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CENTRE FOR AGRICULTURAL MECHANIZATION AND RURAL TECHNOLOGY
(CAMARTEC): AGRICULTURAL IMPLEMENTS PRODUCTION PLANT -
UPGRADING AND STRENGTHENING

TF/RAF/87/902

TANZANIA

Technical report: Development of rural technologies at CAMARTEC*

Prepared for the Government of Tanzania
by the United Nations Industrial Development Organization

Based on the work of Mr. H. Pearson,
consultant in workshop technology - CTA

Backstopping Officer: J. Fürkus, Engineering Industries Branch

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* This document has not been edited

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SUMMARY

This report summarizes the work carried out by the consultant in October/November 1988 in connection with the counterpart CAMARTEC engaged in the development of rural technologies.

The project will assist in the up-grading of equipment and services within the CAMARTEC workshop complex, to train and up-grade the resident technicians and rural artisans. Through the CTA and the resident junior expert the project will also assist in the modification to present designs of farm implements being produced and introduce new designs for testing and production in CAMARTEC and the rural areas.

The report includes workplans for the project and the junior expert, as well as recommendations for equipment purchase and modifications to the CAMARTEC workshop layouts.

Recommendations are made for the successful implementation of the project between CTA missions.

1. PURPOSE OF PROJECT/BACKGROUND INFORMATION

PURPOSE OF PROJECT:

To assist the Government of Tanzania and specifically the Centre for Agricultural Mechanization and Rural Technology for the production of agricultural tools and implements in strengthening their technological capability through institutional and manpower development with a view to achieve accelerated self-reliance.

BACKGROUND INFORMATION:

CAMARTEC:

The Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) was established by an act of parliament in November 1981. The aim of the Centre is to improve the quality of rural life through development, adaptation and implementation of appropriate technologies in the fields of agricultural mechanization, water supply, building construction and sanitation, rural transport and energy.

CAMARTEC officially started its operation in July 1982, is a merger of two separate institutions, one formally known as Tanzania Agricultural Machinery Testing Unit (TAMTU) and Arusha Appropriate Technology Project (AATP). TAMTU used to test agricultural machinery for suitability to Tanzania conditions. TAMTU activities date back to 1955. AATPU was started in 1957 as a project under Small Industries Development Organization (SIDO). The function of the project was to do research and development in building materials, rural transportation, energy and water supply. Both institutions apart from their station activities, had extension and production responsibilities to ensure that the developed technology reached the people in the field.

2. LOCATION/INTRODUCTION

LOCATION:

The Centre is located in Arusha region, Northern-Tanzania. The Centre is 16 km from Arusha municipality on the old Moshi Arusha road and railway. The location of the Centre offers a good working environment with cool temperatures and average rainfall. Located on 80 hectares of level land, there is enough room for a residential area, offices, workshops, testing ground and recreation.

Organizational Structure:

The Centre is a parastatal organization under the Ministry of Industry. The running of the Centre is directed by the Board of Directors under a Chairman appointed by the President of the United Republic of Tanzania. The day-to-day management of the Centre is directed by the Director-General also appointed by the President.

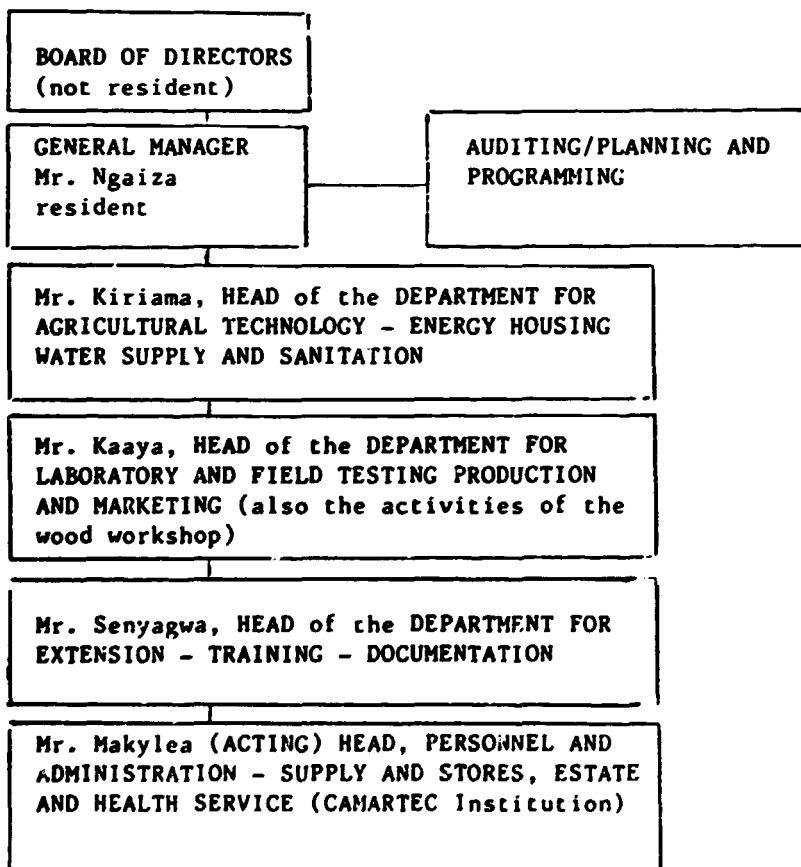
There are three directorates under the Director-General (see attached "Institutional Layout").

INTRODUCTION:

The author departed UNIDO/Vienna 1st November after briefing, arriving in Dar-es-Salaam, Tanzania, at 10:00 a.m. on 2nd November. Planned schedule was to proceed to the duty station at Arusha on Wednesday 3rd November. This was not possible due to the late completion of administrative procedures required in Dar-es-Salaam (DSM) and the cancellation of an alternative later flight. UNDP managed to book a seat on the afternoon flight for 4th November which arrived on time in Arusha.

Whilst in DSM the author met with the outgoing UNIDO SIDFA, Mr. Kikuchi, and Mr. Rasmussen, UNIDO/UNDP Programme Officer who went over various aspects of the project with him. The three main priorities for the present mission being: identification of workshop equipment for purchase, re-organization of CAMARTEC workshop and junior expert work programme.

3. CAMARTEC ORGANIZATIONAL STRUCTURE



The above Heads of Departments are responsible to the General Manager and weekly meetings are held to discuss the CAMARTEC programme. The 3 technical Departments represent 3 workshops, in which the activities indicated are carried out. The Heads of Department not only have to administrate their Departments, but also to involve in practical matters relating to development, testing and production. Plans of the workshops - equipment and layouts, both present and future can be seen under APPENDIX I.

4. ACCOMMODATION and TRANSPORT

The Chief Technical Adviser (CTA) was met on arrival at Kilimnjaro international airport by the UNIDO junior expert and his Tanzanian counterpart, Mr. Kaaya who is the Head of the testing and production unit of CAMARTEC. The junior expert, Mr. Takashi Inoue explained that accommodation in Arusha was a problem at this time due to a preferential trading areas (PTA) meeting being held in the town and that only four days accommodation was available. Added to this was an acute transport shortage. The author would have had to commute the 16 km to and from CAMARTEC each day. However, due to the hospitality of Mr. Inoue in allowing the CTA to stay with him at his house provided by CAMARTEC both problems were solved, Mr. Inoue's house being within walking distance of the project working area. CAMARTEC's transport situation is as follows:

Two land-rover station wagons and one land-rover mobile workshop which is not fitted out, the vehicle being used to carry staff. The two station wagons are 5 years old. One Nissan double cab pickup and one Toyota pickup both are 4 years old. Two 7 ton lorries, 3 years old. One 40 seater bus for staff transport and two motorcycles.

The major load for CAMARTEC's field extension programme falls on the three land rovers. A major strain put on all vehicles is the condition of the road leading from CAMARTEC to the main Arusha highway some 6 or 7 km away, this connecting road is so bad that speeds of over 20 kph are not possible. The road is not surfaced and rarely graded. As other institutions use this road its a problem to know who is responsible for its up-keep.

A Toyota double cab pickup ordered from Japan paid for from project funds has arrived in DSM and is awaiting formal clearance and registration. The vehicle was, however, not available for use during this mission (30th Oct/30th Nov).

5. FIELD TRIPS to MOSHI and KIDC

Field trip to Moshi (11.11.88)

Moshi is a town with a population of about 100,000 situated 80 km east of Arusha.

The purpose of the trip was to determine availability of workshop equipment for purchase with project funds and availability of materials and other resources.

In company of Mr. Kaaya, Head of the testing and production section of CAMARTEC and counterpart to the junior expert, the junior expert and the CTA. The first stop was at the Moshi Machine Tool Factory. The factory is situated a few km out of Moshi town on the Moshi/Arusha road. Moshi Machine Tools is a Bulgarian assisted parastatal project. A range of medium sized machine tools are partly manufactured and assembled at the plant, more complex parts of the machines are imported from Bulgaria.

The range of machine tools available from the factory are: lathes (3 models), milling machine (1 model), drilling machines (2 models), shaper (1 model) and a heavy duty pedestal grinder. Four woodwork machines are available: combination woodworker, planer, band saw and wood lathe.

The purpose of the visit to the factory was to inspect the metalworking lathes produced for possible purchase from project funds. Of the three lathes available one was too small for the required duty. The other two machines are identical other than for bed length. The machines inspected were of robust construction, but very dated in design. On inspection of machines under assembly gears were noted being pinned to shafts in situ using an electric hand drill. Backlash on screw slides was excessive. The sales manager informed us that no four jaw chuck was available for the machine, many other accessories also are not available and would have to be imported. Whilst talking in the managers office he was informed that the price of all machines (even those in stock) should be increased by 30 per cent. The price for one of these machines is US \$18,000. After talks with senior staff at CAMARTEC later, it was recommended to import a machine of much higher quality, fully equipped, for the same price as the Bulgarian machine.

There was no guarantee that because the machine is locally assembled that spare parts will be available, in any event some parts of the machine are imported from Bulgaria.

Field trip to KIDC

Business completed at the machine tool factory and the trip was proceeded to the Kilimanjaro Industrial Development Centre (KIDC), an establishment assisted by the Japanese Government. The KIDC became operational in 1981. The objectives of the centre are:

- to cater for services required by industries in the region to reactivate them by supplying spare parts and rendering a consultancy service;
- to promote technology transfer in production of machinery for agriculture and other industries;
- to identify and promote appropriate industry based on utilization of new materials locally available.

In order to achieve the above objectives five functional units have been established, they are:

- 1) Machine Workshop
- 2) Foundry Workshop
- 3) Briquetting pilot factory (wood fuel)
- 4) Ceramic pilot factory (earthen ware in Moshi, table ware in same)

Of particular interest was the machine shop and the foundry workshop. The machine shop is well equipped and able to complete complex machining operations, such as gear cutting and engine crankshaft fabrication. The workshop has a staff of 8 or 10 machinists and provides a development, machining and training service.

The foundry workshop can produce castings up to 50 kg in alloy, 150 kg in copper alloys and 300 kg in cast iron at a maximum cost of US \$4 per kg. The foundry is equipped with a one ton/hour cupola for cast iron, a 500 kg oil furnace, also for cast iron and a 100 kg furnace for non-ferrous metals. A patternmaking service is also available, charge for the service is a very reasonable US \$1.50 per hour, excluding materials used. The patternmaking and casting facility will provide a very useful input to the CAMARTEC/UNIDO project in the development of farm implements. Time and expense can be saved by using castings for many of the small parts, on planters in particular.

6. PLANNED FIELD TRIP OF THE JUNIOR EXPERT AND COUNTERPART (18.11.88)

With the arrival of the project vehicle it will be possible for the junior expert to implement a field trip programme to rural workshops operating under CAMARTEC guidance. A schedule has been arranged by the counterpart, the junior expert and the CTA for a field trip involving the counterpart and the junior expert in an extensive field trip to five major artizan areas (see attached map).

The purpose of the trip will be to determine the present situation regarding the manufacturing capacity, items being manufactured, manpower skills, materials availability and problems and from the information gathered a work plan devised to implement assist to rural craftsmen through the project and CAMARTEC.

Areas in the south of the country, Songea and Mbeya will be visited at a later date. However, the long distances and poor road conditions will limit the inputs that can be made. CAMARTEC management have indicated they prefer assistance of a higher quality in a limited area rather than a widespread programme of doubtful impact. This shows sound judgement, given the limited resources available for project field activities.

Please see Appendix 2 for details of the field trip and the questionnaire that will be used to gather information.

7. PROJECT COUNTERPARTS

UNIDO Junior Expert:

Early in the mission the author had discussions with Mr. Ngaiza, Director-General of CAMARTEC, concerning a counterpart for the UNIDO junior expert, Mr. Inoue. It was explained that whilst the junior expert was expected to work with all staff at CAMARTEC, he must have one person with whom he can co-ordinate his duties and activities on a day-to-day basis. The officer designated as counterpart to the UNIDO junior expert Mr. Kayaa, Head of the Testing and Production and Woodwork shops. As a Head of Department, Mr. Kayaa has intimate knowledge of the day-to-day functions of CAMARTEC, and of field programme activities.

Counterparts to the CTA:

As the CTA missions are of short duration a specific counterpart has not been designated. The CTA will work with the counterpart to the junior expert. Specific matters relating to the project will be discussed with the Director-General by the CTA. At present weekly meetings are held involving the DG, Heads of Department and project staff to discuss project activities, progress and problems, and action to be taken. The Director-General has a very practical attitude towards the development of CAMARTEC and its projects and makes himself freely available for discussions.

8. FARM IMPLEMENTS DEVELOPMENT

Present Situation:

Farm implements at present under development at CAMARTEC are cultivator, planter, plough and harrow. These implements are of standard design and can be found in most developing countries using animal traction for farming. The design is such that one complete implement performs one function and is not interchangeable.

Construction of these prototypes is heavy, making them expensive to produce. The high price of steel (US \$1,000/ton) and unreliable supplies make it important that designs keep material inputs to a minimum compatible with good function and strength.

The senior technical staff at CAMARTEC are very much in favour of an animal tool bar system on the principle of a basic frame with interchangeable implements. Utilizing project funds provided for the purpose, two sets of an interchangeable implements system have been ordered from a manufacturer in Lesotho. The implements will be tested, evaluated, modified if required to suite Tanzanian farming and production conditions, introduced into the CAMARTEC workshop for prototype production and extension for rural artizan production. This process will be repeated with other designs.

CAMARTEC OX CARTS

The ox cart at present being produced by CAMARTEC and rural artizans has an axle assembly of steel and a body of wood. The steel wheels and axle are very heavy- the whole assembly being fabricated from steel. The wheel rims are formed by rolling two flat strips of 60 mm x 6 mm flat into a 400 mm dia circle. Onto the outer edges of these rims is welded two rings formed from 20 mm dia round bar, used to keep the 700 x 16 size tyre in place. The two rim sections are bolted together via the 40 mm x 8 mm flat spokes. The wood bearings, 80 mm dia x 200 mm long, are pressed into a steel pipe that forms the hub of the wheel assembly. The wheels are mounted on a stub axle fabricated from a 1200 mm length of old railway line with two short sections of round bar at each end for the bearings to run on.

Engineers at CAMARTEC are concerned that supplies of old railway line are becoming scarce.

The hard wood body of the cart measures 1850 mm long x 1250 mm wide x 900 mm deep and is constructed of wood sections 100 mm x 40 mm and 250 mm x 25 mm bolted together. The cart has a capacity of 1000 kg.

OX CARTS MODIFICATIONS

Technical discussions held between the counterpart, junior expert and the author highlighted the need to modify the design of the wheel/axle assembly of the ox cart at present being manufactured, to reduce weight and material inputs. Various ideas will be investigated including the possibility of pressing a wheel rim in sections from 2.5 mm steel plate using the 100 ton hydraulic press available in the CAMARTEC workshop.

Changes to the bearing system will involve using split block wood bearings or commercial plummer ball bearings, rather than the present turned and pressed into the hub design of wood bearing.

Use of such much hard wood in the construction of the cart body is disturbing; the senior staff at CAMARTEC also voiced concern over availability of future supplies of the material and feel that an alternative method of construction using less exotic materials. The most obvious method would be an electric welded frame constructed from light section angles (50x50x6mm). A price list of items produced at CAMARTEC is attached along with an example of cost calculations for ox carts (Appendix III). At this time (November 1988) the Tanzanian shilling was valued at 120 to one US\$.

9. WORKSHOPS

CAMARTEC main workshop area comprise three workshops:

1. Technical Development - Head, Mr. Kiriana
2. Testing and Production - Head, Mr. Kayaa
3. Woodwork

The three workshops (see Appendix I) each have a floor area of 558sq/mt. The technical development workshop is divided from the other workshops whilst the testing and production and woodwork shops have good internal access with each other. This is to facilitate final assembly of agric equipment, such as ox carts, the construction of which combines wood and metal.

a) Technical Development Workshop:

This workshop has a floor area of 558sq/mt and is equipped as follows:

One centre turning lathe, which was damaged in transit and will not produce parallel work. Two drilling machines. A universal milling machine, new but not in use due to the lack of essential accessories. Blacksmith equipment and forge. Power hack saw machine. Electric and gas welding.

This workshop is the least equipped of the three and as such it is proposed to make project equipment inputs as follows:

A new centre lathe, surface grinder, 6mm capacity plasma cutter, 6 ton hand press, a good selection of measuring equipment and the necessary accessories for the full operation of the milling machine.

b) Testing and Production Workshop:

The workshop is equipped as follows:

Two medium sized centre lathes. Four floor standing drilling machines. One universal milling machine, new but not in use due to the lack of milling cutters. Four mechanical hack saw machines, one in need of repair. One hydraulic press of 100 ton capacity. Wheel rim rolling machine. Three pedestal grinders. Seven 250 amp electric welders and benches. Two cropping and strip cutting machines, one needs a new electric motor. Gas welding equipment, work benches and hand tools.

The present layout of the workshop is reasonable, however, some of the machine tools are placed too close to each other. The four drilling machines are set in a tight square formation with only 1.5 mt between them and the nearest lathe. The two lathes are positioned parallel to each other with only a metre spacing. The operator of the front machine is at risk from the rotating chuck of the machine at his back.

Useful floor space is taken up with part finished implements such as ploughs, planters and cultivators, awaiting materials for completion. An area of 12.6 mt x 7.2 mt (90.72 sq/mt) is utilized by the four hack saw machines cutting up bar materials, the materials first being carried from the metal store some 50 mts away.

c) Woodwork Shop:

The woodwork shop is well set out with adequate space between all machines to allow for manipulation of long wood sections. Equipment in the woodwork shop is as follows:

Two combination wood workers. A thickness planer. Band saw. Cross circular saw. Wood turning lathe. Morticer. Saw sharpener. Drilling machine. Two grinders. Benches and hand tools.

No changes are required in the woodwork shop at this time. However, a small input of hand tools could be recommended.

10. FINDINGS

Lack of local supplies of raw materials may have a negative effect on implementation and final impact of the project. Working within the parameters of locally available materials will restrict long-term possibilities for manufacture of standard items of agricultural equipment. Implements manufactured

at CANARTEC cannot be completed due to the lack of some materials. Design of equipment using materials at this time does not ensure such materials will be available in a few months time. This may result in local modification and loss of the implements original function.

A report prepared recently by a GTZ consultant highlights the problem of materials availability. When available, a copy of this report will be sent to UNIDO by the junior expert.

11. CONCLUSIONS

1) The present layouts and re-arranged layouts of both engineering workshops are attached as Appendix I. It is proposed to move the four hack saw machines out of the testing and production workshop to a location nearer the metal supplies store. The operational areas within the workshops are to be clearly identified by lines on the floor, but not with physical partitioning.

The operational areas would be: machine tools, bending and forming, sheet metal-work and welding and assembly. Each area or section should have its own senior technician or foreman who would be responsible for the activities, staff and equipment in his section.

2) Timely inputs have insured a good start to the project. The project vehicle is practically available now. Lists of workshops equipment (Appendix IV) have been compiled along with prices and possible sources for procurement. A materials list has been prepared under Appendix V.

Work plans have been completed (Appendix VI and VII). Implements design and modification, as well as sample implements have been identified for purchase and testing and a field activities programme has been initiated. Based on this the project should be in a position to proceed with project implementation as required.

3) The junior expert has been supplied with housing at the project site and is well settled in. The junior experts previous experience in east Africa and his fluency in Swahili will be a great asset in the execution of his duties. There is little doubt that Mr. Inoue's familiarity with the area and conditions greatly assisted the mission.

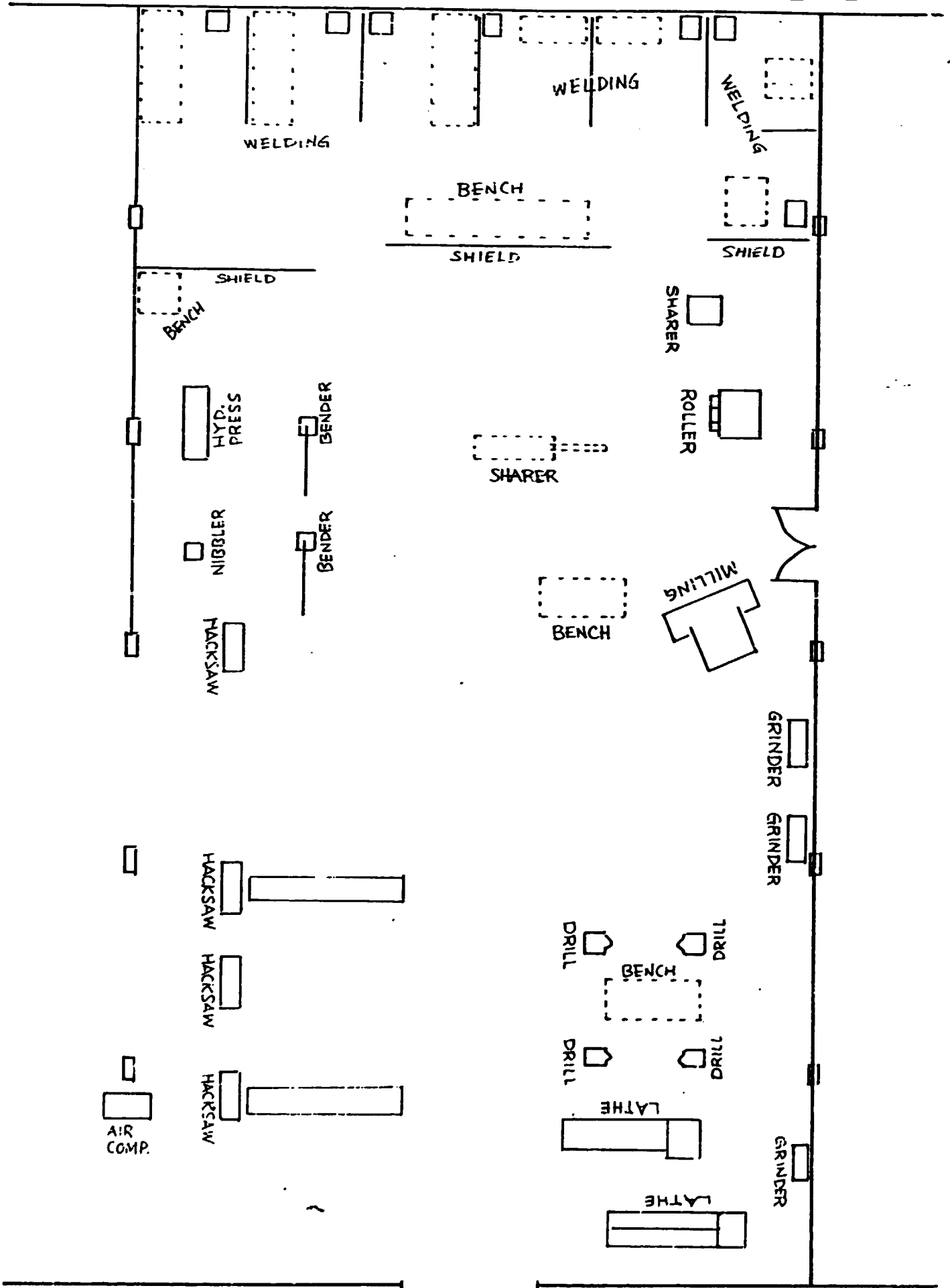
The counterpart situation is good, with a willingness from all local staff to work with the junior expert for project progress.

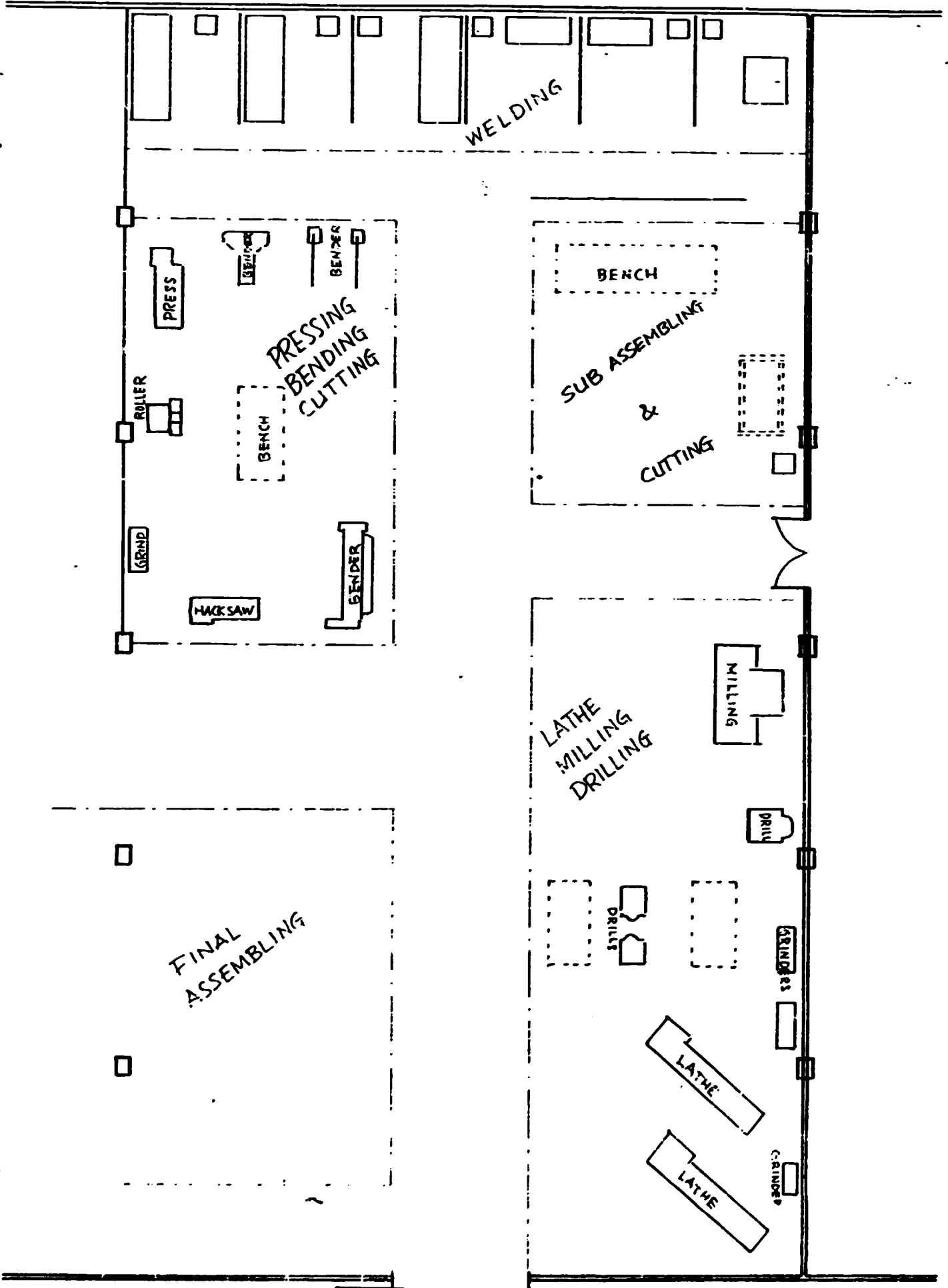
12. RECOMMENDATIONS

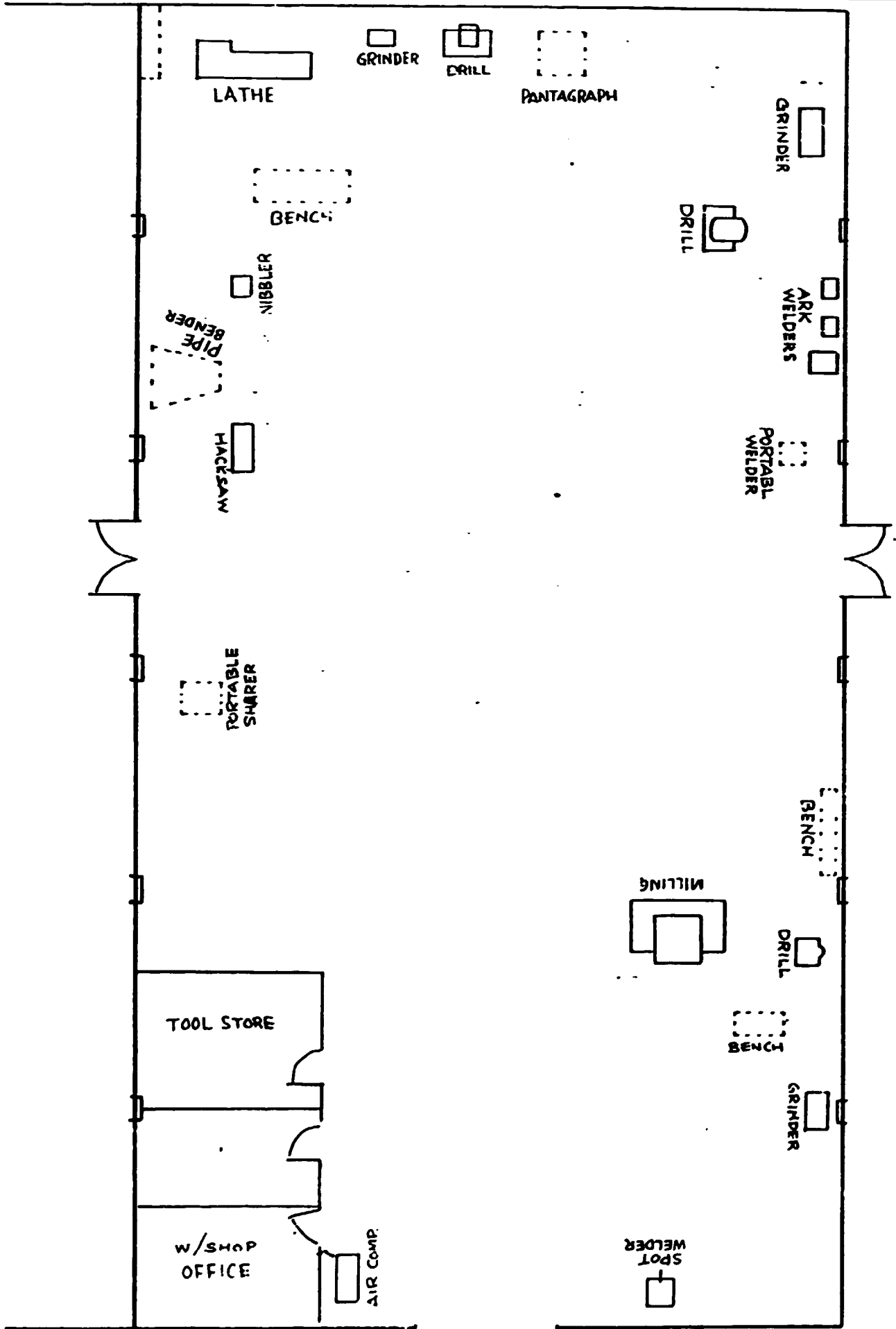
1. Equipment and tools, as well as raw materials for the CAMARTEC workshops has been identified (Appendix 4.5) and should be purchased accordingly from project funds. Following the recent request of the Director-General of CAMARTEC it is suggested that purchase of workshop equipment should be from one country, and, if possible, from one supplier within that country because of previous problems of spare parts procurement for equipment of diverse origin.

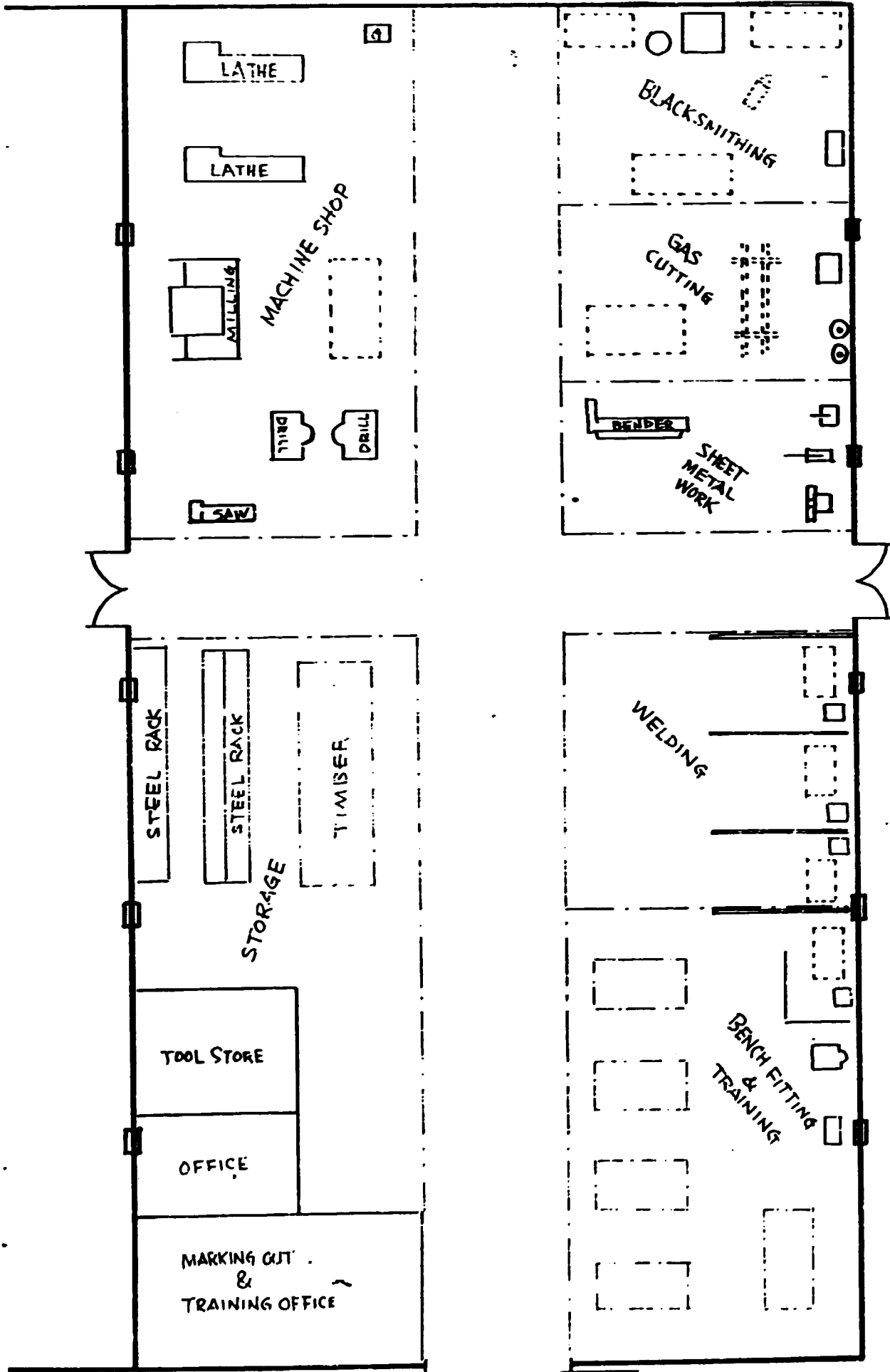
2. The junior expert has been advised to prepare a report covering his arrival and the period up to 31 December 1988. It has also been proposed that the junior expert prepares progress reports every six months. Regular reporting will assist the future CTA mission, as well as the preparation of the final report.

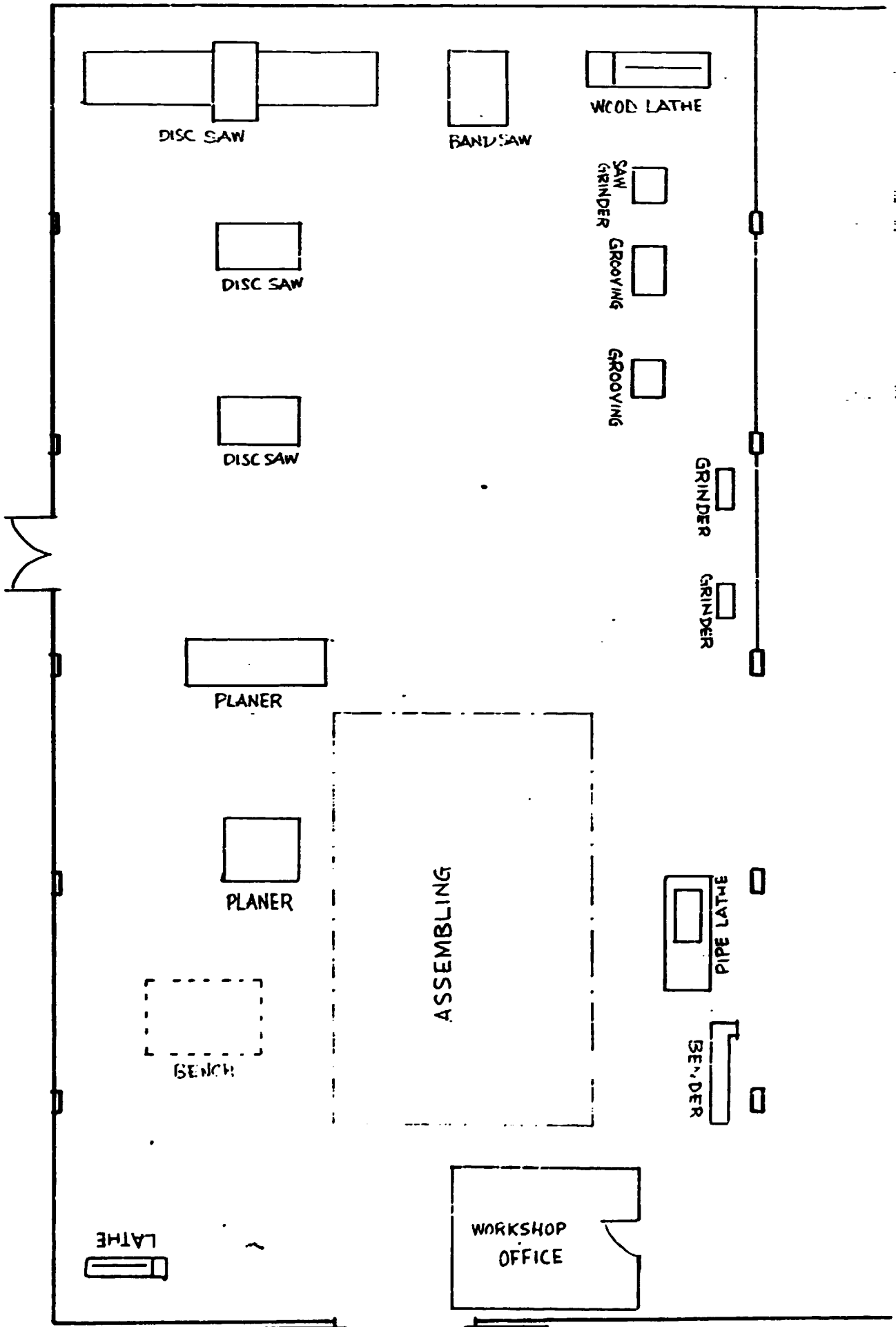
3. Following discussions with the Director-General of CAMARTEC, it is possible to envisage short-term training/studytour of about 4 weeks duration for two persons directly involved in technical development to enable CAMARTEC senior staff to travel within the region (Zimbabwe, Lesotho, Botswana, Swaziland) to observe the functions of similar institutions. The provision of training does not exist in the present project document. However, future project revisions may perhaps allow to include an appropriate training component as indicated above.

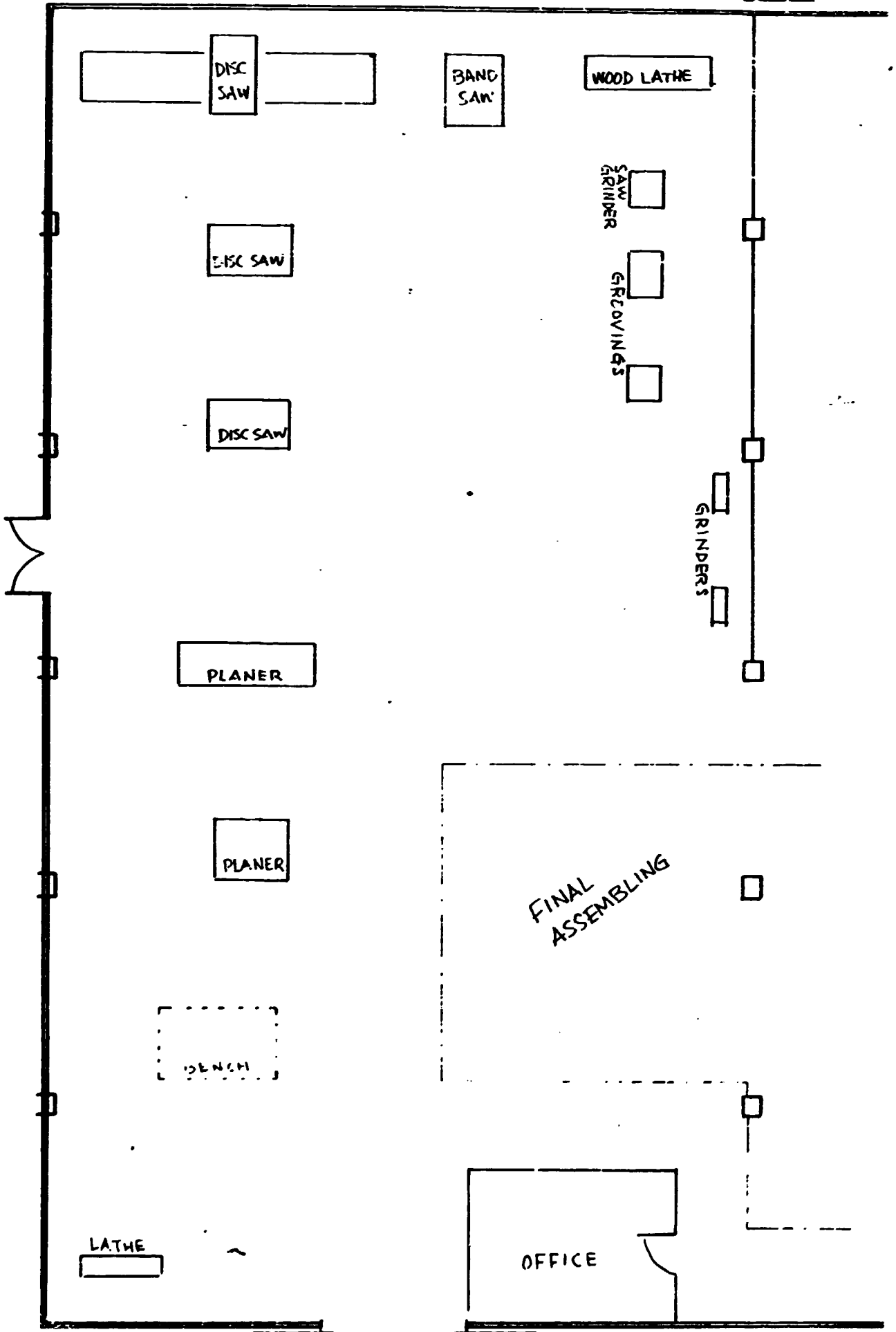












TRAVEL SCHEDULE

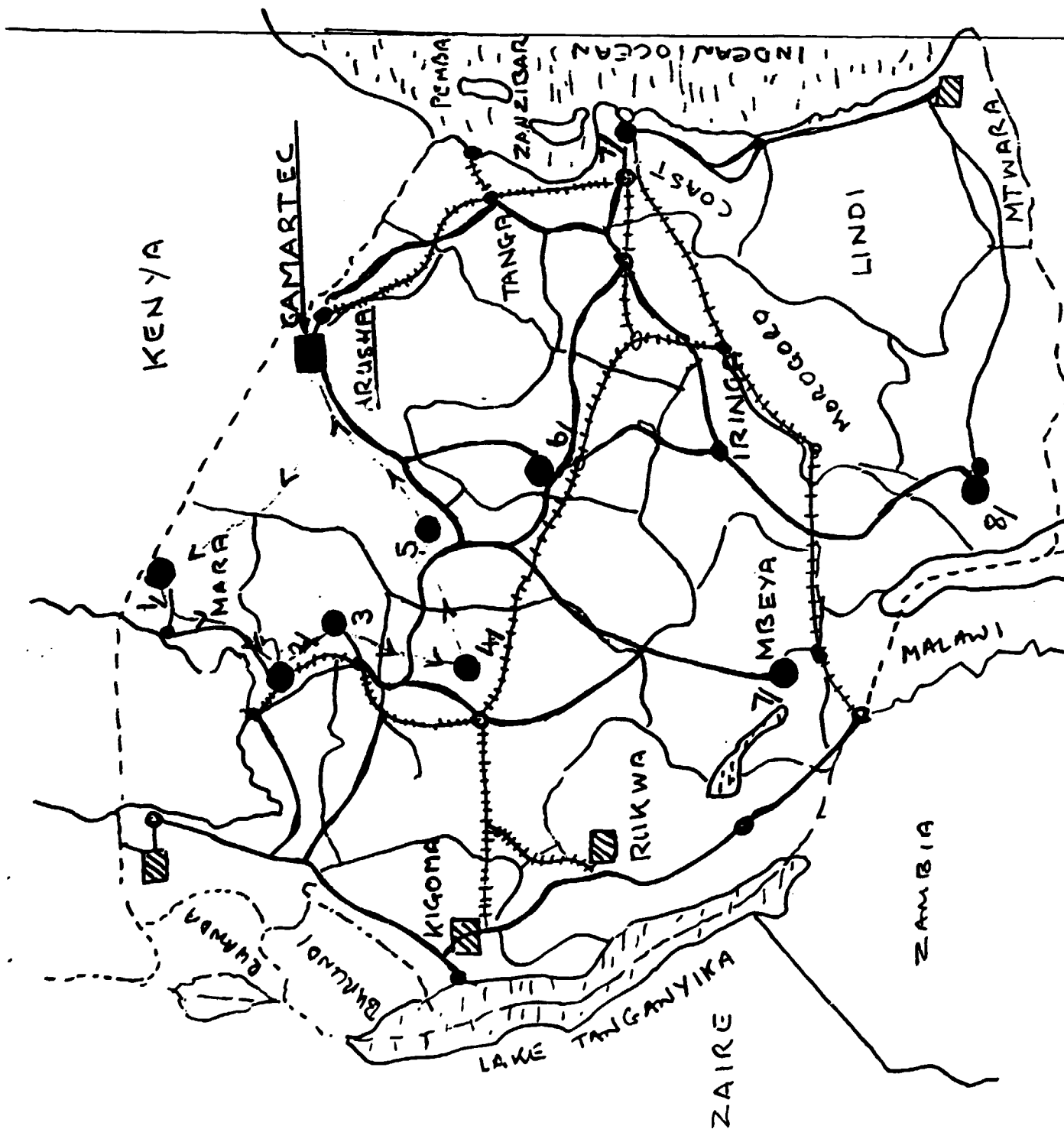
Dec 11/18-88 JUNIOR EXPERT AND COUNTERPART , TF/RAF/87/902

DAY	DEPARTURE	ARRIVAL	DISTANCE (km)	PURPOSE FOR VISIT
1 Sun.	Arusha	Serengeti(Seronera)	300	Overnight
2 Mon.	Serengeti	Musoma	200	Visiting MUSOMA rural craft workshop
	Musoma	Mwanza	240	Overnight
3 Tue.	Mwanza	Malya	120	Visiting MALYA rural craft workshop
	Malya	Mwanza	120	Overnight
4 Wed.	Mwanza	Shinyanga	200	Visiting WIGEHE and other rural workshops
	Shinyanga	Nzega	80	Overnight
5 Thu.	Nzega	NZEGA w/shop	**	Visiting NZEGA rural craft workshop
	NZEGA w/shop	Nzega	**	Overnight
6 Fri.	Nzega	Singida	250	Visiting rural craft workshops Overnight
7 Sat.	Singida	Arusha	420	Back to Arusha

FIELD TRIP OUTLINE



1. MUSOMA
2. MWANZA
3. MALYA
4. NZEGA
5. SHINYANGA
6. DODOMA
7. DAR-ES-SALAAM



PRICE LIST FOR ITEMS PRODUCED BY CAMATEC EFFECTIVE
FROM 1ST JANUARY, 1983.

	<u>T.shs.</u>
1. <u>OX-CARTS</u> (Standard size 3ft. x 4ft. x 6ft)~	
(a) Ox-cart with Pneumatic wheel.....	19,500/=
(b) Ox-cart with metal wheels.....	17,500/=
2. <u>AXLE FOR OX-CART:</u>	
(a)	
i) Complete axle with pneumatic wheels.....	8,000/=
ii) " " " Metal wheels.....	7,000/=
(b)	
i) Complete axle - pneumatic wheels with metal parts accessories for the whole cart.....	13,500/=
ii) Complete axle - metal wheels with metal parts accessories for the whole cart.....	12,000/=
(c) <u>Ox-Cart accessories:</u>	
i) Rail axle.....	2,800/=
ii) (1) Pneumatic wheels 2 @ 2,500/=.....	5,000/=
(2) Metal wheels 2 @ 2,000/=.....	4,000/=
iii) Brake.....	2,000/=
iv) Hitch.....	550/=
v) Wooden Bush Bearings.....	180/=
3. <u>FARM WAGON:</u>	
(a) Farm wagon.....	50,000/=
(b) Complete axle for farm wagon.....	24,000/=
4. <u>DONKEY-CART:</u>	
(a) Donkey cart with Metal wheels.....	12,000/=
(b) Donkey cart with pneumatic wheels.....	13,500/=
5. <u>HAND CART</u>	12,000/=
6. <u>WHEEL BARROW:</u>	
(a) Wooden Wheel Barrow.....	2,300/=
(b) Metal Wheel Barrow.....	4,500/=
7. <u>HAND PLANTER:</u>	1,000/=
8. <u>CULTIVATOR</u>	8,000/=
9. <u>KIFARU PLOUGH:</u>	
(a) Kifaru plough.....	9,500/=
(b) Seed attachment.....	3,000/=
(c) Kifaru plough with seed attachment.....	12,500/=
10. <u>GROUNDNUT SHELLER</u>	3,500/=
11. <u>WINNOWER</u>	5,000/=
12. <u>TOOTH SPIKE HARROW</u>	4,600/=
13. <u>HAND PUMP</u> (Without connecting rod).....	8,500/=
14. <u>CINVA RAY MACHINE</u>	11,200/=
15. <u>WOODEN BEAM</u> (Without hitch).....	120/=
16. <u>BOLTS</u> (without nuts: 1" to 5").....	40/=
" (" " 5½" to 8").....	45/=

EXAMPLE OF COST CALCULATION FOR OX-CARTS (METAL AND PNEUMATIC WHEEL)
MATERIAL, LABOUR AND MACHINE COST FOR OX - CARTS (NEW PRICES).

ITEM	SUB - ITEM	MATERIAL COST			LABOUR COST			MACHINE COST.		
		MATERIAL SIZE/WT	RATE	COST	MAN-Hours	RATE	COST	MACHINE HOURS	RATE	COST
METAL WHEEL OX - CART	*Metal Wheel (2)	48.7 kg.	60/=	2,922/00	4.66	65/=	302/90	3.66	125/=	457/50
	Pipe	2.9 kg.	138/=	400/20	-	-	-	-	-	-
	Brake (1)	13.67kg.	50/=	683/50	7	65/=	455/=	5.33	125/=	666/25
	Hitch (1)	1.7 kg.	60/=	102/00	2	65/=	130/=	1.75	125/=	218/75
	Axle rail (1)	21.27kg.	60/=	1,276/20	4.66	65/=	302/90	4.66	125/=	582/50
	Bolts (30)	3.0 kg.	250/=	750/=	-	-	-	-	-	-
	Nuts (30)	1.0 kg.	600/=	600/=	10	65/=	650/=	10	125/=	1,250/=
	Gravelia 12" x 1"	100ft.	30/=	300/=	-	-	-	-	-	-
	" 4" x 2"	60ft.	20/=	1,200/=	-	-	-	-	-	-
	" 4" x 4"	16ft.	30/=	480/=	3.5	65/=	227/50	3.5	125/=	437/50
	Hardwood 4" x 4"	3ft.	70/=	210/=	-	-	-	-	-	-
	Electrodes	2kg.	270/=	540/=	-	-	-	-	-	-
	Paint and Oil	2L.	680/=	1,360/=	1	65/=	65/=	-	-	-
Assembly Work				3.5	65/=	227/50	-	-	-	
S U B - T O T A L				13,523/90			2,360/80			3,612/50
GRAND TOTAL FOR METAL WHEEL OX - CART, MATERIALS, LABOUR AND MACHINE COST IS										19,497/20
PNEUMATIC WHEEL OX - CART	All as above except Units with (*)									
	Rims (2)	36.6kg.	60/=	2,196/=	11	65/=	715/=	5	125/=	625/=
	Tyre and tube (2)	2	1,400/=	2,800/=	-	-	-	-	-	-
S U B - T O T A L				15,597/90			2,772/90			3,780/=
GRAND TOTAL FOR PNEUMATIC WHEEL OX - CART, MATERIAL, LABOUR AND MACHINE COST IS										22,150/80

All Materials are Mild steel except timber, pipe (Galvanized steel), Paint, Oil, tyre and tube.

EQUIPMENT LIST FOR CAMARTEC PROJECT (TF/RAF/87/902)

MEASURING EQUIPMENT)

1. VERNIER CALIPER	150 mm	x 5
	300 mm	x 5
2. DIAL GAUGE	0.1 mm x 12 mm	x 3
3. MAGNETIC STAND	for DIAL GAUGE	x 3
4. OUTSIDE MICROMETER	0-25 mm	x 3
	25-50 mm	x 3
5. COMBINATION ANGLE GAUGE	300 mm	x 2
6. ENGINEERS SQUARE	75, 100, 150 mm	x 4 each
7. FEELER GAUGE	TAPER TYPE, 13 pcs.	x 5
8. SCREW PITCH GAUGE	METRIC INCH COMBN.	x 5
9. STEEL RULER	300, 600 mm	x 5 each
	1000 mm	x 2
10. DIVIDER	100, 150, 200 mm	x 5 each
11. INSIDE CALIPER	150 mm	x 2
12. AUTOMATIC CENTRE PUNCH		x 5
13. PROTRACTOR		x 5
14. BEAM TRAMMEL SET		x 2
15. SURFACE PLATE	1000 x 750 mm	x 1
16. VERNIER HEIGHT GAUGE	450 mm	x 1
17. SURFACE MARKING GAUGE	300 mm	x 1
18. V-BLOCK SET	100 x 40 x 75	x 2
	40 x 50 x 40 with CLAMP	x 2
19. ANGLE PLATE	200 x 125 x 150	x 1

EQUIPMENT LIST FOR CAMARTEC PROJECT (TF/RAF/87/902)

(MACHINE TOOLS)

- 1. LATHE 1500 mm. with COOLANT PUMP. LIGHTING
3 AND 4 JAW CHUCKS . 3 PHASE 415 VOLT

- 2. SURFACE GRINDER TABLE 500 x 150 . 3 PHASE 415 VOLT
with 10 SPARE WHEELS AND DIAMOND DRESSER

- 3. PLASMA CUTTER (A) CUTTING RANGE 0.5 - 12 mm. 3 PHASE 415 VOLT
with 10 SPARE PARTS KITS FOR CUTTING NOZZLE

- 4. PLASMA CUTTER (B) CUTTING RANGE 0.5 - 6 mm. SINGLE PHASE 240 VOLT
with 10 SPARE PARTS KITS FOR CUTTING NOZZLE

- 5. MACHINE VICES
 1) SWIVEL TYPE 150 x 165 JAW
 2) UNIVERSAL TYPE 150 x 125 JAW
 3) RACK TYPE 150 x 330 JAW

- 6. HAND PRESS NORTON FLY TYPE. 6 ton.

- 7. METAL SHEET BENDER 2000 x 2 mm max.

- 8. METAL SHEET BENDING ROLLER 1500 x 10 mm max.

- 9. CHAIN BLOCK 2.5 ton

- 10. KEYWAY BROACH SET 4 - 8 mm

- 11. HAND ARBOR PRESS for BROACHING

- 12. HYDRAULIC PUNCH with HYDRAULIC PUMP

- 13. ELECTRIC TOOLS
 1) ANGLE GRINDER 4 1/2" (115 mm) x 4
 2) ANGLE GRINDER 9" (230 mm) x 4
 3) HAND DRILL 13 mm max. x 4

- 14. MILLING CUTTERS
 SIDE & FACE CUTTERS
 SHOULDER END MILL
 END MILL

RAW MATERIALS LIST

Project: TF/RAF/87/902

Item	Dimensions	Qty.
ANGLES (Black mild steel)	L = 20 , 25 , 30 , 40 , 50 L = 75 L = 100	× 10 each × 5 × 2
FLATS (Black mild steel)	25 x 3 30 x 3 , 30 x 6 40 x 6 , 40 x 10 , 40 x 12 , 40 x 20 50 x 6 , 50 x 10 , 50 x 12 60 x 6 , 60 x 10 , 60 x 12 , 60 x 20	× 10 × 10 each × 5 each × 5 each × 5 each
ROUNDS (Black mild steel)	Ø = 6, 8, 10, 12, 14, 16, 20, 25 Ø = 30 , 35 , 38 , 40	× 10 each × 5 each
ROUNDS (Bright mild steel)	Ø = 10 , 12 , 16 , 20 , 35	× 5 each
SQUARE	□ = 14 , 16 , 18 , 25	× 10 each
TUBES	O.D. Ø = 20 , 35 , 40 , 50	× 10 each
SQUARE TUBES	□ = 25 , 30 , 50, 25 x 50 ,	× 10 each × 10 each
CHANNELS	50 x 25 , 75 x 40 , 100 x 50 (t = 3 to 5 mm)	× 10 each
MILD STEEL SHEET	t = 1.6 , 2 , 3 , 4 (1.2 x 2.4 m)	× 4 each
ALUMINIUM SHEET	t = 1.6 , 2 (1.2 x 2.4 m)	× 5 each
STAINLESS STEEL SHEET	t = 1.6 , 2 (1.2 x 2.4 m)	× 5 each
STAINLESS STEEL ROUND BARS	Ø = 12.7 , 25 , 50	× 5 each
SPRING STEEL FOR SPRING TINES	□ = 14 , 16	× 5 each
SPRING STEEL WIRE	Ø = 2 , 3	(× 20 kg. each)
TOOL GRADE HARDENABLE STEELS		
- ROUNDS	20 , 30 , 40 , 50	(x 3m × 4 each)
- FLATS	40x10 , 50x10 , 60x20 , 100x20	(x 3m × 4 each)
HEXAGON BAR (Ledloy & Mild steel)	19 mm A/F	(x 3m × 20 each)

* Or available size equivalent to the above dimensions

6m length for each material

All dimensions in mm.

Material not specified are mild steel

Ø = diameter

t = thickness

□ = square

L = angles

WORK PROGRAMME CAMARTEC PROJECT (TF/RAF/87/902)

ACTIVITY \ YEAR	1987												1988					
	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1 APPOINTMENT OF NATIONAL STAFF / COUNTERPARTS																		
2 FIELDING OF JUNIOR EXPERT																		
3 CAMARTEC WORKSHOP LAYOUT AND EQUIPMENT SPECIFICATIONS																		
4 PURCHASE OF EQUIPMENT AND INSTALLATION																		
5 STRENGTHENING OF NATIONAL RURAL CRAFT WORKSHOP NETWORK																		
6 CAMARTEC ANALYSIS OF RURAL CRAFT WORKSHOP AND OTHER PRODUCTION UNITS																		
7 CAMARTEC MEETING OF PARTICIPANTS OF NATIONAL NETWORK																		
8 DEVELOPMENT OF IMPLEMENTS SET UP FOR PRODUCTION																		
9 CAMARTEC MEETING ON PRODUCTION IDENTIFICATION AND MARKET DEVELOPMENT																		
10 CAMARTEC TRAINING PROGRAMME																		
11 CAMARTEC MEETING ON INSTITUTIONAL INTERLINKS																		
12 BATCH LEVEL PRODUCTION AND TRAINING																		
13 CTA MISSIONS																		

* This revised work programme differs only in the overall time scale from the original in the Project Document. Activities and timing of the activities within the time scale remain the same

GOVERNMENT INPUTS FOR CAMARTEC PROJECT

In order to initiate the CAMARTEC start up programme, the government / CAMARTEC will have to undertake a series of activities through their own domestic resources, infrastructure and manpower, so that certain physical areas of the CAMARTEC future work programme and proposed physical facilities are clarified and consolidated.

5 in work programme

STRENGTHENING OF A NATIONAL RURAL CRAFT WORKSHOP PRODUCTION NETWORK

CAMARTEC will strengthen the existing national agricultural tools and implements production network with the participation of 8 rural craft workshops plus 4 existing metal products manufacturing enterprises. These 12 production units should form the core of a pilot demonstration activity for the next 3-4 years.

The main objective of this network is to develop a programme of local production with CAMARTEC assistance so that each of the rural units in it will act as an entrepreneurship promotion/training. CAMARTEC prepares a policy paper on this aspect highlighting the technoeconomic and administrative aspects and secure the approval of the government.

6 in work programme

ANALYSIS OF RURAL CRAFT WORKSHOPS AND OTHER PRODUCTION UNITS

CAMARTEC, through a local subcontract analyses the production facilities and work out the details on the annual production of 1,000 ox carts 500 tool bars, (plough, cultivator, planter and ridger) and 500 disc harrows (all animal drawn) by each of the 12 workshops. The raw materials, manpower, finances, management and organizational aspects are to be elaborated.

7 in work programme

A MEETING OF THE PARTICIPANTS OF THE NATIONAL NETWORK

CAMARTEC organizes a 1-week meeting with the participation of the members of the national network (8 rural craft workshops plus 4 small medium mechanical engineering units). The objective is to discuss the proposed production programme, the material requirements, the necessary technical services, production technology, marketing and organization/management aspects

9 in work programme

MEETING ON PRODUCT IDENTIFICATION AND MARKET DEVELOPMENT

CAMARTEC organizes a 1-week workshop with the participants of all 25 (20 mainland plus 5 Zanzibar) Regional Development Directorates (Regional Agricultural Development Officer), selected Regional Agricultural Input Co-operative Unions, rural integrated development projects (example: Tanga, Iringa, etc), farmers association, Non-governmental Organizations which are promoting agricultural tools and implements usage.

Tanzania Rural Development Bank, Regional Trading Corporation, etc.

The overall objectives of the workshop are to develop an intermediate and long-term programme of CAMARTEC/rural craft workshops (manufacturers), the regional Development Directorates (end-users and rural financial institutions)

11 in work programme

WORKSHOP MEETING ON INSTITUTIONAL INTERLINKS

CAMARTEC a 3 day workshop meeting with the participants of selected appropriate institutions, such as IPI, TIRDO, TSO, SIDO, TEMDO, MEDIA, Agricultural Faculty of University, etc., plus other ministries concerned, as well as to develop complementary programmes as well as to identify areas of mutual assistance. Each institution is to cater travel and per diem.

{ from the Project Document, page 17-19 }
Project Inputs, Government Inputs

WORK PROGRAMME FOR JUNIOR EXPERT (JF/RAF/87/902)

ACTIVITY \	YEAR MONTH	1988			1989									1990					
		10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
IDENTIFICATION OF W/SHOP TOOLS AND EQUIPMENT PURCHASE AND INSTALLATION	1	—————																	
PREPARE PLAN FOR LAYOUT OF WORKSHOP	2	*																	
IDENTIFY AND ORDER SAMPLES OF AGRIC IMPLEMENTS FROM OUTSIDE FOR TEST & MODIFY	3	*																	
TEST & MODIFY THE ABOVE	4				—————														
ORDER AND PURCHASE SELECTION RAW MATERIALS FOR PROTOTYPE DEVELOPMENT - JIGS, FIXTURES AND SPECIAL TOOLS	5	*																	
DEVELOPMENT OF EXISTING IMPLEMENTS AND NEW DESIGNS SETTING UP FOR BATCH PRODUCT	6				—————					*	*	*							
DEVELOP FIELD PROGRAM FOR STRENGTHING OF NATIONAL RURAL CRAFT W/SHOP NETWORK	7				—————					*	*	*							
COORDINATE ACTIVITIES WITH OTHER INSTITUTIONS MEETING AND DOCUMENTATION TECHNICAL REPORTS	8	*			—————					*	*	*							
ON-THE-JOB TRAINING OF COUNTERPART STAFF	9	*			—————					*	*	*							
REPORTING (UNIDO)	10																		
CTA MISSIONS		*								*	*	*							