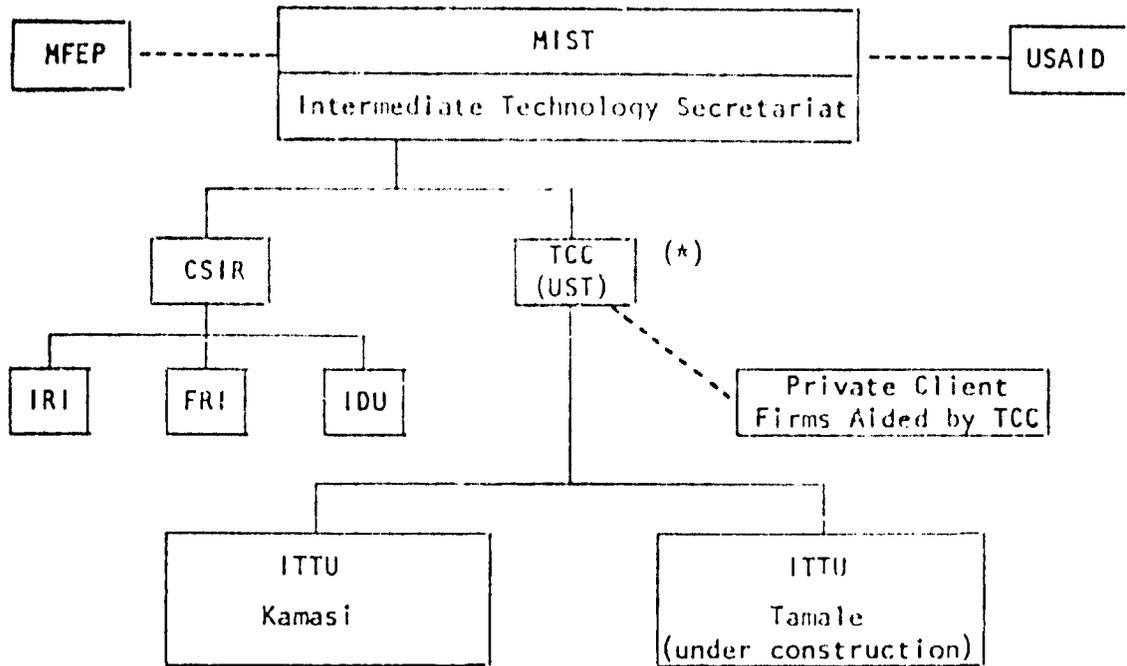
The content of this evaluation report is organized to cover the five paragraphs of the "Statement of Work" (see Annex A, Excerpts from Indefinite Quantity Contract PDC-0000-1-04-3082-00), Work Order No. 4).

Chapter 4 of this report reviews the basic project design and the status of implementation and accomplishments to date against project objectives. An assessment is made of what further inputs are needed to achieve the objectives.

Chapter 5 identifies management, structural, and organizational constraints arising from flaws in the original design and suggests

Figure 2.1

ORGANIZATIONS PARTICIPATING IN DAPIT PROJECT



Abbreviations Used  
(from top to bottom)

- MIST = Ministry of Industry, Science and Technology
- MFEP = Ministry of Finance and Economic Planning
- USAID = United States Agency for International Development
- CSIR = Council for Scientific and Industrial Research
- IRI = Industrial Research Institute
- FRI = Food Research Institute
- IDU = Information and Documentation Unit
- TCC = Technology Consultancy Center (Kumasi)
- ITTU = Intermediate Technology Transfer Unit (Kumasi and under construction at Tamale)

(\*) The Industrial Research Institute (IRI) and the Technology Consultancy Center (TCC) in Kumasi are assisted by the Peace Corps (5 volunteers), USAID (2 contract technicians) and the European Economic Community (1 Director under contract).

corrective measures. The inter-relationships between the participating Institutes are analyzed.

Chapter 6 reviews the goals of the DAPIT project and determines their relevance to the existing intermediate technology development and dissemination system in Ghana and suggests how DAPIT can best contribute to the agencies involved (i.e., MIST, IRI, FRI, IDU, TCC, and private industry).

Chapter 7 examines the goals of the existing agencies and analyzes the consistency of such goals with the DAPIT project.

Chapter 8 reviews the distribution of commodities, largely metal working tools, financed by the DAPIT project, and assesses the capability of the recipient agencies to utilize the commodities in furthering DAPIT objectives.

The final chapter summarizes conclusions and recommendations covered in the previous chapters.

There are three authors of this report. The Chief of the evaluation team is Frank L. Turner, employed for eight years by Checchi and Company and experienced in small industry, appropriate technology, and information dissemination in Bangladesh, Ghana, Mauritania, Nigeria, North Yemen, and Egypt.

Lawrence Morrison, employed by Checchi and Company for over 14 years, is an engineer with small industry and appropriate technology experience in Afghanistan, Central America, Guinea, Egypt, Mauritania, French Guyana, and other developing countries.

Eric Odotei, a development economist, was assigned to assist the evaluation team by the Ministry of Finance and Economic Planning. Mr. Odotei has a masters degree in economics from Northeastern University in Boston, Massachusetts, and successfully completed his assignment at the World Bank's Economic Development Institute in Washington, D.C.

## 2.2 Acknowledgements

The authors of this report wish to acknowledge the support given them by Government agencies, the participating institutes in the DAPIT Project, and by private industry.

At the Ministry of Industry, Science and Technology (MIST), the authors were briefed by Mr. D.M.K. Akumeh, Technical Director; by Mr. A. Eboe-Arthur, Project Manager of the DAPIT Secretariat, and by his colleague, Mr. J.M. Bartels, Technical Director.

At the Ministry of Finance and Economic Planning (MFEP), the evaluation group was met by the Principal Secretary, Ms. Virginia Ofosu-Amaah, who explained that a key policy of the Provisional National Defense Council (PNDC), since its installation December 31, 1981, was to strengthen Ghana's informal industrial sector. This meant, she said, that the Government was committed to the policy of encouraging small-scale industry to produce appropriate technology (AT) products.

Dr. R.G.J. Butler, Acting Director of the Council for Scientific and Industrial Research (CSIR), convened an initial meeting of the Directors of four of the Council's constituent institutes, the Industrial Research Institute (IRI), Food Research Institute (FRI), the Information Dissemination Unit (IDU), and the Crops Research Institute (CRI).

At the Industrial Research Institute (IRI), Ms. Alexandra Amoako-Mensah, Acting Director; Dr. M.F. Dampney and Dr. Francis Acquah, Research Officers, explained the policies and accomplishments of the IRI in strengthening the performance of Ghanaian industry through research in better products and processes and through the introduction of technologies.

At the Food Research Institute (FRI), the Acting Director, Mr. K.K. Eyeson, and the Principal Research Officer, Mr. B.L. Lartey, explained the design and manufacture of AT product prototypes (about 13 prototypes, some of them multi-purpose, have been developed).

At the Information and Documentation Unit (IDU), Mr. D.K. Opare-Sem, Head of IDU, and the Librarian, Mr. J.A. Villars, described the extensive document collection and retrieval system for AT documentation and the methods used by the IDU to maintain an awareness of new developments in the AT field worldwide.

At the Technology Consultancy Center (TCC), University of Science and Technology, Kumasi, Dr. John W. Powell, Director, and Mr. Medicus Washington, Deputy Director for Tamale, described the help being extended by the TCC to entrepreneurs seeking to initiate manufacturing operations; how seminars in beekeeping technology had resulted in a major expansion of this industry; how soap making technologies have been introduced to produce a hard, full-lathering, and low cost soap having a low content of imported raw materials; and how the "minimum tillage" planter, perfected and produced by the TCC, has more than doubled maize yields (where 5 bags were produced, now up to 12 bags can be grown per acre).

At Tamale, the evaluation team met Mr. Frank Robertson, Field Officer of the TCC, who organized meetings with the Architecture and Engineering Service Corporation and the State Construction Corporation to determine the status of construction of the new building in Tamale to accommodate the Intermediate Technology Transfer Unit (ITTU). Frank Robertson also provided a list of over 20 proven AT products or processes that can be manufactured or used in the ITTU or in the workshops of private companies in the Tamale area.

In the private sector, the evaluation group inspected the facilities or conferred with the management of Agricultural Engineers, Ltd. (AGRICO) and Index Engineering, both in Accra, and met with Mr. Al Haji Goodman, a leading entrepreneur and manager of his own metal products company in Tamale.

At the USAID Mission, the evaluation group appreciated the interest, dedication, and extensive support of Mr. Roy Wagner, USAID Director, and Mr. John Thomas, USAID Agricultural Development Officer.

We want especially to acknowledge the insights and written contributions to our report of Mr. Eric Odotei, our counterpart from the Ministry of Finance and Economic Development, who accompanied the evaluation group to Kumasi and Tamale.

We want to recognize the self-sacrifice and skills of the Peace Corps personnel whom we met, specifically: the Peace Corps Director, Mr. Willie Gonzalez; Deputy Director for Rural Development, Ms. Michelle Frugé; PCV's Ralph and Marlene Moshage at the TCC and Mark Simmonds at the IRI.

### 3.0 OUTLOOK FOR APPROPRIATE TECHNOLOGY IN GHANA

#### 3.1 General Comment

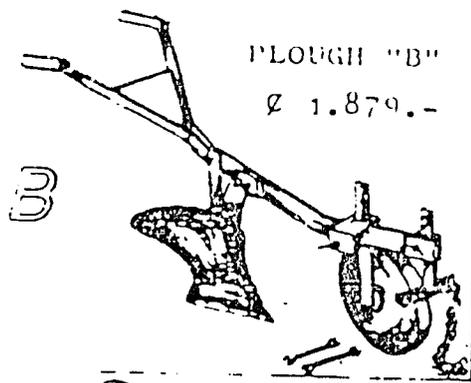
Ghana offers a promising opportunity for the development and dissemination of appropriate technology. This is because of several characteristics of the Ghanaian economy, traditions, and institutions.

#### 3.2 Demand for AT Products

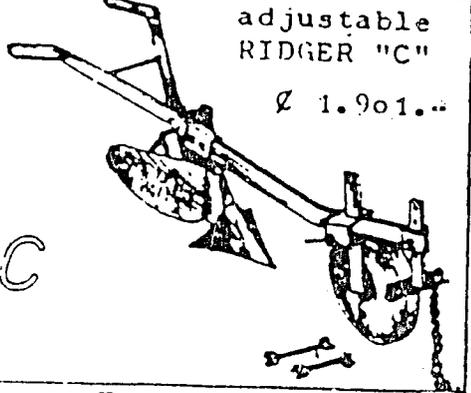
There is a strong demand for AT products as evidenced by such examples as the brisk sales of products made under the auspices of the Technology Consultancy Center (TCC) in Kumasi; the best selling AT products are "minimum tillage" planters, bee hives, palm oil expellers, soap making equipment, looms, and welders.

The Ghanaian-German Agricultural Development Project (GGADP) in Tamale has sold the following AT products from mid-1980 through June 30, 1983:

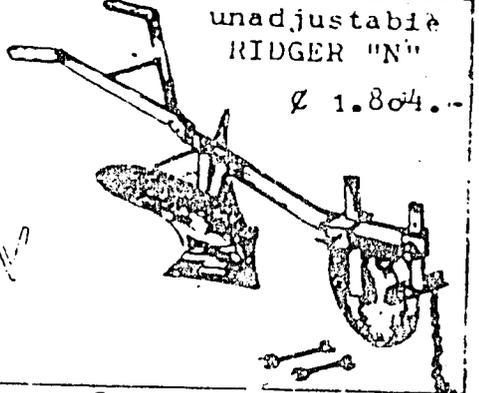
AT Product	Number of Products Sold	Approximate 1983 Price, Each
Plough "B"	1,197	₵3,758
Adjustable and Unadjustable Ridgers	1,059	₵3,600
Adaptable Ridger Body, Unadjustable Ridger Body, Adaptable Plough Body	1,481	₵1,600 - ₵1,800
Cultivators with Rigid Tines	217	₵ 800 - ₵3,800
Two-wheel, Tractor-drawn Cart	479	₵9,000
Two-wheel Hand Cart	211	₵2,200
Galvanized Sheet Water Storage Tanks (240, 500, and 1,500 gallons)	279	₵2,000 - ₵6,000
Triangular Hoes, Unfinished	3,572	₵ 15
Triangular Hoes, Finished	9,722	₵ 25
Rectangular Hoes, Unfinished	23,879	₵ 20
Rectangular Hoes, Finished	2,989	₵ 35
Round Hoe Blade, Unfinished	25,240	₵ 25



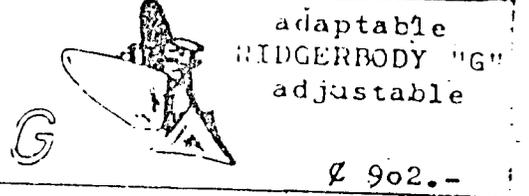
PLOUGH "B"  
 ₵ 1.879.-



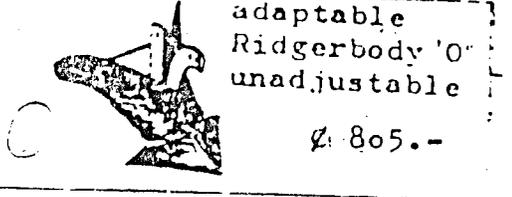
adjustable  
 RIDGER "C"  
 ₵ 1.901.-



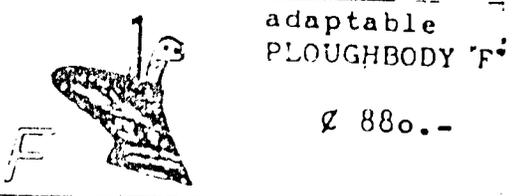
unadjustable  
 RIDGER "N"  
 ₵ 1.804.-



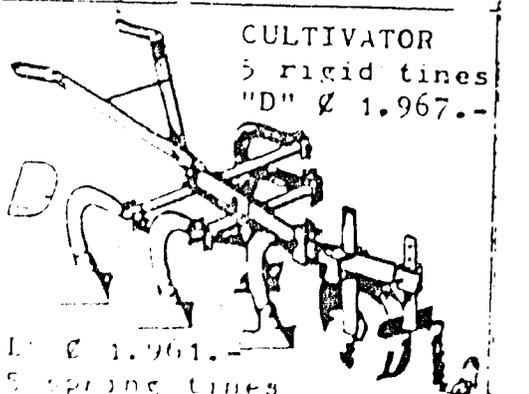
adaptable  
 RIDGERBODY "G"  
 adjustable  
 ₵ 902.-



adaptable  
 Ridgerbody "O"  
 unadjustable  
 ₵ 805.-



adaptable  
 PLOUGHBODY "F"  
 ₵ 880.-



CULTIVATOR  
 5 rigid tines  
 "D" ₵ 1.967.-  
 5 spring tines  
 ₵ 1.961.-

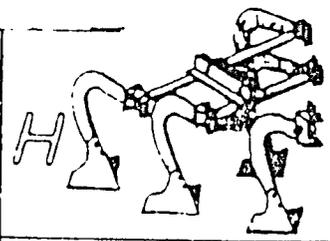
GHANAIAN GERMAN  
 AGRIC. DEV. PROJECT

MINISTRY OF  
 AGRICULTURE

PRICE LIST  
 No 5/83

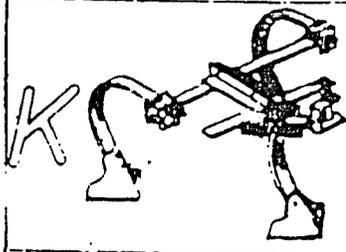
Figure 3.0 - A

This figure is included to show the product line of the Ghanaian-German Agricultural Development Project (GGADP) in Tamale. The prices shown in this figure have nearly doubled since the price list was prepared in 1982.

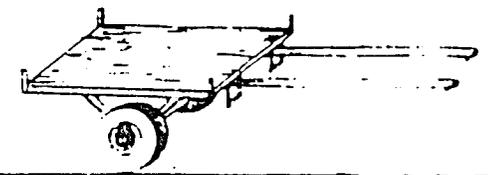


5 rigid  
 tines "H"  
 ₵ 968.-  
 5 spring  
 tines "J"  
 ₵ 963.-

adaptable CULTIVATOR



FARMCART ₵ 4.750.-



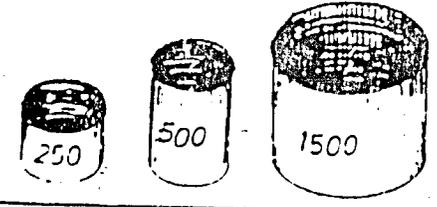
HANDCART ₵ 1.183.-

WATERTANK galva

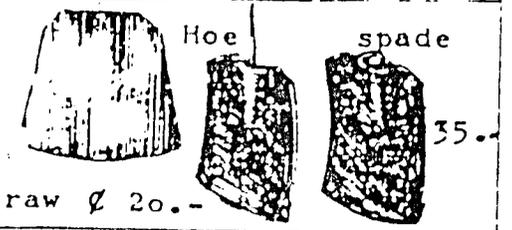
1500 l	₵ 2.699.-
1500 l +lid	3.374.-
500 l	1.793.-
500 l +lid	2.228.-

WATERTANK painted

500 l	₵ 1.221.-
500 l +lid	1.524.-
250 l	660.-
250 l +lid	963.-



HOE triangular  
 finished  
 ₵ 25.-  
 raw ₵ 15.-



Hoe spade  
 35.-  
 raw ₵ 20.-



HOEBLADE ROUND  
 ₵ 25.-

Another indicator of the demand for AT products are the sales figures of the Accra metal working company, Agricultural Engineers, Ltd. (AGRICO). From 1966 through 1982, AGRICO sold 10,510 units of AT products. The best selling products are bullock ridgers (for northern Ghana), corn mills, sugarcane crushers, disc plows, palm oil extraction plants, tipping trailers (tractor drawn), and disc harrows.

AGRICO's product line is not entirely comparable with the product line of the GGADP because the latter's products consist largely of small, light, and often semi-finished items. AGRICO's output consists of finished, heavier, and often machine-drawn or powered equipment.

The combined output of companies or organizations such as AGRICO, the GGADP, Goodman and Son (Tamale), the TCC and its client firms, MBS Metal Ltd., SOMACO, and others, meets only a fraction of the demand generated by Ghana's 700,000 farms. Production by the Ghanaian manufacturing organizations is tightly constrained by the chronic shortage of raw materials rather than by human resources, a shortage of prototypes, or management skills.

### 3.3 Raw Materials for AT Products and Materials That Can Be Processed by AT Methods

A second reason for Ghana's potential success in producing and utilizing appropriate technology is the availability of some raw materials from which AT products can be made, such as hardwoods, leather, and clays. There is a wide range of field and tree crops which lend themselves to processing by AT methods and equipment, such as cocoa, rice, maize, groundnuts, oil palm, coconut, sugarcane, cassava, shea nuts, and tobacco.

### 3.4 Metal Working Traditions and Mechanical Aptitudes

A third reason for the potential success of AT development is the tradition of metal working, especially in the northern regions. A survey conducted for the World Bank by Checchi and Company estimated that there

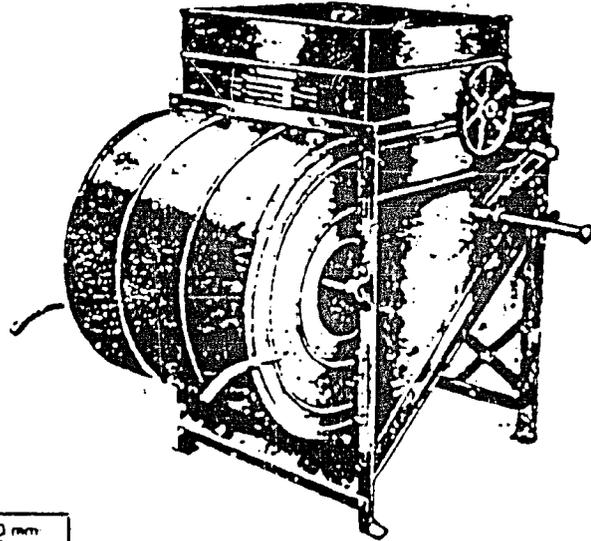
Figure 3.0-B

PAGE FROM AGRICULTURAL ENGINEERS LIMITED CATALOGUE

## KIRLOSKAR AGRICO

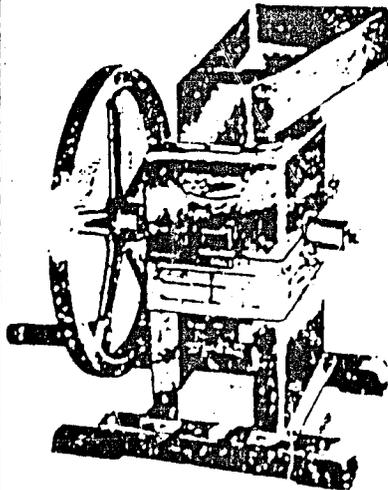
### GROUNDNUT DECORTICATOR WITH POWER ARRANGEMENT

On power operation, requires 3 hp engine or 2 hp electric motor. Processes about 800 kg of groundnut per hour.



Die of fan pulley	100 mm
Speed of the main shaft when worked on power	150 rpm
Die of driving pulley	490 mm
Die of fan driving pulley when worked on power	200 mm
Speed of main shaft when driven by hand	60 rpm
Speed of fan	300 rpm

### "COTTAGE" HAND OPERATED GROUNDNUT DECORTICATOR



Simplicity, strength, portability and easy operation are leading characteristics of the "COTTAGE" Hand Groundnut Decorticator. Any pan can be easily replaced. Four grates of different sizes are supplied with the machine.

It is advisable to sort the groundnuts according to the size, before feeding into the machine.

Other Details	Accessories
Output 35 kg of groundnut per hour at 100 rpm	4 Grates 9, 9.9, 9.90 & 10.75 mm 1 Spanner 9.5 x 8 mm 2 Foundation blocks, wooden

AGRICULTURAL ENGINEERS LIMITED

REG ROAD WEST INDUSTRIAL AREA

P. O. BOX No 3707, ACCRA, TEL No 28260/28292

were 959 metal working establishments in urban areas alone and more, chiefly blacksmiths, in rural areas (Small Industry Development in Ghana, Checchi and Company, 1976, Annex 7, Table 7.5).

There are unusual mechanical skills in Ghana, developed in part from the necessity to keep machinery and vehicles in operation long after what would be considered the useful life of machinery in the developed world. According to Mr. N. Minotra, Production Manager of AGRICO, there are diesel mechanics "everywhere" capable of repairing diesel engines that use the cheapest available fuel for trucks and prime movers.

### 3.5 Institutional Capability

A further reason for the potential of AT is institutional. There are institutions capable of developing AT products and processes such as the Technology Consultancy Center (TCC) in Kumasi, the Mechanical Engineering Faculty of the University of Science and Technology at Kumasi, the Division of Agricultural Engineering at the University of Ghana, at Legon, and the constituent institutes of the Council for Scientific and Industrial Research.

### 3.6 Ghanaian Attitude Toward Appropriate Technology

A final reason for the potential of AT can be found in Ghanaian attitudes and official policies. Ghana has become disenchanted with capital-intensive, high-cost, under-utilized, money-losing, and import-hungry industry; this has given rise to a generally prevalent conviction that AT is the best route to industrialization and improved agriculture.

A reflection of this belief is the inclusion of a key policy in the 1975-80 Five Year Development Plan to utilize AT to strengthen agriculture and to thereby help alleviate continuing food shortages.

Against the above background, the DAPIT Project has every reason to succeed. The report which follows analyzes what the DAPIT Project has done and how its continued operations can be reinforced with the remaining resources available.

#### 4.0 PROJECT DESIGN, STATUS OF IMPLEMENTATION, AND ACCOMPLISHMENTS

This section of the evaluation report is addressed to the following paragraph in the "Statement of Work":

"Review the basic project design and the status of implementation and accomplishments to date (i.e., physical, financial, participation, training, benefit incidence) against project objectives. Determine what further inputs (if any) are needed to achieve the objectives."

The original design of the Project took place during happier times in Ghana when economic and administrative conditions were more favorable than has been the case during the past three years. Much of the disappointing progress in implementation and achievement of DAPIT goals can be laid to the nationwide disruption that came about as a result of the economic and administrative changes Ghana has experienced due to worldwide recession, loss of export earnings, and successive changes in government. Despite these very difficult underlying conditions, it can be fairly stated that the design of the Project and its administration are at the root of many of the difficulties experienced to date. Prior to an examination of the design and administrative weaknesses, it is useful to review the design and achievements at this point in the light of the objectives the Project was expected to attain.

##### 4.1 Project Design

The Project design comprised two phases -- the first is a preparatory period during which all participating organizations were to be suitably equipped in terms of machines, buildings, transportation, training, and technical assistance; and the second -- not yet begun -- is a time for producing end-results. As part of the first phase requirements, a complete management system was to have been set up and functioning. With the value of hindsight, gained not from Ghana but from the accumulated experience of projects in other developing countries, it can be said that

the Project may have been substantially ahead of its present status if no commodities had been provided until it had been physically demonstrated that suitable interim or permanent quarters were available for their installation and operation. This requirement would have assured that the equipment would be ready and available for use in the shortest time. This is still not the case because more than half of the production equipment provided under the DAPIT Project, three years after the effective start of implementation, is not yet installed in a permanent site.

A further criticism of the Project design involves the absence even to this date of an effective management system. It is puzzling to this evaluation team how USAID accepted a project design that did not, as the first order of business, assure by means of a condition precedent that an acceptable management system was in operation before one dollar of donor funds were committed to PIO's. It appears that in its haste to initiate action, USAID cut some corners that it would not tolerate in its internal operations. Instead of speeding things up, this seems to be one of the root causes of unsatisfactory project performance.

Perhaps the most serious design flaw, in our estimation, is the sequence of phases for Project execution. It would seem that a more effective and economical arrangement would have been to have the first phase emphasize the establishment of a project management system and the determination of criteria for approval of the sub-projects submitted by potential participating organizations. Upon selection of sub-projects conforming to DAPIT objectives, the Project would have entered its second phase concerned with providing the participating organizations with what they needed to get the job done. At this point, it seems that the Project has been quite successful in providing four participating organizations with substantial amounts of equipment without any confidence that all of those organizations have more than intentions of contributing to the achievement of DAPIT objectives. There is reason to have serious reservations about the ability of some of the participating organizations to do more than half the job successfully.

#### 4.2 Status of Implementation

The status of implementation of the DAPIT Project is best addressed by reference to the implementation schedule envisioned for DAPIT in the Project Paper, reproduced herein as Annex C-1.

Table 4.2 on the following page presents an abbreviated and combined list of major events taken from the original project implementation schedule (see Annex C-1). These events, keyed to the original schedule numbers, represent milestones on the route to achieving completion of physical preparations and of getting on with the substantive work of the Project.

In broad terms, the present status of implementation can be characterized as nearing the completion of the physical preparation phase, although the distance to physical completion is different for each participating organization and involves substantial additional time in all cases. In terms of an estimated date of completion for physical facilities, we believe that an additional six months is not unreasonable. This places the time of physical preparation completion at about May 1984, providing that the recommendations of this report are adopted. If this estimate works out as anticipated, then this aspect of the Project will have been completed roughly three years behind the originally scheduled date.

We would attribute about half of the delay to faulty project design and an overly ambitious schedule that did not take into account the difficulties of getting things done in Ghana. For the rest, it would seem that the national administrative and economic dislocations of the recent past have played a significant role in aggravating the delays. Finally, a part of the delay seems to have been attributable to less than energetic project management, although without having conducted a management audit, which is outside the scope of this evaluation, we are unprepared to pinpoint the exact reasons for the apparent management lethargy. It suffices to say that USAID files of minutes of meetings and memoranda of meetings with Project participants indicate repeated instances of non-performance of tasks that an effective management organization would be

Table 4.2

## STATUS OF SELECTED IMPLEMENTATION EVENTS

Events (Event Nos. in Annex C-1)	Scheduled Completion		Present Status
	Original	Revised <sup>1/</sup>	
Project Office operational (6)	Nov. 1979		Partial <u>2/</u>
Project Committee operational (11, 14, 18)	Jun. 1980	Mar. 1980	Nonexistent
IDU operational (20)	Aug. 1980	Jan. 1982	Delayed <u>3/</u>
Submission, approval, and completion of demonstration projects (10, 12, 21)	Sep. 1980	Sep. 1983	Not begun
Establishment of Secretariat, completion of operations manual and guidelines for sub-project proposals, selection and funding of initial sub-projects (16, 22, 26 28)	Feb. 1981	Mar. 1983	Not begun
All capital equipment in-country (4, 7, 13, 25, 29)	Mar. 1981	Jan. 1982	Partial <u>4/</u>
ITTU/Tamale completed (9, 30)	Apr. 1981	Sep. 1982	Delayed <u>5/</u>

1/ Revised June 1, 1981; however, validity is questionable because of reference to two-year Project extension beginning October 1983 and end of Project in October 1985. As of date of this report, the official end of Project occurs in September 1984.

2/ Project Manager only; no staff, no policy direction, little support.

3/ Lacking information retrieval system and operating supplies.

4/ Several items missing and lacking essential accessories inadvertently omitted from original orders.

5/ Foundations completed and under-floor fill in progress.

expected to pursue. Chief among these are resolving difficulties with the construction of the ITTU/Tamale building and the time-consuming monitoring and clearance of the Project commodities through the import formalities.

To give the flat statements of present status in Table 4.2 better perspective, it is useful here to give a more detailed account of the status and accomplishments of the Project with respect to each of the participating organizations.

#### 4.2.1. Status and Accomplishments of Technology Consultancy Center (TCC)

TCC participates in the DAPIT Project by virtue of its project to create an Intermediate Technology Transfer Unit (ITTU) in the northern town of Tamale. Construction of ITTU/Tamale was to have been completed by April 1981. At present, the foundations and footings have been essentially completed. Additional concrete work needs to be completed before the prefabricated steel structure, walls, and interior partitions can be erected. The additional concrete work entails pouring the floor slab and building the surrounding drainage channels.

The pre-erection construction has been held up because of the difficulty in obtaining cement and reinforcing materials and because of the delays in the availability of advance payments to the contractor to buy the materials in a timely manner when they are found on the market. During our visit to the site, we were informed by the construction supervisor that the cement was on its way to Tamale. A conversation with the design engineer's representative brought verbal assurances that the use of reinforcing bar would be an acceptable alternative to the reinforcing mesh originally specified. The problem of timely availability of advance payments to the contractor has been solved, we were told, by streamlining the TCC procedure for approval of the release of funds.

We have the impression that the concrete can be completed in a matter of two to three months if the reinforcing material can be found on the local market. We suggested to all concerned that it would be

prudent to begin developing estimates for a contract to erect the prefab so that a contract could be negotiated and concluded by the time the concrete work is completed. Rigging equipment for erecting the prefab was ordered and shipped sometime around mid-year, but has not as yet been landed in-country. The material was shipped under a Pan Am Airway bill and off-loaded in Lagos instead of Accra. Word has been received that the materials have been transshipped to Accra and should have arrived by this time. Inquiries are being made to verify that the carrier transshipped the material and his documentation of delivery to the Accra airport cargo receiving authorities.

All originally ordered commodities intended for ITTU/Tamale have been received by TCC, but there are some essential parts and accessories missing, in most cases because it was not realized at the time of ordering that these were special order items not supplied as standard components of the machines. TCC has requisitioned the needed material and USAID has held up action pending completion of this project evaluation and a decision on the future of the Project. At present, the equipment is stored in the TCC warehouse in Kumasi pending completion of the ITTU. However, lack of reliable electric power supply in Tamale and the shortage of diesel fuel to run a requested but as yet unordered ITTU generator cast doubt on the advisability of moving the equipment to Tamale as soon as the building is completed. An alternative to the original plan is discussed later in this report (section 8.1).

Despite the disappointing progress of the physical facilities for Tamale, TCC is quite active and energetic in pursuing the DAPIT objectives using the resources at hand. Work is currently proceeding at the ITTU/Kumasi on the promotion of small private enterprise production of "minimum tillage" maize planters, beehives, sawdust stoves, small fish farming paraphernalia, and equipment for soap production. A full list of current and anticipated TCC projects within the DAPIT focus appears in Annex B-4.

At Tamale, the TCC maintains a resident technician, Mr. Frank Robertson, until July 30, 1983 provided under a USAID-financed host country contract. Pending a decision on the future of the DAPIT Project, TCC is providing Robertson with a modest living allowance.<sup>1/</sup> Robertson has shown remarkable enthusiasm and initiative in the face of difficulties that might have discouraged a less imaginative and dedicated person. The work in Tamale involves expediting the completion of the ITTU, organizing the local small industrial enterprises into a potential ITTU client base, scouting the rural area for which Tamale is the urban center for the need for appropriate technological improvements, and devising potential solutions to the energy and equipment problems anticipated when the ITTU construction is completed (see Section 8.1 of this report).

The organizing work appears to be proceeding well with the participation so far of about nine small workshop operators and the largest private mechanical workshop in Tamale. Following TCC policy, the Tamale group have been screened to include only those who show maximum self-reliance and can grow only with outside assistance, which will be provided on a reimbursable basis.

Progress is being made in an effort to have the local administration provide land adjacent to the ITTU site for a small workshop park of 24 units and to obtain local financing for the construction of the workshops. The Tamale branch of the National Council on Women and Development is another potential client of ITTU, having requested help in the nature of the development and manufacture of clay baking ovens for bread and other local food specialties. Another client is the local youth development center, which has requested help in the design and fabrication of recreational equipment.

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<sup>1/</sup> In a remarkable vote of confidence, the Ghanaian proprietor of Goodman and Son Metal Workshop in Tamale has been advancing the rent for Robertson's living quarters for the past several months.

Pursuant to the TCC policy of responding to requests from the marketplace for technical assistance and the development of improved technology, the fledgling ITTU/Tamale has gone a step further and observed the surrounding rural area for opportunities to improve on the traditional means of production and processing. This has led to an inventory of potential activities for ITTU/Tamale which, in many cases, are different from the activities of the ITTU/Kumasi. The combined prospective product line is thus richer than before and more suited to the needs and resources of the northern area. A list of the potential improved technologies that might come out of ITTU/Tamale is included in Annex B-4.

In anticipation of technical and operating problems that will face ITTU/Tamale, most importantly the lack of reliable power supply, TCC proposes to place the equipment provided for ITTU/Tamale into operation in an auxiliary location in Kumasi. The purpose would be to maximize the use of this equipment, which is the most modern and productive in the TCC inventory, by producing parts and components of devices, such as the maize planter, for final assembly and distribution in Tamale. As the power supply improves in Tamale, appropriate equipment -- not necessarily the originally intended machines -- would be moved to Tamale and placed into operation.

The ITTU/Tamale technician, Frank Robertson, has been investigating the use of a producer gas generator as an alternative to diesel oil as a source of fuel for an electric generator set for the workshop. Using the waste from a neighboring large government rice mill as a source, such a pyrolytic gas generator could provide all the fuel required for a steady source of electricity for a full working day rather than the highly variable average three hours per day electric supply presently frustrating all industrial production in Tamale.

We support both the alternative use of the Tamale equipment and, after investigation, the purchase of electric generating equipment capable of operating on an assured fuel supply, whether producer gas or diesel. We would be highly sceptical of any verbal assurances that diesel fuel

will be available until the general economic situation of Ghana has improved sufficiently to alleviate the general fuel shortage. Furthermore, it would seem to be most appropriate for a project purporting to further the application of appropriate technology to practice what it preached by taking the lead in introducing the proven producer gas technology to Ghana at the Tamale site where there is a ready supply of rice mill waste available close by for the taking.

#### 4.2.2 Status and Accomplishments of the Industrial Research Institute (IRI)

Alone among the participants in the DAPIT Project, IRI has permanently installed all of the project-furnished equipment and would be fully ready to operate were it not for the lack of essential accessories for some of the machines and the lack of a sheet metal bending machine missing from the original shipment.

The orders for the IRI equipment failed to specify accessories on the mistaken assumption that they were part of the standard complement furnished with the machine. Accordingly, such items as drill bits and tool bits for lathe, among other things, are needed to put certain of the machines in operable condition. In the case of the sheet metal bending machine, the shipping case identified as the container for the sheet metal machine proved to contain something other than the expected machine. The Project Manager informed us that the purchasing agency has been notified of the situation and he is awaiting information on a resolution of the problem. A requisition for the parts and accessories for other machines has been forwarded to USAID. Action on the requisition has been held up pending this evaluation and a decision on the future of the DAPIT Project.

The evaluation team was shown an impressive array of work performed on the development of appropriate technology equipment, and the IRI has furnished a list of developed technology and future projects which appears in Annex B-2. Perhaps the most difficult part of our work has been verifying the facts concerning the extent to which any of this development

work has actually found its way into the hands of end users. We suspect that the uncertainty surrounding the question of dissemination obscures a disappointing performance. This should not come as a surprise given that IRI is a research and development organization that has little or no experience and capability in the commercialization of its results.

A part of IRI's mandate concerns consulting and repair service to industry and, in this respect, IRI has contacts with commercial firms that have used its services. However, the GOG directive that the IRI should adopt a focus on the development of low level technology has thrust the IRI into an unaccustomed role without "marketing" support to get its products out to the rural areas.

In addition to its suspected inability to disseminate its results, the IRI suffers from two other disadvantages vis-a-vis the DAPIT Project, according to our brief investigation. These are also not surprising in the light of IRI's preoccupations. First, it appears that some of IRI's technology may be more complicated and elegant than it needs to be to get the job done. These devices may be an engineer's delight, but may be too costly and complicated for their actual production and use. We have in mind a foot-powered, 3-speed potter's wheel with a complicated mechanism for power transmission and speed changes all hitched to a wheel with a capability for handling rather small pieces of pottery. Another example is an electricity powered and manual newsprint recycling machine that mechanically digests newsprint and then allows for the fibers to be deposited alternately on a set of two screens to produce one sheet of approximately 8" x 11" paperboard each per batch. A third example is a small capacity groundnut sheller, electric motor operated, incorporating a forced-air winnowing compartment. Although this machine could be converted to handwheel operation thus reducing its cost considerably and making it appropriate for use where electricity is unavailable, it would be infeasible to incorporate the winnowing compartment. Since winnowing is a minor problem traditionally accomplished efficiently by manual means, the elimination of the winnowing compartment would further reduce the capital cost without sacrifice of efficiency.

The second disadvantage of IRI, which is shared with all R & D organizations, is the reluctance to release a device for commercialization when it is adequate rather than perfect. The practice of holding up the release of an adequate piece of technology in favor of further improvements often results in otherwise useful devices remaining under development for inordinately long times, sometimes for years. This may account for the reappearance, year after year, of the same devices on lists such as reproduced in Annex B-2. Before IRI can become an effective participant in the appropriate technology field, it needs to pay more attention to what is appropriate and to let go the product when it's good enough for its intended use, saving refinements and improvements for the succeeding model.

Finally, we want to call attention to a particularly laudable effort underway at IRI -- an example of DAPIT cross-fertilization occurring informally, but which should be taking place as a matter of Project design. According to PCV Mark Simmonds, working at IRI, the results of field experience by other PCV's with the maize planter adapted and produced under TCC auspices indicate that the device plants seeds every 9" rather than the intended 18" spacing. Taking the problem in hand, Simmonds is working on a timing device that will eliminate the dropping of every other seed. If successful, the results will be transmitted to TCC for possible modification of its production program.

#### 4.2.3 Status and Accomplishments of the Food Research Institute (FRI)

With regard to its activities under the DAPIT Project, the FRI seems to us to be farthest behind. This judgment, founded on scanty observation and brief discussion, is based on lack of physical progress and suspected organizational malaise and inertia with respect to DAPIT objectives.

In terms of physical progress, FRI has managed to temporarily install only three items of the very substantial complement of DAPIT-supplied equipment. The installed items are sheet metal forming and cutting machines temporarily located in a shed that is being remodeled to allow the

Installation of a DAPIT-supplied drill press. The balance of the equipment is in storage awaiting the completion of a new single-story workshop that was started about five years ago and has now reached the level of the window lintels. Completion of construction has been held up by the GOG practice of granting only annual construction budgets for partial completion. By the time FRI has the funds in hand, the cost of construction material has inflated to the extent that the funds are insufficient to accomplish more than minor additional work. Reinforcing bar, for example, cost about Ø1,000 per ton at the time construction began. It then went to Ø17,000 per ton, and now costs Ø45,000 per ton when it can be found on the market.

We questioned the practice of completing construction projects in piecemeal fashion and were told by our evaluation colleague from the Ministry of Finance and Economic Planning that the GOG had revised this practice and was now selecting individual projects for full completion according to GOG priorities. Because the FRI workshops were not included in the DAPIT Project, they have been assigned a relatively low priority. However, if it had been known by the budget authorities that at least a part of the workshops were DAPIT-related, it may have been possible to obtain sufficient GOG funding from counterpart funds to complete enough of the workshops to permit the installation and operation of the DAPIT Project equipment. The GOG, we were told, places high priority on its obligations under external assistance agreements. This method of financing requires that the FRI submit its workshop construction funding request to the DAPIT Project Manager for inclusion in his DAPIT budget request rather than as a part of its regular annual budget request through normal channels. The unfortunate aspect of this affair is that the DAPIT participants were unaware of this possibility, and that the Project Manager did not investigate the matter in the normal course of monitoring DAPIT progress.

The substantive work of the FRI has good potential for contributing importantly to the achievement of DAPIT objectives. It is this potential that made FRI an attractive candidate for DAPIT assistance in the first instance, and FRI has to some extent lived up to its potential; but not,

we think, as fully as it might. Among the appropriate technology projects undertaken by FRI, presented in Annex B-3, of particular interest are some items not being developed elsewhere. For example, FRI's cassava press is a unique device. Small-size food drying units of wood and plastic sheet depend on solar heat and convection airflow for their effectiveness. Food smoking and drying units using selected firewood fuel are interesting examples of equipment that offer good potential for reduction in size and use of alternative materials to the present metal construction to make them suitable for the individuals or small groups of river and ocean fishermen.

In general, the same observations made about IRI with respect to engineering complication and the need to release technology when it is adequate also applies to FRI. Additionally, even greater efforts will have to be made to augment the meager capabilities of FRI to disseminate its results than in the case of IRI. We deal with proposed solutions to these problems in Section 9.0, Conclusions and Recommendations.

#### 4.2.4 Status and Accomplishments of the Information Documentation Unit (IDU)

Although the IDU is anticipating the completion of a new library building on the CSIR campus, its present quarters present no substantial inconvenience relative to its performance under the DAPIT Project. All of the DAPIT-provided equipment is in hand, but none of it is permanently installed and ready for operation. The offset printing machine is reported to be missing one inking roller and one of the other rollers is reported to be defective due to bending. There were no reports of other machine problems, but the IDU lacks operating supplies, i.e., paper, ink, offset masters, and other essentials, without which the IDU is unable to produce the intended DAPIT newsletter and various other published materials to facilitate communications among DAPIT participants and provide printed materials documenting available appropriate technology. USAID has made an exception to usual practice by relaxing its policy of not financing consumable supplies in the case of IDU for a one-time inventory. These have arrived in-country, but are not yet cleared through import formalities.

IDU was provided with a \$50,000 account against which orders can be placed with foreign suppliers for appropriate technology reference and research materials. IDU complains of the necessity to conduct its external contacts through the intermediary of the Project Secretariat, arguing that the Project Secretariat is an administrative organization and cannot communicate effectively on technical matters outside its competence. It cites an instance of having ordered technical documents through the Project office and not receiving them after some delay. Upon investigation, the IDU found that the documents had arrived without identification indicating that they were intended for IDU and were about to be distributed to other organizations. This minor but unsettling incident leads IDU to plead for the right to conduct business with suppliers directly with information copies of orders and invoices for payment approved and sent to the Project Secretariat for action. As further justification for direct dealings with suppliers, IDU cites the need to build and maintain external relationships under its own identity so that when DAPIT ends, the IDU will be a known information organization in the appropriate technology field.

IDU was to have installed an information data base and retrieval system called SATIS\* with the assistance of a short-term technical advisor. The Director of IDU received three months of training in the United States during which he was introduced to SATIS, but his knowledge of the system is incomplete and he is unable to institute the system on the basis of his limited exposure. The short-term technician was eliminated as a consequence of the deobligation of funds for technical assistance following a USAID-GOG review of the DAPIT Project needs and alternative sources of technical assistance. The technical assistance component of the Project was supposed to be satisfied by the use of host country contracts with two resident expatriates and the participation of Peace Corps Volunteers, but the specialized skill needed for the installation of the SATIS system

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\* Socially Appropriate Technical Information System.

is as yet unavailable from these sources. A member of the Peace Corps/Ghana staff doubts that the required skills would be available from the Peace Corps, and it is considered highly unlikely that a SATIS practitioner can be found among resident Ghanaian and expatriate professionals.

IDU accumulated a modest library of literature and documentation on appropriate technology, but the use of these materials and other services of the IDU, limited as they are by the present status of implementation, is practically nil among DAPIT participants. In the case of TCC, whose activities began several years prior to DAPIT, external relationships and sources of information were well established long ago and substantially augmented by the UST library and faculty at Kumasi. Nevertheless, Frank Robertson, the ITTU/Tamale technician, had referred to the IDU collection prior to moving to Tamale and found some useful material. The use of IDU by IRI and FRI is reported to be negligible. Communications among participants in DAPIT are infrequent, ad hoc, and generally concerned with administrative matters. The information function of IDU is totally unfulfilled, but it is anticipated that the availability of supplies now awaiting import clearance will enable IDU to begin to correct this unsatisfactory condition.

#### 4.2.5 Status and Accomplishments of the Ministry of Industry, Science and Technology (MIST)

As the sponsoring GOG agency for the DAPIT Project, MIST has the responsibility for providing the management and administrative apparatus for the Project. It was envisioned that the Project would be served by a high level policy body to give direction to a Project Office presided over by a Project Manager and supported by an administrative Secretariat. The only one of these requirements to have been implemented is the Project Secretariat, a one-man organization in the person of the Project Manager. The only overall direction, inter and intra-ministerial support given to the Project Office is provided by the Director in charge of science and technology. A Secretariat exists in name only. Act 434, creating a National Small-Scale Industries Board, whose responsibilities included the DAPIT policy function, was passed in June 23, 1981, but it remains to this date

unimplemented. Other than the foregoing, the Project files show minutes of ad hoc meetings under the titles of Joint Consultative Meeting, Interim Management Committee, and DAPIT Project Committee - the last of which is recorded in the files as having occurred in August 1987 - attended by representatives of USAID, MIST, TCC, IRI, FRI, and IDU for the purpose of progress reporting and resolving implementation problems. Despite the understandable preoccupation with the commodities, technical assistance, and training aspects of the Project, we find it strange that there is a complete absence of any reference to the status and progress on the development and dissemination of appropriate technology. One might imagine that these infrequent meetings among participating agencies in DAPIT would have provided at least passing mention of what was going on and what was anticipated in accomplishing the objectives of the Project rather than merely dwelling on the acquisition of means to achieve DAPIT goals.

The Project Secretariat was originally to have received technical assistance in the form of a 36-month assignment of an advisor to assist in drafting an operations manual for the Secretariat and guidelines for sub-project proposals. In addition, the Project provided for 50 man-months of short-term advisors for technical assignments with the participants and to assist with other special problems that might arise during the life of the Project. Discussions between USAID and the GOG Acting Project Manager, Dr. Bartels (the Technical Director of the Science and Technology Department of MIST and the office of MIST responsible for DAPIT) resulted in agreement that the work envisioned for the advisor to the Secretariat could be performed by Ghanaian personnel. We are uncertain if this judgment applied as well to all other outstanding technical assistance positions, but it is clear that USAID considered that the provision of two resident expatriates by host country contracts to assist TCC and the participation of PCV's would meet the needs of the Project at that time, and that the greatly accelerating cost of additional technical assistance personnel from the United States would be a poor use of project funds. The result of the discussion was an amendment to the P10/T in September 1982, de-earmarking \$941,000 which eliminated all outstanding USAID-funded technical assistance positions.

The accomplishments of MIST through the vehicle of its DAPIT management and administrative arrangement are not adequate. The policy and staff obligations have gone unsatisfied, and the Project has been delayed by a lack of management. There has been little regular monitoring of Project activities, formal periodic reporting on progress, steps to resolve difficulties, and delinquent and timely attention to the solution of problems and delays that have beset the Project since its inception.

Although a detailed operations audit would undoubtedly uncover extenuating circumstances, it is equally without doubt that more attention to the substance of the Project would have seen it in a more advanced state of accomplishment than is presently the case.

We think more attention should be devoted to:

- Preparing guidelines for sub-project submission by the institutes and TCC.
- Encouraging the institutes and TCC to come forward with sub-projects.
- Expediting customs clearances and making certain that the commodities reach the correct consignee.

We think that much of the management difficulty stems from the lack of policy-level support and interest in the Ministry where the Project Secretariat is located.

#### 4.2.6 Status and Accomplishments of the Peace Corps

Six PCV's have served under the DAPIT Project thus far. Two-person teams were assigned to TCC, IRI, and FRI, respectively. The TCC team is actively employed in the development of the ITTU/Kumasi foundry and extension work in beekeeping and the recycling of beeswax for industrial import substitution. One of the IRI PCV's proved to be more inclined to rural extension work and has been reassigned. The other IRI PCV is engaged in the development of a small foundry for IRI and the modification of the maize planter introduced by ITTU/Kumasi. The PCV team assigned to

FRI found their work at the institute unrewarding and requested transfer. They have been reassigned to rural extension work with a religious mission at Yendi and are engaged in demonstrating and teaching beekeeping, soup making, and minimum tillage farming techniques with the technical backup from TCC.

The evaluation team had the opportunity to visit with the PCV's at ITTU/Kumasi and IRI. The ITTU/Kumasi team radiate enthusiasm after 17 months on the job, and this enthusiasm is reciprocated by TCC management. The PCV at IRI is interested in what he is doing, but we have the impression that he would wish for a more energetic and businesslike milieu in which to do it. IRI management seem d pleased with his services. All indications are that the PCV's are productive and contributing to the accomplishment of DAPIT objectives in direct proportion with the material support, direction, and encouragement provided by their sponsors.

#### 4.2.7 Status and Accomplishments of USAID/Ghana

The DAPIT Project has had four directly responsible USAID Project Managers since its inception, all of them concerned with food and agricultural affairs. Thus, the Project seems to have been out of the mainstream of activity and expertise of its USAID managers. The present status of implementation shows the signs of a history of an apparent lack of knowhow and management paralleling the GOG performance.

Even more serious has been the switch in attitude concerning technical assistance and the deleterious effect of a "freeze" in U.S. implementation of its obligations under the Project agreement. Due to increasingly strained bilateral relations between the U.S. Government and the GOG, the U.S. Embassy decided on April 1, 1983 to suspend all new development assistance to the GOG. This suspension, which includes technical assistance, participant training, and commodity procurement, remains in effect as of this writing. This has contributed substantially to the generally poor record of accomplishment. Aside from the denial of financial resources, the existence of the freeze casts a pall over the stability

and seriousness of intent of the assistance program that negatively affects the performance of most of the participants. It has been stated that USAID programs are aimed at the people of the country in an effort to raise living standards and create a better world, regardless of the nature of the political leadership at any particular time. This has resulted in U.S. assistance being given under circumstances where the objectives of the two U.S. agencies are in conflict.

USAID has financed approximately \$1,076,000<sup>1/</sup> of commodities, including \$667,000 of equipment and supplies, \$178,700 of prefabricated building and rigging gear, and \$230,300 of vehicles and spare parts. Although a modest additional amount will be needed for parts and accessories inadvertently omitted from the original requisitions to place some of the delivered machines in operable condition, the equipment of participating organizations has been essentially completed. The only outstanding major commodity requests from participants involve electric generating equipment for ITTU/Tamale (see Section 4.2.1) and wet and dry line food processing equipment for FRI. A discussion of these outstanding requests appears in Section 8 of this report.

Technical assistance has been provided in the form of two host-country contracts with resident expatriate Americans for 24 months each. Of the \$143,488 obligated for these advisors, \$83,414 has been disbursed, leaving an earmarked balance of \$60,074. One advisor, Frank Robertson, has completed a two-year contract and is being retained by TCC on a local currency living allowance pending decision on the future of the DAPIT Project and relaxation of the freeze on implementation of the U.S. assistance program in Ghana. The other advisor, also working with TCC, Medicus Washington, has served 14 months of his two-year contract. Technical assistance is also provided by PCV's, as discussed in the preceding section (4.2.6).

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<sup>1/</sup> Approximate rounded estimate derived from PIO/C's. USAID accounting records now being maintained in Abidjan, and no copies available in Accra.

Participant training was included in the original PGA in the amount of \$50,000, with an additional \$157,000 of projected availability over the life of the Project. Our briefing materials do not include the PIO/P's, but we are informed that there have been two short-term training courses implemented -- one for the Director of IDU, and the other for an officer of FRI. The balance of the budgeted training has been suspended for more than a year, ostensibly because, according to the then USAID Director, short-term training courses disrupt the work of the project and participants on long-term training are unwilling to return to Ghana on completion of their training. He suggested that long-term training should be arranged in nearby countries, such as Nigeria. Nothing more has occurred in the area of participant training, presumably because of the freeze.

## 5.0 FLAWS IN ORIGINAL PROJECT DESIGN AND REMEDIAL ACTION

### 5.1 Statement of Work

This section of the evaluation report is directed toward paragraph 2 of the Statement of Work, reading as follows:

"Identify any management, structural, or organizational constraints to implementation arising from flaws in the original design of the project and suggest corrective measures. Particular attention should be paid to studying the interrelationships between individual institutions in the project."

For purposes of this discussion, the authors consider the Project Grant Agreement (PGA No. 641-0084-79-7) and its Annex I as containing the basic Project design. This Project Grant Agreement became effective August 31, 1979.

The Project's Phase One provided for the import of capital goods to be installed in three constituent institutes of the CSIR and the TCC in Kumasi. In general, this was a useful step because it provided Ghana with a foundation for future training, research, testing, and the production of AT equipment. However, some oversights in the Project design made the foundation less useful than would otherwise be the case. These oversights are discussed below.

### 5.2 Insufficient Emphasis on Production and Delivery

In several parts of the Project Grant Agreement, the purpose of the DAPIT is described as being to "identify, develop, test, produce, demonstrate, and deliver appropriate technology" (emphasis supplied by authors).

The evaluation team believes that more attention in the Project design should have been placed on production and delivery. This is because there are (and were even in 1979) an abundance of appropriate technologies with proven acceptability. More of these are listed in Annexes B-1 through B-4.

Section 3.0 earlier in this report describes AT products and processes developed by AGRICO and the GGADP. AGRICO has sold over 10,000 pieces of equipment, such as corn mills, ridgers, harrows, palm oil extraction plants, tipping trailers, sugarcane crushers; the GGADP has sold over 60,000 triangular, rectangular, and round hoes. The TCC client companies have sold about 1,000 beehives, and hundreds of palm oil presses and soap kettles. Despite such sales volumes, these organizations and other producers of AT products have met only a fraction of Ghana's rural demand.

The authors believe that the designers of the Project over-estimated the capability of the constituent institutes (except TCC) to organize the production and delivery of AT products.

A related flaw in the design was the omission of any reference to allocations of foreign exchange for the import of raw materials to be used for the manufacture of AT products. The designers could have established a condition precedent that would have created links between (a) the institutes, (b) foreign exchange allocations for raw materials, and (c) local manufacturers who would produce and deliver the products to rural customers. (During the late 1960's and early 1970's, Dr. R.K.A. Gardiner, then of the Ministry of Economic Planning, encouraged AGRICO to apply for import licenses, some of which were approved, thereby allowing the company to remain in business for 17 years, 1966 to date).

A remedy to the problems of producing and delivering could be found in approving sub-projects requested by the institutes only if (a) the sub-projects would result in substantial local manufacture by commercial firms, and (b) diverting some of the residual project funds to the import of raw materials required by clients of the institutes for making AT products.

### 5.3 Misjudging the Capability of the Institutes

Two of the institutes participating in the DAPIT Project have historically been engaged in research (please see Section 6.0 of this report). The success of the professional employees has traditionally been measured

in terms of research findings and publications. With the advent of the DAPIT Project, the institutes found themselves facing a new role suddenly thrust upon them, namely, an operating role involving production and dissemination of AT products as well as dissemination of their research results.

The evaluation team believes the institutes can adjust to this role as the TCC has done in Kumasi. By assigning certain staff members to the task of developing client companies, the capability to produce and deliver can be enhanced. This assumes that raw materials would be imported.

#### 5.4 Commodities Ordered Without Prior Understanding as to Utilization

The conditions precedent in the Project Grant Agreement are quite clear regarding assurances from the GOG that the ITTU in Tamale would be built to suitable specifications. However, in view of the fact that the ITTU building construction has only just started after a delay of four years (1979-83), the conditions precedent might have included a provision to the effect that the construction should have reached the lintel level or even the plinth level before the commodities were ordered for the ITTU in Tamale. These commodities, largely machine tools and related equipment, are now stored in a building on the campus of the University of Science and Technology in Kumasi.

In regard to all machine tools and other equipment ordered for FRI, IRI, and TCC, orders were placed before a specific utilization plan was agreed upon. It would have been more prudent to identify what products were to be made and what and how many people were to be trained before ordering the equipment.

The Project designers apparently assumed that raw materials would be available for processing in the machines. This optimistic assumption was not warranted in the light of Ghana's history of foreign exchange deficits.

The remedy to this problem may lie in urging the GOG to plan sub-projects that will best assure utilization of the machinery and in seeking allocations of foreign exchange for imports either from the GOG or from AID.

#### 5.5 Little Provision Made for Assuring Inter-Institute Coordination

The Project designers may have assumed that the Project Office (Secretariat) would assure regular liaison between the institutes and TCC. However, the design of the Project would have been stronger if a reporting system had been defined.

Possibly the remedy may lie in assigning a new function to the IDU, namely that of collecting reports on the activities of the FRI, IRI, and TCC, and preparing a newsletter for the information of the Secretariat and USAID.

#### 5.6 Insufficient Emphasis on the Use of Local Raw Materials

Most of the machine tools and equipment indicates that the selection was made with the objective of equipping the institutes to work with metals. Metals are indeed important in appropriate technology, but the Project design could have given greater importance to machinery for processing clay, leather, and wood as materials for producing AT equipment.

## 6.0 RELEVANCE OF PROJECT GOALS AND OBJECTIVES

This section of the report is addressed to the following paragraph in the "Statement of Work":

"Review the goals and objectives of the DAPIT Project, determine their relevance to existing intermediate technology development and dissemination system in Ghana (i.e., MIST, CSIR, Universities, Technological Institutes, private industry) and suggest how DAPIT can best contribute to these entities and vice versa."

### 6.1 Objectives of DAPIT

The main objectives of the DAPIT Project are:

- (a) to increase agricultural production on small-scale farms;
- (b) to provide local craftsmen and small enterprises with a means to produce and sell appropriate technology.

These objectives are mainly to be implemented in the rural areas and are aimed at raising the income levels and welfare of small farmers, and craftsmen in particular, and the standard of living of the rural population in general.

The DAPIT Project intends to achieve these goals by establishing a 'national mechanism' to identify, develop, test, produce, demonstrate, and deliver to the rural sector appropriate technology which will contribute to increasing production and incomes.

These goals and objectives are not new in Ghana. Neither is the development of appropriate technology, as a means of raising the production and incomes of the rural population, unknown. In fact, it is because of the recognition of these that the DAPIT Project was conceived and implemented to hasten the process.

## 6.2 Development of Appropriate Technology in Ghana

Various governments and regimes in Ghana have recognized the need to raise the standard of living of the rural population as a means of achieving economic development. In the early days of independence, the strategy was to establish large plantations using sophisticated farm machinery, equipment, and large-scale, capital-intensive industries were set up to process the agricultural produce in large volumes. In other words, the strategy was to raise the standard of living of the rural population by industrializing the rural areas. This led to the establishment of state farms and processing industries in the rural areas.

The strategy did not work out. Among the reasons for its failure is the fact that most of the machinery utilized for the implementation was of a sophisticated type whose maintenance depended on highly skilled technical personnel as well as the steady availability of raw materials and spare parts, both of which the country could not afford.

Over a decade ago, the concept of raising the standard of living of the rural population took a drastic turn. It was realized that it is more convenient, economic, and efficient to utilize what was then referred to as "intermediate technology" to raise the levels of incomes of the rural populace.

Steps were taken to institutionalize the development and testing and transfer of appropriate technology. The beginning was made with the establishment of the Technology Consultancy Centre (TCC) at the University of Science and Technology (UST) in 1972. Then, the mandate of the Research Institute under the Council for Scientific and Industrial Research (CSIR) was altered in 1975 to emphasize appropriate technology. The main research institutes affected were the Industrial Research Institute (IRI) and the Food Research Institute (FRI).

Other organizations which were involved, on the periphery, in appropriate technology activities were:

1. Ghana Enterprise Development Commission (GEDC).
2. National Council on Women and Development (NCWD).
3. Catholic Relief Services.
4. Agricultural Engineering Department of the University of Ghana, Legon, and the University of Science and Technology, Kumasi.

All the above organizations were in one way or the other involved in some aspect of appropriate technology. However, in the forefront were TCC, IRI, and to some extent, FRI.

It may be appropriate here to mention that it was during this same period that the international aid organizations became interested in rural development, and therefore many donor agencies, such as the U.S. Agency for International Development, CIDA of Canada, the German Technical Assistance Agency, and the World Bank began to support programs using appropriate technology to raise rural incomes.

In response to these efforts, some private companies began to set up manufacturing companies solely to fabricate appropriate technology products (AGRICO, ENDECO, Fafia Engineering, Goodman & Son, MBS Metal, SOMACO).

From the above background of appropriate technology, it is evident that the goals and objectives of DAPIT are relevant to the main development strategy of the country.

### 6.3 Relevance of DAPIT to the Present Development and Dissemination of Appropriate Technology in Ghana

In Section 4.0 above, many of the organizations involved in the development and dissemination of appropriate technology have been mentioned. Many of these have some relevance to the goals and objectives of DAPIT in varying degrees, with respect to the development and dissemination of appropriate technology in Ghana. However, the main ones are:

### 6.3.1 Technology Consultancy Centre (TCC)

The TCC is one organization that can be totally identified with the DAPIT Project objectives. This is because it has set out to do, to a large extent, what DAPIT was set up to do. Among its functions are the "development and transfer of intermediate technology." This, it has achieved through the establishment of another ITTU in Tamale which is now under construction. As far as dissemination of appropriate technology products is concerned, TCC uses private entrepreneurs.

### 6.3.2 CSIR

- Industrial Research Institute (IRI)

The IRI was set up originally to concentrate on solving problems in high technology industry. In 1975, its mandate was changed to enable it to serve the small-scale enterprises. This, it has been doing, and as far as the development of AT prototypes are concerned, has developed an appreciable number of useful implements. However, because few internal changes were made when the mandate was given, AT activity was implemented only to the extent that IRI capabilities will allow.

The evaluation Team realizes that criteria for career advancement in the CSIR, which emphasized research and publishing, tend to restrict the AT activities. This is probably also the reason why dissemination of AT products has not taken place on any significant scale at IRI. The evaluation team also observed that even though IRI has developed many AT products, it produces only on order. The fact that few serious attempts are being made to disseminate AT products developed by the Institute, coupled with the fact that IRI responds only to orders from the public, may tend to minimize the overall impact of AT within the framework of DAPIT objectives.

- Universities

The Faculty of Engineering of the University of Science and Technology and the Agricultural Engineering Departments of the University of Ghana, Legon, as well as the various science and other departments of the universities are either involved directly in AT development or fabrication or assist in its development. The team actually saw a grain silo developed and fabricated by the Agricultural Engineering Department of the University of Science and Technology, which was on display at a carpenter's shop in Kumasi. This silo was a prototype which has been shown to carpenters to replicate.

Nevertheless, the most important role played by the universities and the other research institutes of the universities is to provide scientific information which goes into the development of appropriate technology. An example of this was the support the Chemistry Department of the UST gave TCC in the development of soap-making equipment.

- Private Industry

There are a few private industries that on their own initiative are developing and fabricating AT products. Some of these are big and use modern methods of fabrication. The team had the opportunity to visit one such company, namely Agricultural Engineers, Ltd. (AGRICO) in Accra. The company specializes in the production of agriculturally oriented AT products. The company also takes on contracts from banks and other institutions. At the time of our visit, oil-making equipment was being manufactured for the National Investment Bank. The other, comparatively big organization that specializes in the development and fabrication of agricultural implements is the Ghana-German Agricultural Development Project in Tamale. What is impressive about the above two organizations is that the quality of goods they produce is high and that they

- Food Research Institute (FRI)

All the observations made on IRI are also applicable to FF, except that in FRI's case, the concept of AT as a means of achieving the goals and objectives of DAPIT is even more minimized. The evaluation team observed that there was some confusion in the perception of FRI as to what are the goals and objectives of DAPIT. This confusion has arisen because of the change of directorship of the Institute. The former Director, who was also in charge of the DAPIT Project at FRI, did not set up an institutional mechanism for implementing the goals and objectives of DAPIT. Apart from this observation, the level of AT products developed by FRI tend to apply more to the "medium-scale" entrepreneur than the small-scale.

- Ministry of Industries, Science and Technology (MIST)

The MIST, which is hosting the DAPIT Project Office, is also supposed to be the initiator of policy as far as AT is concerned. It has tried to perform this role to some extent. Act 434, passed by Parliament on June 23, 1981, was supposed to give legal backing to small-scale industries and, among other things, encourage the development of appropriate technology. To this end, a National Board of Small-Scale Industries (NBSSI) was to be set up. This Board would have established the institutional framework within which DAPIT can achieve its goals and objectives more effectively.

However, to date, the Small-Scale Industry Board has not been set up. The evaluation team observed that apart from the Project Manager of DAPIT being physically located at MIST, very little is being done by MIST to give logistic, personnel, or policy support to the Manager in order to achieve DAPIT's objectives.

disseminate the AT products very efficiently since what they produce is in great demand (see Section 3.0 earlier in this report). In effect, therefore, their system of development and dissemination is in accordance with the goals and objectives of DAPIT.

Apart from these two big organizations, there are a host of smaller often "one-man" managed enterprises which specialize most often in the fabrication of AT products. The products range from corn mills, cassava graters, gari-making machines, to the manufacture of bolts and nuts. Most of these companies the evaluation team visited were in the urban areas. However, the rural areas benefit directly from their activities since most of their products are utilized by the rural population.

#### 6.4 Recommendations to Improve Relevance of DAPIT to Present Appropriate Technology Development and Dissemination in Ghana

The following recommendations are intended to help improve the effectiveness of DAPIT in developing and disseminating appropriate technology in Ghana:

- The implementation of the Second Phase of the DAPIT Project must be preceded by the development of criteria for selection of projects for funding, which should include a well defined method of development, fabrication, and dissemination of the AT product. This should help solve the present dissemination problems.
- A Management Committee, composed of all participating agencies, should be set up to manage DAPIT and ensure that the goals and objectives of the participating agencies are always kept in sight.
- Materials and equipment procured for the second phase of the DAPIT Project must be closely monitored by the proposed Sub-project Selection Committee and the Management Committee to ensure that they are used for the purposes for which they are allocated.

These and other recommendations are included in Section 9.0, "Conclusions and Recommendations," of this report.

## 7.0 CONSISTENCY OF THE GOALS OF PARTICIPATING AGENCIES WITH THE DAPIT PROJECT

This section of the report is addressed to the following paragraph  
in the Statement of Work:

"Examine the participating institutions (FRI, IRI, TCC, IDU) to see if goals, objectives, and mandates are consistent with those of the DAPIT project. Attention should be given to understanding what each institution was originally set up to do and what extent the DAPIT Project has assisted them to match their equipment and manpower needs to accomplish their own as well as DAPIT's objectives."

The goals and objectives of the participating agencies are summarized  
below:

### 7.1 Food Research Institute (FRI)

The FRI is one of the eleven (11) constituent institutes of the CSIR. The FRI assists in the development of food processing industry in Ghana, by carrying out research into processing, preservation, storage, transportation, and distribution of the main vegetable and animal foods of the country with a view to producing new foods and improving upon traditional ones.

The activities of the Institute may be grouped under four main divisions: Food Economics and Marketing; Food Consumption Surveys and Planning; Food Chemistry and Food Processing; and Engineering.

Recent activities of the Institute include the development of enriched cereal products, enrichment of unfermented maize products, design and construction of drying units for peppers and cassava, including solar drying, the development and fabrication of fish smoking equipment, and cassava grating and pressing machines.

Under the DAPIT Project, the FRI was to be assisted in the development of food processing techniques by carrying out research in processing, preservation, storage, transportation, and distribution of major food crops.

It is evident from the above that the DAPIT Project is imposing no more functions on the FRI than it was originally established to perform. However, since its creation, the FRI has neither been required nor capable of developing technologies for the transportation and distribution of food crops.

In the area of equipment, DAPIT has provided FRI with sheet rollers, cutters, and pressing machines. However, one cannot assess, at present, the impact this equipment has had on the operations of the Institute since none of the machines is yet installed. According to the Acting Director of FRI and the Head of the Engineering Division, these machines were to be installed at the Pilot Plant Workshop which is still under construction.

Although one participant was scheduled for overseas training, this activity has not yet begun. The participant training program under the Project has been complicated by the present "freeze" the United States Government has imposed on all USAID projects in Ghana.

## 7.2 Industrial Research Institute (IRI)

The IRI is one of the units under the CSIR. From its inception, its activities emphasized high technology and academic research. However, in 1978, its mandate was changed to enable it to concentrate its efforts on identifying and servicing the needs of small industry. The focus of this activity was to be on appropriate technology which utilizes indigenous materials as far as possible.

The scope of IRI's work includes:

- (a) industrial design and prototype manufacturing of equipment;
- (b) organization of technical management clinics for problem-solving in small-scale industries; research and development and other services to aid the growth of small-scale industries.

The Institute has six divisions, namely: (1) industrial chemistry; (2) materials; (3) mechanical workshops; (4) electrical and electronics; (5) technoeconomics; and (6) information and dissemination. The activities of IRI include research on the extraction of essential oils from oil seeds; design of simple electrical equipment such as battery chargers, development of refractory brick using local clay and the fabrication of simple incubators.

Under the DAPIT Project, the IRI was to be provided with commodity and training support to expand its activities.

The DAPIT Project has provided the IRI with capital equipment adequate to enable the Institute to implement the goals and objectives of DAPIT. However, most of this equipment lacks accessories and therefore has not been put to any use. Even then, one can say that IRI is presently fully equipped to be able to develop and fabricate AT products.

### 7.3 Information and Documentation Unit (IDU)

The IDU is a new creation of the DAPIT Project within the Scientific and Technical Information Center of the CSIR. The purpose of the Center is to coordinate the activities of member institute libraries. The Center is made up of a library and the Information Documentation Unit.

Recent activities of the IDU indicate an awareness of publications relevant to the Unit's role in the dissemination of research and technical information on appropriate technology.

Under the DAPIT Project, the Information Center was to expand its activities to include a specialized Intermediate Technology Information and Documentation Unit (IDU) which will disseminate information on appropriate and low-cost technologies to all interested parties. The Unit was to acquire, process, assess, and disseminate information from outside and within Ghana. The IDU was also required to operate a reference center providing ready access to data on inter alia, food processing and preservation, on-farm water storage, and non-conventional energy and fuel development.

DAPIT has so far supplied the IDU with a composing offset machine which needs some accessories and sufficient materials to function within the framework of DAPIT objectives.

DAPIT has also trained a librarian to manage the Documentation Center. What is still needed, according to the librarian, is technical assistance to set up the information retrieval system based on the SATIS concept.

#### 7.4 Technology Consultancy Center (TCC)

The Technology Consultancy Center (TCC) of the University of Science and Technology (UST) in Kumasi was established as a focal point for the stimulation of small-scale industry development in Ghana. This center operates as a semi-autonomous unit of the University, but along the lines of a research institute.

The functions of the Center include:

- Consultancy services of a conventional type for Government departments, public corporations, and industry.
- The stimulation of small-scale industry development through free or low-cost consultancy services and establishment of production units on and off the campus, the provision of manufacturing equipment, collaboration with the faculties to encourage research and development of technologies of a practical nature aimed at solving problems of immediate importance to local industry.

The largest part of the Center's work focuses on the promotion of small industries. Consultancy services are provided to entrepreneurs, craftsmen, cooperatives, village development committees, churches, and other institutions both public and private through the Intermediate Technology Transfer Unit (ITTU) located in the Suame Magazine industrial park in Kumasi. Pilot production units were established on the campus and off campus. The units established outside the campus were to be managed by entrepreneurs or cooperatives. In their absence, the TCC has run them until such time as a company or a cooperative can take over.

The Center has become an agency for the stimulation of grassroots development by means of appropriate technology. It seeks to upgrade the existing craft industries, such as pottery, woodworking, textiles, by the introduction of new products or improved techniques. It also endeavors to create small-scale industries manufacturing products developed in the faculties of the university and utilizing as far as possible locally-produced raw materials.

Under the DAPIT Project, the TCC has been provided with equipment, technical assistance, and construction inputs to enable it to further expand and more effectively promote the generation of small industries based on the products developed at the university and utilizing, wherever possible, locally-produced raw materials.

The DAPIT Project has also provided the TCC with equipment to strengthen the ITTU capability at Tamale. The Tamale project is now under construction, but the evaluation team agrees with the TCC that power may pose problems for the full utilization of the DAPIT machinery since the supply of electricity and petroleum is not assured in Tamale. Section 4.2.1 earlier in this report describes a biogas-fueled generator for Tamale that should offer a feasible power supply.

The ITTU, both in Kumasi and Tamale, are equipped with the requisite technical personnel to enable them to implement the DAPIT program successfully. TCC management supported by two DAPIT experts (Frank Robertson and Medicus Washington) and the four Peace Corps Volunteers appear to the evaluation team to be capable of assuring progress of the DAPIT Project.

The evaluation team observed that the TCC normally reacts to problems brought to them by the general public. This therefore does not pose any problems of dissemination of technologies since by this means the individuals do the dissemination. However, this practice of reacting to problems may preclude a number of relevant but not so popular appropriate technologies from being developed.

It could be more effective for the TCC to make surveys and some needs assessment of the rural population and thereby determine what type of AT should be developed. However, the evaluation team acknowledges the fact that the Project Manager of the ITTU at Tamale (Frank Robertson) intends to assess needs as the basis for determining technologies and products to be developed.

## 7.5 Conclusions and Recommendations on Consistency of Goals of Participating Agencies with that of DAPIT

### 7.5.i Conclusions

- It appears that there is no major divergency of goals between DAPIT Project and the goals of the participating agencies.
- The drawbacks experienced so far have been due more to management problems.
- Two of the participating agencies, FRI and IRI, do not have the institutional framework to disseminate technologies under the DAPIT program. That is, the FRI and IRI are not experienced in working with manufacturing organizations to expand production of AT products and parts. The TCC, on the other hand, is continuously subcontracting with client companies to produce AT products and parts. This practice requires that the TCC extend technical assistance to the producers and that the TCC monitor the performance of the producers to make sure that the components or products meet expected specifications.

### 7.5.2 Recommendations

- (a) To meet DAPIT goals more effectively, there should be a mechanism for monitoring the activities of the participating agencies (FRI, IRI, IDU, and TCC). This can be achieved through the proposed Management Committee and the Sub-project Evaluation Committee discussed in Section 9.0, "Conclusions and Recommendations."
- (b) There should be a designated contact man within the participating agencies who would have responsibility for coordinating all DAPIT activities.

- (c) Periodic reporting of DAPIT-related activities within the participating agencies should identify any divergence from DAPIT goals.
- (d) In order that AT will be more relevant to the needs of rural areas, the participating agencies in the DAPIT Project should survey the activities of the rural people and determine what type of appropriate technology should be developed.

## 8.0 CAPABILITY OF INSTITUTIONS TO UTILIZE DAPIT COMMODITIES AND NEED FOR ADDITIONAL INPUTS TO ACHIEVE DAPIT OBJECTIVES

This section of the evaluation report is addressed to the following paragraph of the Statement of Work:

"Review the distribution of the existing project-financed commodities and assess the capability of the recipients to utilize them to further the project objectives. Specify any redistribution as appropriate of underutilized commodities."

There is considerable variation in the capabilities of the various institutions to utilize DAPIT commodities to the fullest extent in pursuit of DAPIT objectives. This results in part from the need for specific training in the operation of the more sophisticated equipment -- a need that was recognized in the original project design by the provision for participant training and technical assistance -- and in part from the different roles assigned to each institution in the DAPIT scheme and their traditional mode of operation. Accordingly, each institution is discussed separately below in an effort to assess their capabilities and needs with respect to DAPIT.

### 8.1 TCC

TCC is an established institution in the development and dissemination of appropriate technology and has a track record of success in (a) developing AT products, (b) finding serious candidates for assistance in starting up or expanding small industrial workshops to manufacture the products developed by TCC, (c) financing the cost of and providing production machines and equipment, (d) training the small operator in the relevant production techniques, and (e) assisting with marketing and management advisory services.

TCC has, in recent years, broadened its activities to include technology for the small farmers and rural inhabitants as well as the needs of small industry in urban centers. Among all the practitioners of

appropriate technology in Ghana, TCC ranks highest in our estimation and we attest to their capability to use the DAPIT commodities with skill and efficiency.

The TCC plan to place the ITTU/Tamale equipment into service in Kumasi temporarily pending resolution of the problem of power supply in Tamale is a sensible and effective alternative to the otherwise extended idleness of the equipment, and we endorse it. In view of the poor condition of the power plant equipment in Kumasi and the serious shortage of diesel fuel, we agree with TCC's request for an electric generator for ITTU/Tamale, but we question the logic of powering the generator by a diesel motor. If the Tamale power plant is insufficiently supplied with diesel fuel to provide power for all of the normal working hours of the day, we doubt that ITTU/Tamale will be able to obtain enough fuel to make up for the lack of public power. There is proven technology and equipment available in the United States for generating producer gas from sawdust and other dried vegetable matter, such as rice straw and rice hulls from the mill near the ITTU/Tamale site. We suggest that TCC consider this alternative not only as a solution to its own problem of fueling an electric generator at reasonable cost, but also as a solution to the same problem affecting the operations of many other small industries throughout Ghana.

In addition to the electric generating set, TCC needs additional parts and accessories for several of the DAPIT-supplied machines to put them in operating condition. We recommend that USAID finance the purchase of these commodities.

Lastly, much of the potential benefits to be realized from ITTU/Tamale depend, for an initial period, on the services of the two technical advisors to set up the plant, organize the client base, and train the operators. The technical staff of ITTU/Kumasi is fully engaged in Kumasi operations and cannot readily spare trained operators for Tamale, even if they could be persuaded to relocate. One of the two technical advisors (Medicus Washington) has about ten months remaining on his host country

contract. The other (Frank Robertson) is awaiting a decision on the future of the DAPIT Project before leaving Ghana for work elsewhere. Both technical advisors bring to the Project a unique combination of technical expertise, long experience in Ghana, and enthusiasm for the work. Their loss to the Project would place ITTU/Tamale start-up operations at a distinct disadvantage.

## 8.2 FRI

FRI is the most problematical of the participating agencies in the DAPIT Project from the point of view of evaluating its capabilities to utilize Project commodities to further DAPIT objectives. We have nothing concrete on which to base an opinion. A few of the pieces of equipment are set up temporarily, but the more technical equipment is unpacked in storage awaiting completion of the new workshops. From what we have seen in the way of prototypes at FRI, we are inclined to doubt that FRI is as capable in machine shop work as the other participants, and therefore anticipate that FRI personnel will need substantial training to make effective use of their equipment.

From the point of view of enthusiasm and initiative in carrying out the full range of activities needed to disseminate their technology, we are uncertain about FRI's potential performance. Nevertheless, we do not wish to preclude their continued participation if they can meet the requirements for the well thought out, fully documented subproject proposal and performance standards we recommend in Section 9.0 of this report. If FRI can measure up to the standards set for all participating agencies, we believe they should have an opportunity to produce and distribute AT products along with the other agencies.

FRI will need additional inputs in the form of accessories to place their machines in operable condition and will require GOG financing to complete the part of their new workshops intended to accommodate the DAPIT equipment. We would like to suggest an alternative method of GOG budget submission be adopted that will maximize FRI's chances for obtaining a lump sum to complete the required construction, namely: that the workshop construction is essential for DAPIT.

USAID has received a request from FRI to finance the purchase of wet and dry line food processing equipment. The PGA states, "The Food Research Institute ... will be provided research and shop equipment, materials, and training to assist in strengthening it as a major force in the study, design, and testing of appropriate technology processes and implements in the field of agriculture and family food processing and preservation." We do not see the relevance of the requested additional equipment to rural family food processing and preservation, and we are puzzled by the notion that this mechanized technology is appropriate for devising techniques to be used at the household level. It seems appropriate for FRI to work with small-scale equipment made of materials accessible to rural people at low cost; indeed, that it is part of their mandate to develop such technology. FRI has done some laudable work on various designs of solar heated air convection dryers, and this is the kind of equipment that fits in with the DAPIT focus. It would further the achievement of DAPIT objectives if FRI could be redirected toward the desired level of technology rather than be encouraged to stray by furnishing the requested equipment.

### 8.3 IRI

Based on our observation of the installation of DAPIT equipment and the orderly and rational layout of the IRI machine shop, we guess that IRI is somewhere between FRI and TCC in machine shop capability. The word, "guess," is used advisedly. We did not see the IRI shop in operation, having arrived there in mid-afternoon when few workers were present because, we were told, many were on annual leave and others had already left for the day. Nevertheless, IRI had some items of sophisticated machine equipment installed and in use prior to the arrival of the DAPIT machines and we assume that IRI is capable of using them in view of their experience in providing technical training and repair services to their industrial clients. The request for participant training for IRI personnel as part of the first phase of the Project indicates that IRI recognizes a need for upgrading the skills of some of its personnel. This is a reasonable proposition considering that IRI has no experience with the level of advancement of some of the DAPIT machines, in particular, the automatic turret lathe and

the gear milling machine. Accordingly, IRI will need technical training for its personnel in the operation of some of the DAPIT equipment. We suggest in Section 9.0 that TCC help in training.

As with other participating institutions, IRI will need machine accessories omitted from the original machine requisitions to put its equipment in operable condition. Additionally, it may be necessary to replace a sheet metal forming machine that has not been received due to a marking error on the shipping container. Inquiries are now in process to determine the location of the missing machine and to obtain delivery. Failing this, it will be necessary to reorder the machine, at relatively modest cost, to round out the IRI capability.

#### 8.4 IDU

The equipment provided under the DAPIT Project requires no capability beyond the present skills of the IDU personnel. However, if IDU is to achieve its potential under the DAPIT Project, it will need technical assistance to develop an appropriate technology data base and retrieval system. The elimination of the IDU technical advisors positions that occurred in September 1982 (see Section 4.2.5) denied IDU a short-term technical advisor to set up the SATIS retrieval system and train IDU personnel in its operation. We understand that the system requires no additional hardware. IDU informed us that there were a few minor problems with the DAPIT equipment arising from missing or damaged parts. These will have to be replaced if the equipment is to be placed in operation.

#### 8.5 General Comment

The scope of work for this evaluation raises the question of redistribution of under-utilized Project commodities. As things now stand, we think of no instance of acceptable utilization as yet of the commodities provided by DAPIT, with the exception of the vehicles. In all cases, the utilization of the commodities remains, for practical purposes, in the future. Although there seem to be indications that some participating

agencies can be expected to make fuller use of the equipment than others, we are reluctant to pre-judge what may happen from here on because we are convinced that more effective management of the Project can yield improvements in the performance of the participating agencies.

## 9.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions of the evaluation team and the corresponding recommendations are as follows:

1. The DAPIT Project is more relevant to Ghana's economic and social condition than ever before. Phase One of the Project seeks to set up a national mechanism for the development and field testing of the appropriate technology is now nearing completion. Unless the Project proceeds with Phase Two -- the production and dissemination of the technology and the products -- then much of the purpose and value of the investment in Phase One will be lost. However, the time remaining for completion of the Project is too short to allow full accomplishment of Phase Two, which we estimate will require about two years after the participants are fully operational for DAPIT Project purposes. We believe that this operational readiness, that is, Phase One, can be achieved by the end of the present Project period set for September 30, 1984.

### Recommendation

The DAPIT project completion date for Phase Two should be extended an additional two years, until September 30, 1986.

2. Accomplishment of the purpose of Phase One is far behind schedule because of a complex of factors inimical to efficient operation. Not the least of these are factors extraneous to the Project and beyond the control of any of the participants. The physical progress, i.e., construction of buildings, importation and installation of commodities in operable condition, though disappointingly slow, has proceeded far in advance of the other work that was to be accomplished in Phase One, namely, establishing an effective management and administrative structure; conducting demonstration projects; and preparing, evaluating, and selecting sub-projects for financing and implementation under Phase Two. The management and administrative structure is far from adequate, and there has been no action evident on the demonstration and sub-project tasks.

We regard the lack of adequate management to be largely responsible for the inaction on demonstration and sub-projects. It is critical for the success of the Project that improving project management and administration from the policy level downward be made the first order of business.

#### Recommendation

As a condition precedent to the disbursement of any U.S. funds for purposes other than completion of physical facilities already begun, the GOG should organize, staff, and make operable a complete and adequate management and administrative apparatus. We suggest that this include a secretariat to handle routine Project administration; a management committee, including the Project Manager and the heads of TCC, IRI, FRI, IDU, or their alternates empowered to vote, to meet not less than quarterly to coordinate their activities, report on progress, problems, and steps to resolve difficulties; and a sub-project selection committee of professionals in the field of project evaluation and selection. Such professionals can be found among Project officers on the staff of the NIB, ADB, GEDEC, with technical and market expertise from Agricultural Engineers, Ltd. (AGRICO), Agricultural Extension Service, University of Ghana, Departments of Agriculture and Mechanical Engineering, and others. Depending on the flow of sub-projects reported by participating agencies through the management committee for frequency of meetings, we suggest that the sub-project committee meet not less often than quarterly.

3. Additional inputs are needed to complete Phase One. Some equipment is inoperable because of lack of needed accessories and parts not originally ordered, and certain technical assistance appears to us to be indispensable to effective continuation of the Project and the achievement of DAPIT objectives.

## Recommendation

USAID should finance the following commodities and technical assistance needs of the Project for the completion of Phase One:

### MIST

- Two short-term technical advisors for three months each, concurrently to assist the DAPIT Project Manager to produce an operations manual, guidelines for the proposal of sub-projects, and criteria for the selection of sub-projects. In addition, the GOG may want to consider a host country contract for a long-term advisor, preferably a resident of Ghana, to assist the Secretariat in preparing, processing, and securing approval of sub-projects.

### TCC

- Two long-term technical advisors for 25 months each to continue the services currently being provided by Frank Robertson, Electrical Engineer, and Medicus Washington, Tool and Die Expert. Our strong endorsement goes to retaining the original advisors based on their technical capabilities, accomplishments, and long experience in Ghana. These services are also needed for Phase Two.
- Electric generating equipment for ITTU/Tanale based on producer gas fuel generated on site from pyrolysis of rice mill waste.
- Parts and accessories for existing DAPIT-provided shop equipment already requisitioned by TCC.

### FRI

- Parts and accessories for existing DAPIT-provided shop equipment already requisitioned by FRI. We specifically recommend against U.S. financing of the requested wet and dry line food processing equipment for the reasons discussed in Section 3.0 of this report.

### IDU

- Reinstatement of one short-term technical advisor for three months to assist IDU with the installation and operation of the SATIS data base and retrieval system.

- **Parts and accessories for existing DAPIT-provided printing equipment already requisitioned by IDU.**

4. Additional training is needed to complete Phase One. TCC was provided the services of an expert tool and die maker in recognition of the need for training in the operation of the new, more advanced equipment furnished for ITTU/Tamale. The same need exists in the IRI and FRI organizations. Since the training capability already exists at TCC, we see no reason why TCC should not serve as the source of the required training for the other participants of the Project on the same terms and conditions as TCC offers training for its clients.

#### Recommendation

The GOG should finance the training of machine operators from IRI and FRI in the use of automatic turret lathes, gear making machines, and other equipment according to the requests of IRI and FRI. Such training should take place at TCC facilities in Kumasi for a period deemed suitable by TCC and followed up by a short period of training at the IRI and FRI workshops by the TCC technical advisor to insure that the basic training is transferred on the machines at IRI and FRI, which are of different make than the TCC machines.

5. Sufficient developed appropriate technology already exists in Ghana to form the basis for sub-projects for production and dissemination to end-users. There is a danger that continued concentration on the research and development (R & D) aspects of DAPIT will see the arrival of the end of the project with less than satisfactory dissemination of results and products.

#### Recommendation

No sub-project for R & D should be approved until the proposing organization has been granted approval and funding for a minimum of two sub-projects to produce and disseminate technology

already in a state of readiness. The proposer should be required to show acceptable progress in the actual dissemination of these products before receiving approval of additional R & D.

6. The achievement of the DAPIT Project objectives will be enhanced if the proposals for sub-projects are required to combine the rigorous justification of industrial feasibility studies and the scheduling and resources management of detailed production and marketing plans. Of particular concern under present conditions of drastic shortages in Ghana is the safeguarding of raw materials from diversion of purposes other than those approved (see Annex D for suggested items to be covered in sub-project proposals).

#### Recommendation

Guidelines for sub-project proposals should require that every aspect of the proposed technology, production, and dissemination be fully discussed and justified from the point of view of technical feasibility, economics, production scheduling and cost, marketing feasibility, and materials control. Approved sub-projects should be monitored closely to assure that operations proceed according to plan.

Annex A

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STATEMENT OF WORK  
FOR EVALUATION OF THE DAPIT PROJECT

(Note: This Annex A contains the statement of work in the contract with Checchi and Company for the evaluation of the DAPIT Project. The contract is part of a work order under Indefinite Quantity Contract No. PDC-0000-1-04-3082, Work Order No. 4, effective 6 November 1983.)

## Annex A

### STATEMENT OF WORK FOR EVALUATION OF DAPIT PROJECT

1. Review the basic project design and the status of implementation and accomplishments to date (i.e., physical, financial, participation, training, benefit incidence) against project objectives. Determine what further inputs (if any) are needed to achieve the objectives.
2. Identify any management, structural, or organizational constraints to implementation arising from flaws in the original design of the project and suggest corrective measures. Particular attention should be paid to studying the interrelationships between individual institutions in the project.
3. Review the goals and objectives of the DAPIT project, determine their relevance to existing intermediate technology development and dissemination system in Ghana (i.e., MIST, CSIR, Universities, Technological Institutes, private industry) and suggest how DAPIT can best contribute to these entities.
4. Examine the participating institutions (FRI, IRI, TCC, IDU) to determine if their goals, objectives, and mandates are consistent with those of the DAPIT project. Attention should be given to understanding what each institution was originally set up to do and to what extent the DAPIT project has assisted them to match their equipment and manpower needs to accomplish their own and DAPIT's objectives.
5. Review the distribution of existing project financed commodities and assess the capability of the recipients to utilize them to further the project objectives. Specify any redistribution as appropriate of under-utilized commodities.

In achieving the above, the contractors will be expected to work as a team with two Ghanaian consultants from the Ministry of Finance and Economic Planning, the University system, or the Council for Scientific and Industrial Research. Seven working days will be spent in Kumasi and Tamale evaluating the TCC and ITTU components of the project. The remainder of the contract period will be spent in Accra evaluating the other components of the project. USAID will provide all in-country travel arrangements.

PROVEN TECHNOLOGIES

This Annex B consists of proven and acceptable appropriate technologies as reported by the Technology Consultancy Center (TCC) in Kumasi (Annex B-1), the Industrial Research Institute (IRI) of the Council for Scientific and Industrial Research (CSIR) in Accra (Annex B-2), by the Food Research Institute (FRI) of the CSIR in Accra (Annex B-3), and by the TCC Field Officer, Mr. Frank Robertson, in Tamale (Annex B-4).

## Annex B-1

### ESTABLISHED TECHNOLOGIES TRANSFERRED BY TCC

There are a number of well-established and widely-used technologies that the TCC has been transferring for several years. These are listed below with some attempt at grading in terms of popularity (roughly profitability) and appropriateness (roughly degree of local self-sufficiency).

#### Grading by Popularity

1. Soap making
2. Palm oil production
3. Beekeeping
4. Minimum tillage farming
5. Welding and steel fabrication
6. Metal machining
7. Fish farming
8. Broadloom weaving

#### Grading by Appropriateness

1. Beekeeping
2. Fish farming
3. Palm oil production
4. Soap making
5. Minimum tillage farming
6. Welding and steel fabrication
7. Metal machining
8. Broadloom weaving

Beekeeping has virtually no foreign inputs since even the hives are made from locally-produced timber. Fish farming is similar in this respect. Palm oil production uses imported raw material for its plant and equipment but its own raw material is locally produced. Soap making is similar but needs five percent imported raw material (2.5 percent by the TCC method). Minimum tillage farming needs a larger proportion of foreign inputs in the form of fertilizer and herbicides. Welding sets can be made locally and a few are produced. However, most metal working industries use all imported machinery and much imported raw materials. Weaving uses locally made looms but all its raw material is imported at the present time.

#### Other Technologies

The TCC has transferred many other technologies which are not popular or widely used enough to enter the above gradings. These include the following:

9. Paper glue manufactured from cassava starch
10. Paper glue manufactured from latex
11. Glass bead making
12. Drying of brewers spent grain
13. Lost wax brass casting
14. Charcoal making
15. Wood pyrolysis
16. Perfume extraction by steam distillation
17. Simulated human hair wigs from sisal hemp
18. Castor oil production
19. Caustic soda making
20. Pedal-driven rice thresher

#### Technologies Supported by Clients

There are some technologies made possible by the manufacture of products by TCC clients. These include the following:

21. Carpenter's sawbench
22. Wood-turning lathe
23. Corn-mill
24. Cassava grater
25. Gari plant
26. Sugarcane crusher
27. Palm kernel cracker

These are all popular and appropriate technologies and would rank together with the top 8 if enough first-hand experience was available to the TCC.

Signed:

DR. J. W. POWELL  
Director

17th November 1983

Annex B-2

IRI DAPIT PROJECTS

1. Proposed/Completed (Results Being Disseminated/Awaiting Dissemination)

Project	Remarks
1. Solar Dryer	Designed for the quick drying of farm produce and for the marketing of farm products under hygienic conditions in rural areas.
2. Solar Cooler	Designed for the preservation of farm products and perishables such as meat and fresh fish, and for the provision of midday cold water for rural dwellers and farmers.
3. Potash Oven	An easy construction from empty oil drums for the efficient burning of cocoa, plantain, and oil palm husks for making indigenous soap in the rural areas.
4. Leach Box	Constructed in wood for straining potash to improve the quality of indigenous soap.
5. Lead weights for fishing nets	Designed to increase the catch of fishermen.
6. Boiler for a small-scale ointment making enterprise at Madina near Accra	The boiler was constructed from empty oil drums. Design suitable for plants of similar nature in the rural areas.
7. Reshaping of cutlasses for farmers	Cutlasses unsuitable for local use were imported from China. The Ministry of Agriculture therefore requested the Institute to reshape them to farmers' specifications.
8. Biogas Plant	<p>The plant is designed to make use of organic wastes (animal and plant) which are available in farming/rural communities. The advantages to be derived by these communities include:</p> <p>(i) the production of an energy source that can be stored and used more efficiently;</p>



### III. Future Developments

<u>Project</u>	<u>Remarks</u>
1. Extension work on solar dryer for cocoa beans	The work will involve the adaptation of an indigenous technology.
2. Maize sheller	Development of a hand and treadle operated maize sheller. A labor-saving device.
3. Dehulling machine and hammer mill for grain processing	This unit is for an Agricultural Research Organization to establish its second service center in a grain farming community. It will help the rural community through the provision of service and employment.
4. Fruit-juice presses for citrus fruits and pineapples	Equipment for processing fruit juice, sited near a citrus farming community as cottage industry, will help market the produce of the villagers.
5. Brick press and pug mill	To be used for the establishment of a brick and tile cottage industry to supply building materials for a cluster of cottages.
6. Saw dust stove	To involve the building of a wood waste burning stove.

SUBMITTED BY INDUSTRIAL RESEARCH INSTITUTE

Annex B-3

TECHNOLOGIES DEVELOPED BY THE  
FOOD RESEARCH INSTITUTE (FRI) OF THE CSIR

Technologies	Remarks
1. Fish Smoker, Open Type	Made of sheet metal and rods.
2. Fish Smoker, Closed Type	Made of sheet metal and rods.
3. Cassava Grater	Perforated tin grate.
4. Oil Palm Fruit Expeller	To make edible oil.
5. Solar Drier for Peppers	Made of polyethylene sheets and wood strips (reduces moisture from 60 down to 8 in three days depending on sun).
6. Solar Drier for Cassava	Same materials as above.
7. Groundnut Sheller	
8. Cabinet Drier	Uses light bulb and fan.
9. Hand Operated Maize Sheller	
10. Maize Crib	Kenya type.
11. Cassava Press	Mechanical, hand operated.

Annex B-4

PROVEN TECHNOLOGIES THAT COULD BE PRODUCED BY THE ITTU/TAMALE  
OR BY CLIENT COMPANIES OF THE ITTU IN THE NORTHERN REGIONS

SUGGESTIONS BY FRANK ROBERTSON, TCC FIELD OFFICER, TAMALE, NOVEMBER 17, 1983

Name of Technology	Remarks
1. Wooden bee hives	Already being produced by TCC in Kumasi, by TCC client companies, and widely disseminated as in Yendi by PCV's, Bill and Denz Martin-Muth.
2. Wooden barrels for water storage, preferably 1,000 gallon capacity	Requires one metal fixture which could be forged at ITTU or by client companies of ITTU. Experience with such barrels in Cape Coast area shows they can last many years longer than storage tanks made of galvanized sheet metal.
3. Wooden ladders	Needed to facilitate roof repairs.
4. Wooden looms	Suggested by National Council for Women and Development.
5. Abrasives	Made from local sandstone.
6. Shoemaking equipment for producing "Afro-Moses" shoes	Made from waste rubber and local leather.
7. Clay ovens for baking	Suggested by National Council for Women and Development.
8. Parts for water pumps	There are hundreds of hand pumps which are inoperative because of missing parts that could be cast at the Tamale ITTU or by client companies.
9. Cast iron plates for pepper grinders	Could be cast at ITTU.
10. Plates for corn grinders	These depreciate rapidly because of hard use and because castings do not contain enough magnesium or other hardening alloys. There are reportedly three major types of corn mills used in Ghana: (a) India Rex, (b) India Amuda, and (c) U.K. Premier. If these could be made in large volumes of hard metals, productivity in rural Ghana could be improved.

Name of Technology	Remarks
11. Charcoal distillation equipment	This is needed to conserve energy which is now flared off and to produce better charcoal.
12. Locks	These can now be made by Al Haji Goodman and Son, Tamale, but he is short of raw materials.
13. Prefabricated silos for maize and yam storage	These could be made in kits that farmers could transport easily and assemble on-farm as is being done in Kenya. These could reduce post-harvest losses substantially (claims are made in Kenya of 20 percent savings).
14. Spinning wheels	Suggested by National Council for Women and Development.
15. Minimum tillage planter	These are already being made at the ITTU in Kumasi and are in wide use. TCC claims that maize yields have been raised from 6 to 12 bags per acre using these planters. According to Ralph Moshage, PCV, the raw materials for the planter cost ₵4,500 and the retail price charged is ₵6,000.
16. Farming hand tools	The Ghanaian-German Agricultural Development Project, Tamale, has sold 23,879 unfinished rectangular hoes and 25,240 unfinished round hoe blades in less than 3 years.
17. Kitchen implements	Suggested by the National Council for Women and Development.
18. Automotive repairs	Especially repairs of alternators, starters, radiators, brakes, clutches.
19. Rice threshers	These can be hand operated or powered with 3-5 HP Briggs & Stratton or Kohler gasoline or kerosene engines.
20. Groundnut shellers	These are already being made by AGRICO in Accra, but production has been discontinued because of a shortage of raw materials.

ORIGINAL IMPLEMENTATION SCHEDULE FOR DAPIT  
(appearing in Project Paper of July 9, 1979)

## Annex C-1

## DAPIT PROJECT IMPLEMENTATION SCHEDULE

Event No.	Event	Date to be Completed
1.	PP completed	Jul. 1979
2.	Project authorized	Aug. 1979
3.	Project Agreement signed	Aug. 30, 1979
4.	Capital equipment and commodity specifications completed	Oct. 1979
5.	Initial CP's met	Nov. 1979
6.	MEP Project Office operational (MEP/PO)	Nov. 1979
7.	Capital equipment ordered (I)	Dec. 1979
8.	Technical Advisors' selection begins	Dec. 1979
9.	ITTU construction begins	Jan. 1980
10.	Demonstration projects to MEP/PO	Jan. 1980
11.	Project Committee (PC) members selected by MEP/PO	Jan. 1980
12.	Selection of initial participants for training (I)	Feb. 1980
12A.	FY 80 Project Agreement signed	Feb. 1980
13.	Capital equipment ordered (II)	Mar. 1980
14.	Demonstration projects approved by MEP/PO	Mar. 1980
15.	PC operational	Apr. 1980
16.	Secretariat members selected by MEP/PO	May 1980
17.	Technical Advisor for IDU in country	Jun. 1980
18.	PC begins drafting guidelines for sub-project proposals	Jun. 1980
19.	Technical advisor for PC/Secretariat in country	Jul. 1980
20.	IDU operational	Aug. 1980
21.	Initial demonstration projects completed	Sep. 1980
22.	Secretariat Operations Manual and Guidelines for sub-project proposals finalized	Oct. 1980
23.	Technical Advisors for ITIU in country	Oct. 1980
24.	FY 81 Project Agreement signed	Nov. 1980
25.	Capital equipment arrives (I)	Nov. 1980
26.	Secretariat begins processing sub-project proposals	Nov. 1980

Event No.	Event	Date to be Completed
27.	Participants selected for training (II)	Jan. 1981
28.	First selection of sub-projects funded	Feb. 1981
29.	Capital equipment arrives (II)	Mar. 1981
30.	ITTU completed	Apr. 1981
31.	First project evaluation begins	Oct. 1981
32.	FY 82 Project Agreement signed	Nov. 1981
33.	First sub-projects evaluated	Feb. 1982
34.	Short-term IDU Technical Advisor in country	Jun. 1982
35.	Second intensive project evaluation begins	Mar. 1983
36.	End of project (PACD)	Sep. 1983

Annex C-2

DAPIT PROJECT IMPLEMENTATION SCHEDULE - REVISED JUNE 1, 1981

A. MIST Secretariat Implementation Plan

Event No.	Event	Date Due
1.	Project Committee members selected	Jan. 1980
2.	Project Committee becomes operational	Mar. 1980
3.	Participant training candidates selected	Mar. 1981
4.	Request for technical assistance program proposals sent to AID/Washington	Jul. 1981
5.	Prepare P10/C for Secretariat office equipment	Jul. 1981
6.	PC approves guidelines for sub-project proposals	Aug. 1981
7.	Participant departs for training in U.S.	Sep. 1981
8.	1981 Project Agreement signed	Nov. 1981
9.	Staffing of Secretariat completed	Dec. 1981
10.	RFTP approved by AID/W and contractor selected	Jul. 1982
11.	Technical Advisor selection for Secretariat begins	Jul. 1982
12.	Secretariat office equipment arrives	Jul. 1982
13.	Secretariat office becomes operational	Jul. 1982
14.	Technical assistance to Secretariat arrives Ghana	Sep. 1982
15.	1982 Project Agreement signed	Nov. 1982
16.	Secretariat operations manual completed	Jan. 1983
17.	Secretariat begins processing sub-project proposals	Jan. 1983
18.	Demonstration project applications submitted to Secretariat	Jan. 1983
19.	First sub-project selection funded	Mar. 1983
20.	Demonstration project applications approved by Secretariat	Apr. 1983
21.	Initial demonstration projects completed	Sep. 1983
22.	First project evaluation begins	Sep. 1983
23.	1983 Project Agreement signed	Nov. 1983
24.	Project extended two additional years	Oct. 1983
25.	Second intensive project evaluation begins	Sep. 1985
26.	End of project (PACD)	Oct. 1985

### B. Technology Consultancy Center (TCC)

<u>Event No.</u>	<u>Event</u>	<u>Date Due</u>
1.	Capital equipment and commodities ordered	Jan. 1981
2.	Diesel vehicles ordered	Aug. 1981
3.	Capital equipment and commodities arrive	Jan. 1982
4.	Diesel vehicles arrive	Aug. 1982
5.	Construction of Intermediate Technology Transfer Unit (ITTU)	Aug. 1982
	a. Prefab supplier identified and estimated time of prefab building arrival in Ghana stipulated	Jun. 1981
	b. Contractor for selection process initiated	Aug. 1981
	c. Construction schedules for foundation and prefab building construction submitted by architect	Aug. 1981.
	d. Bid documents prepared for construction services contract submitted by architect	Aug. 1981
	e. Evidence that TCC has acquired legal title to the land and available for ITTU construction	Aug. 1981
	f. Maintenance plan for equipment and facility submitted by architect	Oct. 1981
	g. Construction contract awarded and construction begins	Jan. 1982
	h. Foundation construction completed	Mar. 1982
	i. Prefab building erected	Sep. 1982
6.	<u>Participant Training</u>	
	a. Short term training to India	Jan. 1982
	b. Short term training to U.S.	Jan. 1982
7.	Peace Corps participation	Sep. 1982
8.	Technical assistance to TCC arrives in Ghana	Sep. 1982

### C. Food Research Institute (FRI)

<u>Event No.</u>	<u>Event</u>	<u>Date Due</u>
1.	Capital equipment and commodities ordered	Sep. 1981
2.	Peace Corps participation	Oct. 1981
3.	Possible long term technical assistance	Aug. 1982

Event No.	Event	Date Due
4.	Capital equipment and commodities arrive	Sep. 1982
5.	Sub-project applications submitted to Secretariat	Jan. 1983
6.	Demonstration project application submitted to Secretariat	Jan. 1983
7.	Sub-projects application approved	Mar. 1983
8.	Demonstration project application funded	Apr. 1983
9.	Initial demonstration projects completed	Sep. 1983
10.	First sub-projects evaluated	Sep. 1983

D. Information and Documentation Unit (IDU)

Event No.	Event	Date Due
1.	Capital equipment and commodities ordered	Jul. 1980
2.	Participant selected and leaves for U.S.	Mar. 1981
3.	Capital equipment and commodities arrive	Jul. 1981
4.	IDU operational	Jan. 1982
5.	Technical Advisor selection for IDU begins	Jul. 1982
6.	Technical Advisor for IDU arrives	Sep. 1982
7.	Short-term Advisor for IDU selected	Sep. 1982
8.	Short-term Advisor arrives in the country	Jan. 1983

Annex D

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**SUGGESTED POINTS TO BE COVERED  
IN SUB-PROJECT PROPOSALS**

## Annex D

### SUGGESTED POINTS TO BE COVERED IN SUB-PROJECT PROPOSALS

Guidelines for preparing documentation for sub-projects should include: (a) description and drawings of the AT product or process proposed; (b) quantity of the products or equipment to be produced; (c) raw materials needed, imported and local, and costs of each for quantities needed; (d) cost of labor, overhead, and profit; (e) name of subcontractor which will produce parts; (f) same for assembly; (g) same for distributor of products; (h) plan for demonstration, if needed; (i) description of market; (j) time schedule for production and distribution; (k) retail and wholesale prices; (l) schedule for collecting funds from subcontractor; (m) schedule for release of raw materials; (n) procedures for safeguarding raw material; (o) procedures for monitoring quality and conformity with specifications; (p) procedures for making sure that raw materials are used for sub-project and not diverted; (q) relevance of the AT product or process to the DAPIT objectives (i.e., assisting to improve the incomes and productivity of rural inhabitants); (r) percentage of the production and distribution work to be performed outside the participating agency (approval of a sub-project would be more likely if all or most of the production, assembly, and distribution were performed outside the participating agency).

Raw materials would be sold to producers and a revolving fund created for each participating agency.

EXAMPLE OF SUCCESSFUL APPROPRIATE TECHNOLOGY  
DEVELOPED FOR CONDITIONS PREVAILING IN GHANA

## Annex E

### EXAMPLE OF SUCCESSFUL APPROPRIATE TECHNOLOGY DEVELOPED FOR CONDITIONS PREVAILING IN GHANA

The purpose of this Annex is to describe an example of appropriate technology that has been developed by the TCC in Kumasi to suit Ghanaian farming conditions. This AT equipment is referred to in the foregoing evaluation report as the "minimum tillage" planter. (This equipment is also known as the "TEK" planter.)

In recent years, the concept of "no tillage" or "minimum tillage" agriculture has emerged as a practice for soil preparation that is better suited to developing countries than tillage by tractor or bullock-drawn ploughs or ridgers. Soil preparation by conventional ploughing exposes thin top soil to sunshine thereby reducing moisture content. Tractors consume scarce fuel and bullocks or camels require expensive feed.

The minimum tillage concept, however, requires no tractors or draft animals and punctures the soil only to the extent necessary to bury the seed.

The minimum tillage planter raises the yield of maize from 5 bags (500 kg.) to as much as 12 bags (1,200 kg.) per acre. About 60 of these planters have been built in the TCC's Intermediate Technology Transfer Unit in the Suame Magazine in Kumasi, and more are under construction by private metal working shops.

In January 1984, the TCC plans to bring a manufacturer and his apprentice work force from Accra to the ITTU and to instruct them in the manufacture of components for the planter and later in the manufacture and assembly of the entire machine. Repeating this process for transferring know-how will make it possible to produce planters in many localities throughout Ghana.

Raw materials to make the planter cost about ₵4,500 (about the equivalent of U.S.\$150). The retail price to the farmer is ₵6,000 (U.S. \$200).

The planter is a rotary injection type, designed to be pushed by one person at a steady, slow walking pace. It is based upon an original design developed at the International Institute for Tropical Agriculture, Ibadan, Nigeria, and further developed by a British company as the MASDAR planter.

Now the ITTU at Suame is offering a modified design to farmers in Ghana. Although the planter is designed to plant maize, it can be fitted with extra seed wheels to plant other seeds. These extra seed wheels can be purchased from the TCC in Kumasi.

The planter is normally sold without a drag chain because this item cannot operate on mulched or imperfectly cleared ground. However, if a very clean planting bed, free of all dead stalks, twigs, stumps, stones, etc., is to be planted, the drag chain and bar can be used to cover the seeds better. Drag chain and bar assemblies can be purchased from the TCC in Kumasi.

A flat steel tire is also optional for use with seeds other than maize, to ensure that seeds are not planted too deeply in very soft earth. Under normal conditions for planting maize, as much depth as the planter can achieve is required and the tire is not needed.

