EVALUATION REPORT OF THE INTERMEDIATE TECHNOLOGY PROGRAM OF THE NORTH SHABA RURAL DEVELOPMENT PROGRAM (660-0059)

by

Joseph K. Campbell, P.E., Ronco, Inc.

May, 1982

The statement of work for the Evaluation team describes my responsibility as follows:

"The Intermediate Technology Specialist shall, through observations of current Project tool-production activities and visits to a number of farms throughout North Shaba evaluate the appropriateness of tool production. He shall evaluate the technology in terms of increasing the productivity of farm labor, the timeliness of operations, time savings and the efficiency of farm operations generally. He shall also identify likely future needs for intermediate technology beyond basic hand tools and assess the adequacy of current efforts to meet these needs.

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And he shall recommend changes which could not only make this syb-system more effective but also increase the chances of project process sustainability beyond the termination date of AID's participation. Specifically, he shall :

a. Evaluate past and current production levels, inputs, training and final use of tools to determine the success of this sub-system in meeting project objectives.

b. Evaluate the future financial and physical viability of this sub-system activity. Has GOZ/ project subsidization as practiced been necessary/justifiable in the past? Will imports be necessary in the future or could intermediate technology efforts use mainly local resources? Could local manufactures be competitive with tools brought in from Kinshasa or abroad?

c. Determine if there are any entities, public or private, capable of taking over this sub-system after project termination.

d. Explore the advisability of further promoting private repair/fabrication shops in village or larger communities, using the blacksmiths trained under the project.

e. Determine the effectiveness and appropriateness of

current project training, both formal and informal, as well as the levels and types of training required to carry on current or expanded levels of manufacturing and distribution plus research and development. Is continued blacksmith training advisable? Are current locations of traing appripriate for the future?

f. Evaluate future intermediate technology needs and assess the sub-system's capability to meet these needs.

g. Explore the desirability and possibility of integrating intermediate technology activities with agricultural research activities.

h. Identify and define the range of physical and natural resource constraints that would affect an expanded technology development effort.

i. Suggest categories (and examples within these categories) of tools and equipment that seem most appripriate and affordable for farmers within the project area.

j. Review the distribution system for hand tools and other intermediate equipment. Are tools and equipment available as well as affordable to small farmers? Outline recommended options for improved distribution.

After an evaluation team discussion it was decided that the report should also include a discussion of the replicability and sustainability of the Intermediate Technology Subsystem.

Field observation and visits were made prior to the writing of this report. Three days were spent in Kinshasa, one day at the Cassava Research Station (INERA) at M'Vuazi, 20 days in or near Kongolo, a day at the Ngaba Research station near Mbulula, a day in the Kivu Sola area and two days in the Nyunzu area.

The reports most applicable to the Intermediate Technology Subsystem are listed as Appendix A. Names of persons in Zaire with whom I discussed farming, tools and the North Shaba Project are listed as Appendix B.

CHAPTER I - INTRODUCTION

The "Project North Shaba" began as the North Shaba Maize Production Project (No. 660-11-199-059) had as its purpose "to identify an effective rural development process for improving small farmer production and income which is replicable in other parts of Zaire". (Ref. 16). The primary sub-goals of the Intermediate Technology Subsystem were to:

1. Purchase and sell to farmers:

   500 corn shellers (maize shellers)
   500 hand mills (burr mills)
   200 peanut decorticators (hullers)
   200 rice hullers
   100 oil palm presses
   10,000 machetes, coupe-coupes, ect

2. Establish an Intermediate Technology Center at Kongolo to manufacture appropriate equipment for sale to farmers and to train village blacksmith to repair imported and Intermediate Technology Center produced equipment.

3. Develop improved maize storage facilities.

It was postulated that by making appropriate agricultural tools and village level processing equipment available to small farmers - a more efficient use of labor would result, thus making a

significant contribution to the attainment of the project goals.

The orginal Project Paper was signed in Sember 1976 and was scheduled to terminate on September 1982.

The grain storage activity proposed in the project paper was never undertaken, but this was due to the termination of the National Office of Cereals (ONACER) program and was not a deficiency on the part of the Intermediate Technology substem. The responsibility for grain storage work was transferred from Intermediate Technology to the Research and Extension Subsystem.

In August 1980 the original Project Paper was changed to the "North Shaba Rural Development" project (No. 660-059) which had as its purpose (Ref.17) "to increase the net income of small of small farmers in the project area by 100% by the end of the project as a result of raising corn production from 27,000 MT (1978) to 49,000 MT; and to develop a rural development process in the form of a model that is replicable in other parts of Zaire". The project assistance completion date was extended to September 30, 1983.

Under the amneded Project Paper to the primary sub-goals of the Intermediate Technology Sub-system were to :

1. produce tools and machines in the refurbished SNCZ shop in Kongolo
2. train local blachsmiths
3. Test and fabricate appropriate machines for village use.

The Intermediate Technology dollar budget for the final three years of the project (1980 - September 30, 1983) also provided for :

1. funding through 1981 for an expatriate engineer
2. two man-months of technical assistance
3. training of Intermediate Technology Sub-system personnel outside of Zaire
4. $47,000 for new equipment.

The most important evaluations of and recommendations for the Intermediate Technology system are provided in the following reports:

1. Evaluation of the North Shaba Integrated Rural Development Project Zaire by Dimpex Associates (no date)
2. Small Agricultural Tool Production in Zaire by William Fiebig, May 6, 1981
3. Report on Production of Small Agricultural Tools in the PNS Project by Manfred Mueller, August 1981
4. End of Tour Report by Merritt Sargent, December 1981
5. End of Tour Report by Brook Aitchison, January 1982
6. Five Years Later: Progress and Sustainability in Project North Shaba by Development Alternatives, Inc., March 1982.

The reports by Fiebig and bv Mueller are the most useful for evaluation of the IT subsystem.

Although the six reports are useful, none was prepared by an engineer from outside of the project -- a striking void. Because of training and experience, an engineer would have more likely observed strengths and weakness of the I.T. Subsystem not observed by persons trained in other disciplines.

The Mueller report (Ref. 3) is very useful in that it contains cost-of production-data and makes the point that the tool quality/cost trade-off can only go so far before a farmer will refuse to purchase a low quality tool even if he can purchase it at a low price.

The Fiebig report (Ref. 2) provides some detail about the physical operation of the Intermediate Technology subsystem as well as a description of other intermediate technology activities in Zaire.

Mr. Brooks Aitchison was the only advisor to the Intermediate Technology subsystem, so his End of Tour Report (Ref. 1) is useful in providing a sense of the philosophy of the I.T. subsystem. The organization chart of the I.T. subsystem is shown as appendix C.

There have been in North Shaba some physical and natural resources constraints that have retarded an expansion of technology in regards to agricultural tools and machines. In my opinion

the major constraints to the use of more agricultural technology in the form of tools and machines by farmers are:

1. Lack of money
2. Lack of animal mechanical and electrical power
3. Availability of land
4. Poor transportation.

Some data (Ref. 3) indicate that the average farmers' household requires seven hand tools and the average life of a tool is five years. If the average cost of a tool is 15Z, the farm household must spend 21Z (7 tools ÷5 years x 15Z = 21Z) annually just to replace basic tools. Since the total cash available to the household is somewhere between 325 and 1,000 Z, there is little discretionary income available for additional agricultural machines and tools. In view of this condition, a tool or machine must,,because of its uniqueness, be available if task is to be done - machete would be in this category; or the technology must be so far superior in performance to the traditional method that it is economically desirable - for example, the manually operated maize grind

The farmer in North Shaba lacks animal or mechanical power. Since it is primarily power by which a person's effort is amplified, it means that the farmer in North Shaba for the present and for the probably life of Project North Shaba will be constrained to manual power. A well-fed man has a work output equivalent to about one-tenth horsepower over eight hours.

Animal power in the form of cattle or horses does not appear feasible because of the tsetse fly. If the tsetse fly were to be eliminated, the introduction of draft animals into a society which has not utilized draft animals would be a long term development process. Mechanical power in the form of internal combustion engines is also unfeasible at present because of lack of income to support the machines and the poor availability of fuel in the countryside.

For the present, it appears that human powered equipment is the most feasible, although the choice of useful technology is very limited because of the small power output of a person.

In North Shaba there is sufficient land for slash and burn agriculture although it is true that farmers must travel further and further from their villages to find "forest" land to slash and burn and plant to maize. Since the farmer can farm with low power input by using slash and burn methods, there is not pressure on him to intensify agricultural production on the land by the use of higher outside energy sources such as fertilizer; more efficient cultivation methods such as planting in rows and using push type cultivators; or utilizing the internal combustion engine to pump water for supplementary irrigation to grind maize, etc.

Poor transportation increases the cost of moving farm produce to market and thus reduces the farmers market and income. The lack of transportation retards the flow of information and limits the availability of spare parts. The lack of transportation in North

Shaba has limited the effectiveness of the Extension service, has made it difficult for farmers to attend meetings, and has caused serious problems in repairing mills distributed by the I.T. subsystem and delivering steel to blacksmiths.

CHAPTER 2. FINDINGS

Measurements.

The basic objectives of the Intermediate Technology subsystem currently are to (1) produce hand tools such as hoes and machetes, (2) produce processing equipment for village use such as peanut decorticators and small burr mills, (3) train blacksmiths to produce hand tools, and (4) operate a repair center.

Since tools and machines produced and people trained are physical entities, a measure of accomplishment can be obtained merely by counting the various items. These data have been gathered by the Intermediate Technology Subsystem and have been reported in various project reports.

The reason that tools and machines should be fabricated and blacksmiths trained is to provide farmers with useful and economically viable tools. Before tools or machines are designed, it is essential that the customer's (the farmer in North Shaba) wants, needs and preceptions of tools as well as his ability to purchase tools is known. After the initial gathering of this information, there must be a feed-back loop between the customer and the I.T. Subsystem in regards to tool performance.

It appears to me that in the interests of efficiency, this information should be obtained and disseminated by the Information

Subsystem (SCAD). However, SCAD was not staffed to serve as a feed-back loop for the I.T. Subsystem, so at the end of 1980, the I.T. Subsystem established a "Research and Development Service" (Ref. 1). However, from discussion with farmers, checkin of tools at the depots at Kongolo, Mbulula Nyunzu, and discussions with the Chief of the Intermediate Technology subsection, it is obvious that the feed-back of farmer, PNS extension personel, SCAD and the I.T. subsystem is not yet effective.

Accomplishments of the Intermediate Technology Subsystem

1. In Kongolo an Intermediate Technology Center and Workshop was established in the former railroad and shipyard shops (Chemin de Fer des Grands Lacs railroad and river transportation) belonging to the National Railroad Company (SNCZ). By September 1977, the I.T. Subsystem consisted of the subsystem Chief Cit. Sedzabo and a head blacksmith leading a five-person team with four shop machines in use and a small tool production of 200 units per month (Ref. 1).

2. From the initiation of the project in 1977, through March 1982, approximately 33,000 tools such as hoes, machetes, coupe-coupes, etc. and 225 machine prototypes and processing machines (such as peanut decorticators and palm oil presses) were produced by the I.T. subsection.

I.T. TOOL PRODUCTION

Year	Hoe	Machette	Coupe-Coupe	Shovel	Blacksmiths Misc. Tools	Axe
1978	4,231	1,273	1,763	0	0	856
1979	3,532	263	1,702	30	533	278
1980	2,752	1,301	1,694	8	2,337	237
1981	3,173	924	2,246	403	1,363	19	0
1st. Qtr. 1982	460	89	568	0	0	0	0
TOTAL	14,148	3,850	7,973	441	4,235	84	1,371

Source : Ref. 14

I.T. MACHINE PRODUCTION

Year	Palm Oil Press	Peanut Decortication	Misc. Machines
1978	21	0	0
1979	50	43	0
1980	11	23	42
1981	14	21	0
1st Qtr. 1982	0	0	0
TOTAL	96	87	42

Source : Ref. 14

3. Besides the hand-tools, at least one prototype was consructed after research about the following machines (Ref. 1) :

Grain winnower
Wire loop pedal threshers
Diaphragm irrigation pump
Lift pump for water well
Soap making techniques
Protective box for (water) spring
Maize shellers (3 designs)
Blacksmith's forge
Palm oil press

I.T. REPAIR INCOME		
Year	Income from Repair work (Z)	Receipts from repairs & tool sales as reported by PNS Accounting Office (April 1982)
1978	795.75	-
1979	7,592.50	19,472
1980	9,417.00	7,309
1981	26,692.00	89,516.60
1st. Qtr. 1982	12,660.00	10,253.
	67,157.25	1,26.550,60

Source : Ref. 14

4. From 1978 through the first quarter of 1982 the Intermediate Technology Subsection in the Kongolo shop performed Z.67,160 of repair work for farmers and merchants.

5. Beginning in March 1979, eighty-six men from villages in the project area received two weeks of blacksmith training at the I.T. Shop. As part of the training the made their own blacksmithing tools.

6. In the last quarter of 1977, the expatriate advisor for the Intermediate Technology subsystem, Mr. Aitchison, received a month's training in blacksmithing and related work in England. From October 1980 through January 1981, the Chief of subsystem, Cit. Sedzabo Seko, received training in Intermediate Technology in France.

Cost of Accomplishments of the Intermediate Technology Subsystem

It is difficult to obtain exact financial data for the Intermediate Technology Subsystem (ITSS) from the Project Management Unit (PMU), but examination of the cost of the ITSS and the cost of the North Shaba Project reveals that the Intermediate Technology Subsystem has received about 5 1/4% of the project's funds. See the following table.

Intermediate Technology Subsystem Expenditures

Calendar Year	$ U.S.	Countepart Funds (Z)	G.O.Z. (Z)
1977	251,000.	0	0
1978	70,000	0	0
1979	45,000	0	41,600.
1980	26,000	40,270	62,540.
1981	351,000	13,824	157,650.
TOTAL	743,000	54,094	261,790.
Total PNS Budget 77-82	$14,126,000	28,557,050	28,360,665.
I.T. as % of PNS	5.26%	0.63%	3.12%
1982 I.T. BUDGET	$54,600	0	2240,000.
1982 PNS BUDGET #	5,222,400	706,000	12,375,00
I.T. as % of PNS	1.04%	0%	1.94%

Source: Data from R. Ackerman of PNU on 17 April, 1982

CHAPTER 3 - ANALYSIS OF FINDINGS

At a point where three-quarters of the project life has been expended what is the health of the Intermediate Technology Subsystem? Has it met the goals set for it during the evolution of Project North Shaba?

Among the various subsystem of PNS, the Intermediate Technology Subsystem is unique in that there has been only one chief of the subsystem, Cit. Sedzabo Seko, and one expatriate advisor, Mr. Brooks Aitchison. Cit. Sedzabo joined PNS in January 1977, and arrived in Kongolo at the of 27 as chief of the Intermediate Technology Subsection in August 1977.

Cit. Sedzabo is an Agricultural Engineer (B.S. d'Engenieur du Genie Rural, National University of Zaire, July 1976) and had five months of experience as an irrigation engineer before joining Project North Shaba.

Mr. Aitchison at the age of 23 arrived in Kongolo in September 1977, as a Peace Corps advisor to Cit. Sedzabo and the Intermediate Technology Subsection. Mr. Aitchison has a B.S. degree in mechanical engineering.

In his End-of-Tour report of January 1982 (Ref. 1), Mr. Aitchison evaluates the I.T. Subsystem by writing:

"I believe that we have generally achieved ITSS' three basic goals, but much work still needs to be done. We have a strong production and repair center that is organized and functioning very well, but is not yet self-financing. We have an RID service which ties into this Center. It is functioning and productive, but at a very slow rate. Much could be done to expand this service. We also have a training service which is viable, productive and successful, but which could be expanded into other technical fields as well.

"What have been ITSS' quantitative outputs to date? We have produced and sold over 25,000 handtools in the project area. We have produced and sold over 170 Intermediate Technology machines. We have performed over 40,000 Z. worth of outside jobwork for clients. We have taught 86 village blacksmiths how to forge agricultural hand tools and make blacksmithing tools. We have sold over 5 tons of metal stock to these blacksmith for use in forging agricultural hand tools. We have trained 40 Intermediate Technology Technicians and Administrators in the day to day operation of an I.T. Center."

One of the first tasks for the I.T. Subsystem was to renovate the unused machine shop, forge shop, and foundry which PNS had acquired from the National Railroad Company (SNCZ). The equipment includes three drill presses, four large engine lathes, three small engine lathes, a shaper, a planer, a power hacksaw, a forge with under the floor air draft sytem, a pneumatic drop hammer, a cupola, supply of coke, and crucible among other machine shop and carpenter shop equipment. However, the I.T. subsystem does not have on hand in Kongolo an inventory of the equipment and facilities purchased from SNCZ. Has some equipment removed from the shops? For example, were the powered metal shears and the two-meter wide set of powered rolls, now in an adjacent SNCZ shed, included in the sale? PNS is fortunate to have the elements for a good production and training facility as found in the SNCZ shops it acquired in Kongolo. Renovation of the I.T. shop facilities is about 85% completed.

Five old steel barges on a "marine railway" adjacent to the shop are the source of steel for the manufacture of agricultural and tools and village level processing equipment by the I.T. Subsystem. This source of steel is both an advantage and a curse. An advantage is that the steel is in Kongolo. A curse is that the steel is unsuitable for a tool such as a machete which must be able to retain a sharp edge and be easily bent under ordinary usage.

The I.T. Subsystem got off to a fast start in producing agricultural tools such as hoes, machettes and coupe-coupes.

"There is no good English translation of coupe-coupe although the word Scythe is sometimes used. The coupe-coupe used in Zaire is approximately 75 cm. long and resembles a lightweight machette sharpened on both edges about one-fifth of the length back from the blade tip. Since the coupe-coupe is used primarily for cutting grass, the sharpened portion is often soft bent at an angle to the major plane of the tool". In September 1977, the Subsystem was producing 200 tools per month.

What suggestions did previous evaluations make in regards to the I.T. subsystem? Has the I.T. Subsystem implemented the recommendations?

The Dimpex Evaluation of mid 1979 (Ref. 5) said little about the I.T. Subsystem, but noted that "the program is progessing generally as projected by the PP". The report contained four general recommendations."

1. The Subsytem should obtain help in gathering information concerning the demands for and the problems encountered in the use of I.T. manufactured tools.
2. The manufacturing cost and the selling price of tools should be adjusted so that the I.T. subsystem becomes a profitable venture in 1982.
3. Thought should be given to the disposal of the I.T. subsystem at the end of the project.
4. Some on-the-job training be provided for selected technicians.

The Fiebig report, "Small Agricultural Tool Production in Zaire", of May 1981 (Ref. 2) did not make any recommendations.

The Mueller report of August 1981 (Ref. 3) recommended that I.T. purchase one railcar load of used rails immediately. Railroad rails are of sufficient carbon content so thatthey can be used to make good quality machetes axes, and hoes.

The I.T. subsystem attempted to establish a feed back system to provide information about the demands for and problems with I.T. tools by inaugurating the "ITSS Research and Development Service" at the end of 1980. However, since this service consists of one person, Cit. Katuta Wailunga, it cannot be very effective as a feedback mechanism.

As to the recommendation that the manufacturing cost and the selling price of the tools he brought into line so that the Intermediate Technology Subsystem becomes self supporting; an attempt has been made to do so by increasing the prices of tools and doing more outside repair work.

Between August 1981 and November 1981 the prices of tools and machines were increased substantially. For example the price of hoes was increased from 6Z to 10Z, machetes from 7Z to 10Z, and coupe-coupes from 7Z to 12Z. An increase of output of tools would also reduce unit cost and thus increase profitability, but until quality of the tools is improved, there will be farmer resistance to purchasing PNS tools.

It is estimated (Ref. 3) that there are 125,000 basic hand tools in use in the PNS area, but that 75,000 more hand tools are needed. When one assumes that the average hand tool last five years, than there is a replacement market of approximately 25,000 hand tools per year. Since the I.T. shop has produced tools at the rate of 8500 per year (based on 4,248 tools being produced in first six months of 1981), depending on the tool mix, it would appear that sales should be assured.

Unfortunately the quality of the tools and the distribution network only three sales offices in PNS area work against increasing sales. As long as cost of production and distribution is higher than the selling price, tool production will not be financially viable.

Price list of I.T. as of Nov, 1981 and Current as of April, 1982

Hoe	10 Z ($1.79)	watering can	40 Z ($7.16)
Axe	10 Z ($1.79)	rake	15 Z($2.68)
Coupe-coupe	12 Z(2.15)	Maize shelling aid	10 Z($1.79)
Machette	10 Z ($1.79)	Palm oil extractor	500 Z($89.45)
Shovel	10 Z ($2.68)	Peanut decortication	300 Z($53.67)
Trowel	10 Z ($1.79)	Used steel plate	15/kg($1.22/lb)
Chisel	15 Z ($2.68)		
Hammer	30 Z ($5.37)		

"based on exchange rate of 5.59 Z per 1,00 U.S.$

The recommendation in the Mueller report that the Intermediate Technology sybsystem purchase a railcar of used railroad rails from SNCZ in Lubumbashi at a low price of about 300Z per ton, but now SNCZ doen't want to sell the rails. The pneumatic hammer in the Intermediate Technology forge shop would have made it possible to make tools from the steel rails.

Has the production levels of the basic agricultural hand tools and the end-use of the tools met the project objectives?

In September 1977, tool production was at the rate of 200 tools per month. In considering only the basic agricultural tools - the hoes, machetes, and coupe-coupes -- the average production rate was as follows (Ref. 14):

Year	Total	Monthly average
1977	-0-	200
1978	7,267	606
1979	5,497	458
1980	5,747	479
1981	6,343	528
1st quarter 1982	1,117	272

Source : Ref. 14

It can be seen from the monthly average of hoe, machete and coupe-coupe production that the highest rate of production was in 1978. Production then decreased due to the fact that the steel plate could not be removed from the barges at a sufficiently rapid rate. Removal of the rivets was the problem, but this bottleneck was solved by obtaining pneumatic chisels. Production then increased. The workemen were working on a bonus system. For each tool produced above a daily quota, a production bonus was paid. Unfortunately, lack of a suitable inspection standard resulted in an increased production of poor quality tools.

During the first quarter of 1982 the rate of production decreased due to lack of sales and a supply of tools in stock at the tool sales office in Kongolo, Mbulula, and Nyunzu. At the same time the Chief of the subsection tighned up on quality by rejecting the very poorest tools made by the workmen.

So it appears that the I.T. Subsystem has fairly well met the goal of the project in regards to the number of basic tools produced, but has done a poor job in regards to tool quality and tool selection. For example, the hoe preferred for weeding has a shape different from one used for tillage, but I.T. offers only one model.

Training has been conducted at three levels in the Intermediate Technology Subsystem:

1. Training of the Subsection Chief and his advisor
2. Training of I.T. workforce
3. Training of blacksmiths.

During the first half of 1977 the I.T. Subsystem Chief, received approximately a month's training in Intermediate Technology at the Centre de Development Communitaire (CEDECO) at Kimpese, Bas-Zaire. During the last quarter of 1977, the I.T. Subsystem advisor went to England for one month's training in blacksmithing and related activity. Three years later beginning in October 1980, the I.T. Subsystem Chief, spent 3 months at GRET (Groupe de Recherche et D'Echange Technologique in Marseilles, France to study intermediate technology). The training in France had much in the philosophy of Intermediate Technology but little in technical details.

Upon reviewing the first five years of the Intermediate Technology Sybsystem, it appears to me that the expatriate advisor did not have the experience required to provide needed advice and training to the chief of the I.T. Subsystem. For example, the machine tools acquired with the SNCZ shop facilities could be very valuable in manufacturing needed appropriate technology such as burr mills for grinding maize and cassava, oil palm presses, peanut decorticators, etc.

Moreover, the advisor did not obtain four elementary items necessary for utilizing a lathe and found in any operating machine shop:

1. a set of micrometers
2. a reference book for the machinist
3. cutting oil
4. a bench grinder reserved for tool bits.

Micrometers and associated calipers and depth gages are required if one is to receive the unique advantages of machine tools. As of April 1982, the finest measuring device in the I.T. Subsystem is one venier caliper.

Reference books such as the "Machinist's Handbook" or "Mark's Mechanical Engineering Handbook" in English as well as similar handbooks in French are required where machine tools are being used or metals are being forged. Such references provide information on cutting speeds, tempering temperatures, clearances for various fits, etc. In particular, where people are to be trained and the chief of the subsection is to become more efficient, such a reference book should be obtained at the initiation of the project. As of April 1982, no such references are available to the I.T. Subsystem.

Cutting oil, sometimes called machining fluid, is required when doing some types of metal cutting. The I.T. Section attempted to get by, using diesel fuel as cutting oil until 1981, when a new advisor in the Infrastructure Subsection ordered some cutting oil .

Grinders are essential for fine grinding such as sharpening drills and bits, and rough grinding such as removing flash from castings. To keep the grinding fine work, and another wheel for

fine grinding. Grinding wheels should be kept square and true by means of a simple tool called a "grinding wheel dresser". As of today there is no grinding whell dresser nor a bench grinder reserved for the fine work of sharmening drills or tool bits, in the I.T. Subsystem shop.

The training of the I.T. shop workforce has been an important element in the operation of the I.T. Subsystem. In September 1977 the I.T. Subsystem Chief Sedzabo and six other persons. Today it consists of 39, including :

1	Subsection Chief	2	Electric & Gas Welders
1	Subsection Asst. Chief	3	Mechanists
1	Research & Development Man	3	Carpenters
6	Blacksmiths	7	Maintenance
6	Foundrymen	4	Office Perso...
3	Metal Cutters on Barges		
2	Metal Cutters on Shears.		

There is no formal training program for the workers in the I.T. subsystem; however, when electrical and acetylene welding equipmment was obtained, a retired SNCZ welder was hired to teach two I.T. employees to be welders and when the foundry was renovated, a former SNCZ foundryman was hired to teach the others. The three machinists are young men who were trained in Kalemie.

A program to train village blacksmiths has always been a part of the I.T. program. The original project paper had a goal of eighty trained blacksmiths by September 1982 (Ref. 16). With the training of the last group in November, 1981, eighty-six blacksmiths have been trained (Ref. 1). So statistically, this segment of the I.T. subsection has met the Project Paper's goal.

The blacksmithing training consists of a two week course in Kongolo. The blacksmiths lodge at the home of I.T. workers. Each blacksmith receives 10 Z per day (as of Nov. 1981) to pay for food, soap, etc.

The blacksmiths are taught metal selection, tempering, tool making and management. Each participant makes a set of tools for his own use. At the end of the training period a "graduation" party is held for the trainees and their hosts.

An area of blacksmithing which does not receive attention in the training program is the forge. At the I.T. shop an electric blower provides a steady supply of air through underground pipes to the forges. Most village blacksmiths in North Shaba use a crude in-ground type of forge with poor air draft. A study of air draft systems used on forges in Indonesia and Ghana for example.

The blacksmith should also receive some training in the disassembly of the burr mill, peanut decorticator, and oil palm press, since the village blacksmith is a logical village focus for machine adjustment.

Unfortunately after the blacksmiths return to their villages with supply of steel there is not an effective distribution system to insure that blacksmiths can obtain additional steel to continue to make tools. This problem must be solved if blacksmith training is to produce results.

The Kongolo I.T. Center is the most satisfactory site for training blacksmiths,since equipment and materials as well as I.T. blacksmiths are in Kongolo. Furthermore, at Kongolo there is an opportunity to teach blacksmiths about maize mills, peanut decorticators and other I.T. machines. The I.T. shop at Kongolo should be the one blacksmith training center for the PNS area.

Integration of agricultural research and intermediate techlology research

Agricultural Research is conducted under the Research and Extension Subsystem (R&V). It is my opinion that there should not be a formal integration of the Intermediate Technology Subsystem with the research function of R&V for it has had serious difficulties in carrying out the research function. An integration of Agricultural Research and Intermediate Technology would probably be a detriment to each.

Examination of Agricultural equipment and discussions with people at the Ngaba Research Station reveal that land preparation and the growing of maize for seed multiplication was accomplished by tractor mechanization. The Ford 5600 and Fiat 880 farm tractors, Massey-Ferguson 3-bottom discplow, Ford 309 corn planter, and the I.H. 133 field cultivator which I saw at Ngaba on April 14, enables the research station to grow maize in a mechanized fashion. This is appropriate for seed multiplication and those experimental trials which do not require a farming or cultivation system as used by the farmer in North Shaba. However, when the research plots are such that the plots are to reflect conditions in farmers' fields, hoes, machetes, coupe-coupes, maize shellers, etc. manufactured by the Intermediate Technology Subsystem should be used in the research trials.

There is a definite need for increased cooperation between the Extension function of the R&V and the I.T. subsystem. At present there is little cooperation between I.T. and the Extension part of R&V. The approximately 65 Extension Persons have not been trained in the use of the tools and machines produced or imported by I.T.

The extension persons should receive training in the use of I.T. machines so that they could better serve both the farmer and

the project by being knowledgeable about the machines produced by I.T. and serve as a feed-back loop information and suggestions about improving farmers tools and village level machines produced by the I.T. subsystem.

Appropriate Tools and Equipment for the Project Area

The cash income of the average farm family in the North Shaba Project area is uncertain, but is probably somewhere in the range of 325Z" to 1,000Z"" per farm household. Of course these area gross estimates.

Since hoes, machetes, and coupe-coues are basic farming tools, there will continue to be a demand for good quality tools at a reasonable price. Processing machinery which serve more than one household in a village is also appropriate.

The Intermediate Technology Subsystem has the machine tools and foundry which could be used to manufacture the simple processing machines for which there is a need and a demand in the villages Peanut decorticators, burr mills to grind maize, rice hullers, and perhaps water pumps, are appropriate and affordable at the village level. Unfortunately, the machines thus far developed by I.T. still require design improvements to reduce cost and to improve performance and maintenance charactetistics.

"Le Revenue per Menage dans l'Aire du P.N.S. 1980 from S.C.A.D. in which the cash income of 325Z was a total of: 167 from maize; 143 palm oil; 5 cotton, and 10 peanuts.

"" See page 50 of Project North-Shaba Report.Annual 1980/81 (Ref. 18). If the product of the production and prices is divided by the 29,000 farm families, a cash income of approximately 1,000Z per farm household is obtained.

When developing or adapting a machine to produce in the I.T. shop for use by the farmer or in the village, some design work must be done. For a trained engineer such as the I.T. Subsystem Chief or the former I.T. advisor, design should be most readily accomplished by using a drawing board and describing the machine and its parts as mechanical drawings. However, the I.T. facilities do not enclude a drawing board and there are no drawings of machines which have been developed by the I.T. subsystem. By first designing a machine on paper, it is easier to make changes and secure a design which will have a minimum of shop operations and usually less scrap.

However, sometimes it is easier and faster to copy an imported machine and test the local version before making drawings. If the version performs satisfactorily, than drawings and/or templates are made to be used in manufacturing the units. The I.T. Subsection does have templates for manufacturing the peanut decorticator.

In my opinion the following tools and machines are not only needed by the farmers and could be purchased by the farmers, but the I.T. shop could manufacture them if proper materials were employed, designs were adopted to available materials and shop tools, and the machines and facilities of the I.T. shop were utilized more fully. For more comments about design features of some of the I.T. designed machines see Appendix D.

Recommended Simple Tools

1. Digging hoe
2. Cultivating hoe
3. Machete
4. Coupe-Coupe

Recommended Village Level Machines

1. Manually powered burr Mill (for grinding maize)
2. Peanut Decorticator
3. Oil palm press
4. Oil palm nut cracker
5. Water pump
6. Pedal thresher for rice
7. Manually operated rice huller.

What is the future financial viability of the Intermediate Technology Subsystem?

The original Project Paper (Ref. 16), the amended Project Paper of August 1980 (Ref. 17) and the Dimpex Evaluation (Ref. 5) mentioned the fact that the I.T. Subsystem is to be financially self sufficient by October 1982 and that the subsystem at the end of the project be sold or given to a private group, organization, or individual as profit-making venture. The chief of the sub-section and his advisor have made efforts to make the subsystem self-supporting. Suggestions for the disposal of the subsystem have been of a general nature and not specific proposal.

The Intermediate Technology Subsystem with its payroll of thirty-nine persons currently performs four primary functions:

1. Manufacturing hand tools
2. Training blacksmiths
3. Constructing some village level processing machines
4. Repairing equipment for merchants, other PNS subsystems, and some farmers.

Intermediate Technology Subsystem's physical plant is certainly the basis for quality production of tools and machines.

In 1976 Project North Shaba purchased buildings, a number of machine tools (old but usable) and five old river boats for $375,000. The boats were purchased for their steel plate. At the time it was assumed that $1.00/kg was being paid for the usable steel in the boats (Ref. 3).

Subsidization of the I.T. Subsystem in Project North Shaba to renovate the shops, hire an advisor and train blacksmiths has been justified. The persons in the project area who receive blacksmith training did not have the financial means to pay for the two weeks of training which they received.

Development of village level machines requires an investment of money in design time and the building and testing of prototypes with financial self sustainability expected at a future date. Unfortunately, as of May 1982 the Intermediate Technology Subsystem does not have any machines ready for production which can be produced and sold at a breakeven point or for a profit. This portion of the program will require a continued expenditure of money with the expectation that suitable units can be manufactured and sold by I.T. within the next six or nine months, assuming that the subsystem receives some design help.

Repairing equipment for merchants, other PNS Subsystems and some farmers should not be done at a loss and should not require subsidization, but at present there is a lack of accounting data and facts in both I.T. and P.M.U. as to the degree of profit or loss in each of the four primary functions of the Intermediate Technology.

A detailed study of the cost of producing tools in the Intermediate Technolgy shop is contained in the Mueller Report (Ref. 3). Basing the costs on the first six months of production in 1981, Mueller estimated that the three most common tools had the following costs:

	Machete	Coupe-Coupe	Hoe
Gen: production cost	5.01	5.01	10.02
Depreciation	3.01	3.01	6.02
Cost of steel at 5.50Z/kg	3.58	4.95	4.13
TOTAL I.T. Cost	17.18	18.55	20.13
I.T. Selling Price (Nov. 1981)	10.00	12.00	10.00
UMAZ (Kinshasa)	12.82	--	17.36
Chanimetal (Kinshasa)	15.01	14.61	18.25

Sources: Price List of 1 Nov. 1981 Mueller Report (Ref. 3)

The Mueller study states that the cost of handles is excessive and should be reduced. Handles cost $ 2 in the villages. The UMAZ and Chanimetal tools would be two or three $ dollars highe in cost in Kongolo because of transportation charges; thus, when these conditions are taken into account it is possible that the cost of an I.T. produced tool in Kongolo will be no higher than a tool imported from Kinshasa. Unfortunately, even if the cost of the wooden handle is reduced by $3.50 and the deprection is ignored, the current selling price will not cover manufacturing costs. The price of the tools must increase if the I.T. tools are to reflect all the costs which should be assigned to them. However, then the I.T. tools would be priced at about the same price as the tools imported into North Shaba. Sales of the I.T. tools would drop because the I.T. tools are generally of lower quality.

In the foreseeable future, there will probably need to be a hidden subsidy in that the steel for the tools was purchased in 1976 and there is no current payments being made into a sinking fund for future steel purchases or into a sinking fund to reflect depreciation of plant machinery.

CHAPTER 4 - SUSTAINABILITY OF THE I.T. SUBSYSTEM

What can be done to provide the Intermediate Technology Subsystem with a better chance of sustainability and make it a more desirable entity to sell to a private, governmental, or philanthropic organization? In this section two lines of action will be discussed. One for the situation where the project ends as scheduled on September 30, 1983, and the other for the situation where the project would be extended.

Village Level Processing Equipment

Since there is a farmer demand for village level processing equipment such as maize mills (burr mills) and since the I.T. Subsystem has the facilities to produce such equipment, an opportunity exists for the I.T. Subsystem to fulfill farmer's need. Unfortunately, I.T. has not yet constructed a complete maize mill. To manufacture maize mills or other machines which function properly and can be sold at a reasonable cost, I.T. must make more efficient use of its plant resources and labor force. Using the maize mill as an example the following changes must be affected.

First, the design of the mill must be selected. Twenty small Hunt manual powered burr mills and twenty large Hunt manual powered burr mills are currently in use in the PNS area. One of these designs should be selected to be copied. If the large unit is too difficult to be powered by the people using it, then perhaps the smaller unit should be selected as the unit to manufacture. For more discussion about burr mill design see Appendix D. The HUNT burr mill is made in England and is common in Africa. Copies of it are being manufactured in some local foundries in Africa, so there is no need to purchase various mills and conduct a testing program.

Outside of the grinding plates, position of hopper, and feed screw, the mill should be redesigned to use the materials which the I.T. shop has in abundance. For example, the stand supporting the mill should be a weldment made from the steel angles being removed from the barges.

Who will do the redesign? A weakness of the I.T. subsection is that of machine design. An expert in the design of machines for local manufacturing and simple maintenance should be hired to spend two months in Kongolo working with the I.T. Chief, Assistant Chief and Research and Development Man redesigning the mill for I.T. manufacture and teaching the above three persons the elements of practical machine design where the facilities of the plant, capabilities of the workmen, desires of the farmers, and the financial constraints are reflected in the final design.

The cupola uses scrap cast iron as its raw material, thus the steel plates from the old river boats are not used in the foundry. The foundry is a key resource in building village level processing machines and in creating an entity which will have value at the time it is sold by PNS. As early as possible a practical expert foundryman should be hired as a consultant for one or two months to make recommendations and to teach the I.T. foundrymen to make better castings. Unless this occurs, the foundry will continue to produce high cost castings. As the foundry improves, it will not only be an essential part of the manufacturing work of the I.T. subsystem, but will be valuable for repair services.

The I.T. machine shop has tools which are not being fully utilized. Of course part of this lack of utilization is that more lathes and other machines then necessary for the PNS project were in the shop purchased from SNCZ. These machines can be utilized in manufacturing village level equipment. But who will help the Chief of the I.T. subsystem teach the machinists better practices and obtain at least normal productivity from the equipment?

The current mechanical advisor in the Infrastructure subystem, Mr. Robert Engisch, is very knowledgeable about machine tools and the operation of a machine shop.

It may be well to have a portion of this advisor's effort seconded to I.T. for the machine tools until September 1983. The arrangement should be beneficial to both Infrastructure and I.T. Infrastructure has need of lathes, shapers and milling machines to make repair parts for their road building equipment while I.T. requires training in the proper use of the machine tools There is always the possibility of a conflict between personalities in I.T. and Infrastructure but in this particular arrangement both subsystems have much to gain by working together.

The quality and quantity of maize mill parts should improve if the above steps are taken.

Hand Tools

It is generally known that I.T. hand tools are of low quality. Because of the steel used for the tools, the tools cannot be expected to keep a cutting edge. However, there is a demand as long as the higher quality tools imported from Kinshasa or from foreign countries are much higher priced. Good tools because of their higher cost are not always available in North Shaba where merchants often perfer to put their money into consumable items which cost less per unit and have a much higher turn over rate than do agricultural tools. Therefore, tool production should continue at the low level it was running during the first quarter of 1982. One or two men would make tools every day, the other blacksmiths would only make tools when they are not engaged in other manufacturing or repair work. In an effort to upgrade

quality, perhaps each blacksmith should stamp his mark as well as a PNS mark onto each tool he makes.

Because of the cost of shipping the tools from Kinshasa to North Shaba, it should be mossible for the poorer quality tools to compete. The demand for tools would be met by tools imported from Kinshasa or Lubumbashi, I.T. produced tools and blacksmith produced tools.

Repair Work

In various visits to the I.T. shop, it appeared to me that repair work was consuming a lot of I.T. manpower, but is this effort contributing to the overall PNS project? Is it generating sufficient income to recover costs or is it providing a subsidized service to Kongolo area and merchants?

The I.T. shop charges 30Z per hour ($5.73/hr at official rate) for repair work no matter how many workman are involved on the job. If electric welding is required, there is an additional charge of 2Z per stick of welding rod ($3.36 official rate). In 1981, the gross income from repair work was at an average rate of 2,224Z per month. During the first quarter of 1982, the average monthly gross income is 4,220Z per month.

Assuming that income from repair work is 4,220Z per month and that only labor at 30Z per hour was used (not the actual condition since many of the repairs require are welding), it would mean 140 hours of work. Assuming that only one man did repair work and he works 7 1/2 hours per day, the repair current level of repair work would keep him busy 19 days/month out of the normal 22 working days in a month.

In order to make fair charges for repair work and to reduce conditions that may encourage dishonesty in the future in the reporting of repair income, the method of calculating charges should be based upon number of man hours consumed, supplies such as welding rod, consumed, and a percentage surcharge added to the cost of labor and supplies, for it is logical that a job demands more man-hours of effort should be charged more than one requiring fewer man- hours of efforts

The PMU and the Chief of the I.T. Subsection should also review together the present system of payment of repair work and the physical disposition of customer payments to insure that the opportunity for misappropriation of customes payments is minimal.

I believe that the repair service for farmers and businessmen should continue but that the method of computing charges should be reviewed and changes instituted so that charges reflect the cost in wages, supplies, depreciation, and capital so that the I.T system is not subsiding the repair service.

A program should be set up to train village blacksmiths in maintenance and simple repair of maize mills. This training should take place under the extension function of the R&V Subsystem with funds from that subsystem, but with the teaching conducted by I.T. Subsystem personnel. If simple machines such as maize mills are to release women for other work, it is essential that there be a person in the village who has some knowledge about the operation and repair of such a device.

Those with Extension responsibilities in the R&V Subsystem do meet on a regular basis. At some of these meetings, the I.T. Subsystem Chief and some other I.T. personnel should be invited to discuss specific subjects such as maize mills, machine distribution, repair charges, etc.

- Assuming that Project North Shaba is extended beyond September 1983 -

If Project North Shaba is extended beyond September 1983, the same actions should be taken as in the situation where the project is not to be extended.

In October 1983, if I.T. is self supporting, it should continue as suggested above. If it is not self supporting, the machine shop should be transferred to the Infrastructure Subsystem and the foundry and forge shop, closed down or sold.

If the I.T. Subsystem is not profitable by October 1983, and if the current economic slump in mining and thus metal working companies in Zaire continue it will probably be difficult to find a buyer for the I.T. Subsystem. Since the I.T. Subsystem currently serves as a repair center for merchants and farmers in the Kongolo area, some equipment might be sold to a private businessman who would continue as a repair center for the Kongolo area.

CHAPTER 5 - REPLICABILITY/ADAPTABILITY

If Project North Shaba were to be replicated in another area of Zaire, would it be possible to replicate the present Intermediate Technology Subsystem as part of the replicated Project? The answer is "no, it is not very likely".

The PNS I.T. Subsystem facilities such as the machine shop, foundry and raw materials (mild steel, coke, scrap iron) which were available in Kongolo are unlikely to be available in most areas of Zaire requiring an agricultural development project. Furthermore we can learn from experience, in fact if Project North Shaba were to be established in North Shaba tomorrow, the Intermediate Technology Subsystem should not be an exact copy of the present Project North Shaba.

- Adaptating of the I.T. Subsystem to other rural development projects in Zaire is feasible. Of the primary responsabilities of the I.T. Subsystem of Project North Shaba - tool production, blacksmith training, manufacture of village level machines, and, repair services, the activities would be in the following order of priority with 1 of first priority :

1. training of blacksmiths
2. repair services
3. assembly of village level machines
4. manufacture of agricultural tools.

The first two activities are essential, the third is desirable, and the fourth not required in most situations.

The training of blacksmiths is important since it is the local blacksmith who will be available to repair hand tools or to make new

tools. The training of the blacksmith should also include learning about the operation, maintenance, and repair of village level machines such as maize mills

It is essential that refresher training be conducted annually for the blacksmiths so that they may continue to inprove their skills. This has not been done in Project North Shaba.

The North Shaba Project is also revealing the importance of establishing a raw material supply network for the blacksmiths. In some areas of Zaire local sources of scrap metal will be able to supply the blacksmiths, but in other areas such as North Shaba a distribution system utilizing Project Personnel, grain merchants or other already linked by an information or a trading network will be required to supply steel to the blacksmiths.

A repair service by an Intermediate Technology Subsystem Center in essential to repair those machines which cannot be repaired by the local blacksmiths. The same facilities will also be used for training blacksmiths.

Mass production of agricultural tools such as machetes, coupe-coupes and hoes should in most cases not be undertaken in most situation since present production facilities of such tools are underutilized. Present factories in Kinshasa and Lubumbashi are also in areas where the quality of steel required is more readily available than in most agricultural regions of Zaire.

The manufacture of village level machines should probably be part manufacturing and part assembly with certain specialized parts imported from manufacturing centers in Zaire or overseas and final assembly and some manufacturing done at the I.T. Center.

It is essential that as part of any rural development plan which includes an Intermediate Technology Center for the distrib-

ution and/or manufacturing of agricultural tools or machines that a market survey be first made in the project area to determine what the farmers state they need, what they will pay for those devices, and the amount of cash income they probably will have available to buy the tools or machines. Without such knowledge about the "customer" the project will be severely handicapped.

CHAPTER 6 - RECOMMENDATIONS

The following recommendations apply to the Intermediate Technology Subsystem which according to the Amended Project Paper (Ref. 17) is to be self supporting by September 1982 and sold to an organization or person by the termination of Project North Shaba.

1. Within in the next several months a technical expert in practical operation of a gray iron foundry, particularly in the areas of cupola operation, sand conditioning, mold technique and pouring techniques should be hired to work with the I.T. Subsystem Chief and the foundry group for a month in teaching them better gray iron casting techniques. The expert should be French speaking. Such a person is probably available in the Lubumbashi or Kinshasa areas.

2. Beginning immediately and continuing until September 1983, a portion of Infrastructure Subsystem's Mechanical Advisor's time should be seconded from Infrastructure to the machine shop area of the I.T. Subsystem for the purpose of improving machine shop operation and machine tool maintenance.

3. An engineer with practical experience in the design for manufacture and use of village level processing machines he hired for two months to work with the Chief, Assistant Chief and Research and Development man to aid and to teach that in the process and design technique required in redesigning a machine to be produced in the I.T. facilities and sold to farmers in North Shaba in particular and Zaire generally. This expert should be in Kongolo within the next few months but his visit should not coincide with that of the foundry expert. He will need to bring his own drawing instruments.

4. Emphasis should be placed on making repair parts and eventually complete maize grinders.

5. Small Agricultural tools production should continue but at the current reduced rate of about 300 per month.

6. The repair service schedule of charges should be revised to more accurately reflect actual costs and the system of calculating charges and payment of those charges be revised to obtain a better accounting procedure with financial safegards.

7. PMU should be more responsive in providing the I.T. Subsystem with information such as monthly sales of types of tools and budget information since this information is needed to manage the subsecti

8. The subsection Chief should be given the authority for approving vacation for the employees in his subsection since he is the on responsible for the subsection. At presentthe Director of the project must approve an individual's dates of vacation.

9. The PMU should actively seek a buyer of the I.T. facilities after making an inventory of plant equipment and comparing it with the inventory of the items purchased from SNCZ.

10. The distribution of tools produced by I.T. or purchased elsewhere should be through the extension arm of the project. It may be necessary for PMU to forciably persuade the two subsections to work as a team.

11. Reference book such as the Machinist's Handbook as well as some micrometers be obtained for the I.T. machine shop.

A P P E N D I C E S

A. - References

B. - Persons consulted in Zaire

C. - Organization Chart of Intermediate Technology Subsystem

D. - Comments about some Processing Machines being developed by the I.T. Subsystem.

APPENDIX A

REFERENCES

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18. Project Nord-Shaba Rapport Annuel 1980/81 by Direction (in French)

APPENDIX B

PERSONS CONSULTED IN ZAIRE*

USAID/KINSHASA

Washington, D.C. 20523

1. Mr. Norman L. Sweet
   Mission Director

2. Mr. Lee Braddock
   Planning & Evaluation Officer

3. Mr. Richard Peters
   Food & Agriculture Officer

4. Mr. David Soroko
   Project Officer of Project North Shaba

5. Mr. Ike T. Hatchimonji
   Project Office of Cassava Outreach Project

6. Mr. Ross Wherry
   Project Officer

Project Nord-Shaba
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Kongolo, Nord-Shaba, Zaire

1. Cit. Mateso
   Director

2. Dr. David Gow
   Development Alternative Inc. Advisor

3. Mr. David Ackerman
   Director for Administration and Finance

4. Cit. Sedzabo Seke
   Chief, Intermediate Technology Subsystem

5. Cit. Bakulu Batangi
   Asst. Chief, Intermediate Technology Subsystem

6. Cit. Katuta Wailunga
   Research & Development, Intermediate Technology Subsystem

7. Mr. John Gold
   Advisor for SCAD

---

* In Zaire the Family name is written first.

8. Cit. Useni
   Chief, Research & Extension Subsystem

9. Cit. Kangudi
   Asst. Chief of Research

10. Mr. William J. Dalrymple
    Advisor to the Farmer Group Development Subsystem

11. Cit. Mpunga
    Chief of Marketing & Credit Subsystem

12. Mr. Phil Keasey
    Advisor to Chief of Infrastructure Subsystem

13. Cit. Dibwe
    Mechanical Maintenance Group Leader in Infrastructure

14. Mr. Robert Engisch
    Advisor to Mechanical Maintenance Group in Infrastructure

15. Mr. Charles Calnan
    Advisor on Bridge Building in Infrastructure

16. Mr. John Loftin
    Advisor on Road Rehabilitation in Infrastructure

17. Mr. Ed Salm
    Project Pilot and Aircraft Mechanic

18. Mr. Ronald Mininger
    Development Alternatives Inc. Logistics Expediter in Kinshasa

Project Nord-Shaba
NYUNZU, Nord-Shaba

1. Cit. Esul Bwar a Bwar
   Chef de Secteur

2. Cit. Nasibu Azazi Kamwanga
   Asst. Chief, Extenstion

3. Cit. Sinuko Mpyana
   Asst. Chief, Extension

Department of Agriculture, Government of Zaire

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1. Cit. Luamba me Duma
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1. D. Pels
   Director, Manufacturing

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1. Cit. Ally Diwani Mwinyi
   Director

ITTA/Zairian National Cassava Program (INERA)

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Gare-Mueke, Bas-Zaire
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Kinshasa

1. Dr. T.P. Singh
   Cassava Breeder
2. Dr. S.J. Pandey
   Extension Agronomist

Kuvu Sola Mission

B.P. 6, Kongolo
Nord Shaba, Zaire

1. Padre Antonio
2. Sister Elizabeth

Others

1. Mr. William Fiebig
   B.P. 233
   Kikwit, Bandundu, Zaire
   (He wrote the report "Small Agr. Tool Production in Zaire)

2. M. Francis DeCock
   Chef de Secteur
   ESTAGRICO
   Kongolo, Nord-Shaba

3. Mr. Shafegine Kanj
   Maize Trader
   Kongolo, Nord Shaba

4. Cit. Lomena S.M. Ibere
   12980 E. 47th Ave, Circle
   Denver. Colo.
   (Cit. Lomena is a mining engineer studying at the Colorado School of Mines. I met him at the Cassava Research Station where he was providing advice on drilling a water well)

5. Chief Mahundu
   Chief and Blacksmith
   Village of Siulu near Kongolo

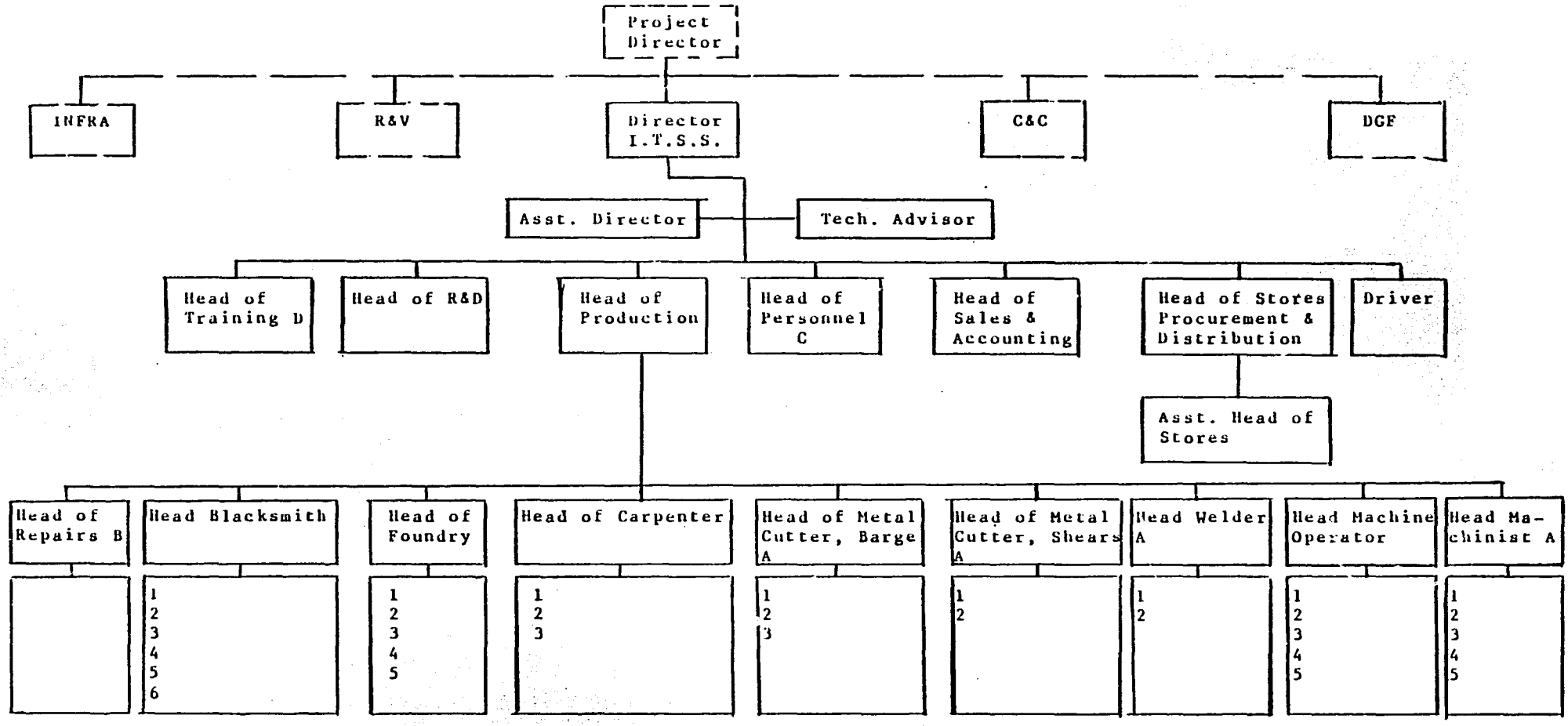
6. Dirk & Mia Pannecoucke
   Medial Agent
   Kongolo, Nord Shaba

7. Mr. James Diderich
   Peace Corps Volunteer in Zaire
   (taught blacksmithing at Institut Professionel de Katoka (IPROKA) in Kananga)

Evaluation Team

L. David Redding, Team Leader & Economist
2. Henry C. Wiggin, Research Specialist
3. Joseph K. Campbell, Agricultural Engineer
4. Andree Black-Michaud, Rural Development
5. Sanath K. Reddy, Extenstion Agronomist
6. Mike Spiegel, Civil Engineer
7. Everett L. Headrick, Project Management
8. Sylvia Watts, Women in Development
9. David Leong, USAID-Washington
10. Betsy Stephens - Health
11. Louise Fresco - Agriculturist, U.N.

APPENDIX - C ORGANIZATION CHART OF INTERMEDIATE TECHNOLOGY SUB-SYSTEM.



A- Filled by Head of Production
B- Filled by Head of R&D
C- Filled by Head of Stores & Head of Accounting
D- Filled by Assistant Director

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APPENDIX D

Comments about some Processing Machines being developed by the Intermediate Technology Subsystem

Manually operated Burr Mill

This type of mill is used throughout Africa to grind maize or dried cassava into flour and peanuts into paste. In 1978 I.T. received 20 small and 20 large manually operated Hunt (English) burr mills. Thse mills were sold to farmers or farmer groups.

These mills sold for 550 Z and have received acceptance by the purchasers. There have been some problems. For example some of the set screws securing the drive wheel to the shaft loosened because there were no locknuts. Inadequate lubrication has also been a problem in some cases, but this is to be expected in a non-mechanized group of society. These problems emphasize the need for training purchasers of the mills in proper adjustment and lubrication.

The working part of this type of mill consist of two identical cast iron grinding plates. Replicas of the plates have been made in the I.T. foundry. Although the body of the Hunt mill is a gray iron casting, the body could be designed to be made out of the 5 mm mild steel plates from the barges. It would be necessary to import into Kongolo steel shafting for the one shaft in the mill. Until the I.T. foundry improves its casting technique, it will be better to design the mill with a fabricated sheet steel body.

In an I.T. produced mill attention should also be given to using pins instead of set screws and lock nuts where possible; heavier bushings; and the use of oil impregnated wooden thrust spacers to adjust for wear in the bronze thrust washers.

Peanut Decorticator

The current I.T. decorticator hulls peanuts, but it could be made simpler and the number of parts reduced by redesign. For example, instead of using pieces of pipe for the pivot bearings, the pivot point could be a hole cut into the angle iron frame section.

For the working face of the machine, a cast iron plate such as used on the imported peanut decorticator at the Kivu Sola Mission could be made in the I.T. foundry and used on the I.T. machine. Such a working plate would probably acommodate a greater variation in size of peanuts than the present I.T. design.

Furthermore, with such a working face, there is the possibility that by providing a second set of pivot points, and several retarding bars in the bottom of the decorticator, the unit could possibly be used to shell maize. It would be worth invertigating.

Oil Palm Press

The I.T. oil palm press is not really a press, but is an oil palm extractor which extracts oil from the pericorp of the palm fruit (in North Shaba, oil is not generally extracted from the kernel).

The traditional method of extracting palm oil is to first cook the palm fruit in boiling water and while still hot dump the fruit into a modified 55 gallon oil drum standing on end. The top of the drum is open while the bottom of the drum is perforated to allow the oil to drain into a collecting spout. An essential part of the device is a vertical wooden shaft set along the longitudinal axis of the oil drum, resting on a wooden thrust bearing at the bottom of the drum and at the top set in a hole in a cross bar attached to two vertical posts set about six feet each side of the oil extractor drum. About six cross sticks protude through that part of the vertical shaft within the oil drum. Two other cross sticks, each about six feet in length, protude from the verticle shaft at a height of four to four and a half feet above the ground.

Oil extraction occurs when two or four persons push against the two upper cross sticks as they walk around the drum, agitating the cooked fruit within the drum, releasing the oil from the pericap of the fruit.

A complaint of the traditional device is that people become dizzy.

To overcome the problem of diziness the I.T. Subsystem had designed and constructed from steel sheet an oil extractor which uses the same principle as used in the traditional extractor. In the I.T. oil extractor the rotating shaft to which the agitator arms are attached is a horizontal shaft which is powered by a crank on each end. Two people - each one turning a crank - power the extractor. However, people claim that the unit requires too much power and is tiring. In my opinion the unit probably does not require more power than the conventional oil extractor; however, in the conventional unit workers push the cross bars at chest level thus using both arm muscles and the strong leg muscles to power the agitator. In the I.T. unit a person uses only the muscles of one arm to power the agitator; the arm becomes tired and the workman states that the I.T. extractor "takes more power".

I.T. has an experimental model which is claimed to be an improved on the present design. The agitating shaft is vertical. It is still powered by two hand cranks. Each crank is cantilivered of the frame. At the end of each crank shaft is a cast iron bevel gear which meshes with a cast iron belvel pinion fastened to the vertical agitating shaft. In examining one of the units I found that much force on a crank can deflect the crankshaft sufficiently so that the bevel gear and pinion do not mesh.

Some additional question must be asked. Will the additional cost of the gears and additional bearing result in an oil extractor which is superior to the traditional design? If perchance the latest I.T. model is a much better oil extractor than the conventional unit can the farmer or village afford it? How does I.T. propose to eliminate the problem of gear deflection for if it occurs in the shop, it protends failures and broken gear teeth in the field?

Wire Loop Pedal Thresher

A wire loop pedal thresher is used for threshing rice and is a very common machine in S.E. Asia where the thresher is carried to the rice field so that the sheaves of rice do not need to be carried very far to the thresher. A foot treadle operates the threshing cylinder, thus the farmers hands are free to hold a sheave of rice while the machine threshes out the grain.

The I.T. Shop has constructed two prototypes. One unit 104 cm wide x 75 cm high x 112 cm deep appears to be too heavy and too large for easy transport. It is constructed primarily of wood.

A smaller unit has a cylinder of 45 cm diameter--as measured to the tips of the wire loops - and 46 cm length. This unit is approximately the size of those made in S.E. Asia. Unfortunately, the steel frame for the unit is so heavy that it too would be difficult to transport on a bicycle or to be carried some distance by two men. The small I.T. wire loop thresher uses a foot pedal and an eccentric mechanism to drive the threshing cylindre. It would probably be easier to use if a wooden treadle the length of the thresher were used instead of the metal foot pedal. Such a system is used on the small Asian pedal threshers. The International Rice Research Insitute (IRRI) in the Philippines has plans for such a thresher.

Another rice threshing device is a wheelbarrow thresher made from one common 200 liter oil drum. The International Institute of Tropical Agriculture (CIAT) in Cali, Columbia has a design (by Engineer Lloyd Johnson) for converting an oil drum into a wheelbarrow thresher. In this device the sheaf of rice is flaided across a grating on top of the "wheelbarrow". The rice falls into the box section of the device. As threshing occurs the device is wheeled from one area of the field to another. The wheelbarrow thresher can than be used to transport the grain to the farmer's house.

Of course before production of any of these units are mass produced, it is necessary to determine the selling price of the machine and the demand for the machine at the necessary price.