Report on a study into the various ways to manufacture knife handles at the tanzania Mechanical Engineers Co-Operative Society (TAMECO) Ltd

REPORT ON A STUDY INTO THE VARIOUS WAYS TO MANUFACTURE KNIFE HANDLES AT THE TANZANIA MECHANICAL ENGINEERS CO-OPERATIVE SOCIETY (TAMECO) LTD.

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written in commission of
the Humanistic Institute for
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1. BACKGROUND INFORMATION.

The Tanzania Mechanical Engineers Co-operative Society (TAMECO) Ltd., is a co-operative registered with the Registrar of Co-operative Societies in Tanzania.
It is, in essence, a co-operative where-in persons voluntarily associate together as human beings, on basis of equality, for the promotion of the economic interests of themselves.
TAMECO was founded in 1972 by some members of the Dar es Salaam Motor Transport Company and registered as a co-operative in May 1973.

The Dutch involvement with the co-operative goes back to 1975 when a volunteer of the Organization of Netherlands' Volunteers (ONV) visited TAMECO.
At that time TAMECO was involved in a variety of activities such as:

- *car repair;*
- *panel beating and spraying;*
- *maize milling;*
- *forging and metal working.*

The co-operative employed some 40 people and knife making was the most important activity of the forging and metal working section. Knives were made from scrap iron at a rate of approximately 80 pieces a day.
The production process was a typical traditional artisan process.

On TAMECO's request, the ONV-expert on his return to the Netherlands, contacted Eindhoven University of Technology in order to find out whether the knife production could be increased to approximately 200.000 pieces per annum. A project proposal was drafted based on the supply of second hand knive making machinery and the Humanistic Institute for Development Co-operation (HIVOS) was found willing to finance the project.
The machines, including an electrically driven forging hammer, an excentric press, a hardening oven, a grinder and a variety of electrical motors, arrived on site in November 1977.

Soon after the installation of the machines it became apparent that there were serious technical problems and TAMECO requested Eindhoven University of Technology to look into them. A mission arrived in Dar es Salaam in November 1978 and came to the conclusion that most of the machines supplied by The Netherlands were unsuitable for knife manufacturing. In addition it appeared that TAMECO was losing money on the knife production and a new project proposal was drafted in January 1979, consisting of two phases.

In the first phase, some simple equipment, a suitable hardening oven and band iron was to be send to Dar es Salaam in order to enable TAMECO to continue knife production in an economic way.
In the second phase a new production line was to be supplied to enable TAMECO to produce some 300.000 knives per annum.

Late 1979, HIVOS agreed to finance the new project proposal, a production line was ordered and arrived in Dar es Salaam in November 1980.
The new production line was installed by experts from Eindhoven Universtity of Technology and was soon operational.
In addition, managerial assistance was provided to upgrade the existing organisation.
In November 1981, the project was formally handed over to the Tanzanian authorities.
A review of TAMECO's history from 1981 onwards is given in paragraph 3.

2. *SHORT DESCRIPTION OF THE PRESENT TAMECO PRODUCTION PROCESS TO MANUFACTURE MULTI PURPOSE KNIVES FOR USE IN RURAL AREAS.*

The production process designed and implemented in 1979/1981 is still operational and consists of:
- *pressing the blades from imported steel strips;*
- *drilling of holes in order to later fix the handle to the knife;*
- *hardening;*
- *quenching in oil;*
- *cleaning;*
- *tempering;*
- *cooling;*
- *checking;*
- *straightening;*
- *right hand grinding;*
- *left hand grinding;*
- *polishing;*
- *cleaning;*
- *additional shaping;*
- *sharpening.*

In the period 1981-1987 a number of modifications were introduced, often after experimenting with various alternatives.
The original 2 mm plate steel, was changed to 1.6 mm, thus saving raw materials. Since the SAFAN-puncher gave problems right from the start, a die was made to punch the holes in the blades when pressing the blades. This also did not prove to be satisfactory and eventually it was decided to drill the holes.
Other minor modifications were introduced, mainly geared at improving the quality and the look of the knives. These are mentioned in paragraph 3.

After starting up the new production line in 1980, wooden handles were made in the traditional artisan way. In 1981 TAMECO was however supplied with a complete set of wood working machines enabling TAMECO to make wooden handles more effectively.
This handle making process is still in operation and is described in paragraph 4.1.

Under Tanzanian conditions it must be considered surprising that the metal and wood working processes initiated in 1980/81 are still operational more or less according to manufacturers specifications.
This has to be contributed to three interacting factors:
- *the excellent quality of machines provided;*
- *skills and ingenuity of the TAMECO staff;*
- *the backstopping provided by the Dutch organizations involved.*

Summarizing, it would appear that TAMECO is capable of running a modern knife factory and the level of skills and know-how is such at present that further innovations of the production process can be considered without endangering TAMECO's future.

3. *REVIEW OF PROBLEMS FACING THE MANUFACTURING OF KNIVES TO DAY.*

The first stage of the collaboration project between TAMECO, Eindhoven University of Technology (EUT) and the Humanistic Institute for Development Co-operation (HIVOS) was completed in November 1981, when the project was formally handed over to the Tanzanian authorities.
At that time TAMECO had operational a modern production line capable of producing approximately 300.000 multi purpose wooden handled knives.
After 1981, HIVOS continued to financially support the project, particularly with finance for raw materials and spares and advice on administrative and financial matters. The role of EUT was reduced to that of technical and training consultant to TAMECO and HIVOS.
In the period 1981-1987 various TAMECO members stayed in The Netherlands for training and TAMECO's General Manager, R.L. Mbawala, attended a number of project policy meetings in The Netherlands.

In many ways TAMECO has done well in the 1981-1987 period. It proved capable of maintaining the production line mentioned in chapter 2 in good working condition and gradually the TAMECO members acquired all the skills and the experience to run a small industry technically as well as organisationally. Practical modifications were introduced and TAMECO managed to mobilize locally available resources. Polishing rolls and polishing paste e.g., are now produced locally and do not have to be imported anymore. Recently TAMECO has also succeeded to have a die made in Dar es Salaam for the excentric press.

In other words TAMECO has developed a strong and self-reliant attitude toward daily problem solving.

Of course there have been and still are a number of serious technical and infrastructural limitations. To start with there is the everlasting burden of securing enough foreign currency to import the main raw materials such as steel and grinding stones and the spares necessary to keep the machines and equipment in working condition.
The revenues of TAMECO are such that Tanzanian currency is available, but time and time again it proves to be very difficult or impossible to convert it into foreign currency. Recommendations regarding a possible solution of this problem are given in chapter 5.

Then there is the marketing problem. From the start of the project TAMECO's main customer has been the Household Supply Company (HOSCO), a para-statal, which marketed the knives through Regional Trading Companies (RTC's) to both wholesalers and traders. Only small numbers were sold directly to whole salers, traders and private individuals.

Late 1987 this situation changed drastically and HOSCO is not longer willing to accept the bulk of TAMECO's production at the required price and the quality offered.
Furthermore, due to a more liberal import policy, imported knives are available again the shops. Be it at prices from Tsh 700 upwards for stainless steel products. This compared to a carbon steel knife of TAMECO at approximately Tsh 100 in the Dar es Salaam region.
In view of this development and following recommendations made in the report compiled by mr. H. op het Veld (November 1987), TAMECO started its own promoting campaign through newspapers and radio advertisements. This, in a relatively short period, has led to a number of "outside" orders (see appendix) amounting to an annual demand of over 300.000 knives. The latter is exclusive normal HOSCO sales.
Summarizing, it would appear that TAMECO is able to find sufficient buyers for its products on the 'free' market and to keep its present machine capacity fully occupied.
Provided of course the quality of knives is compatitive and provided the price gap between imported knives and TAMECO knives remains significant. Although also in the past TAMECO made special knives on request (e.g. for skinning and tapping rubber), it has recently shown a remarkable aptitude to quickly act on sudden demand developments. An example is the execution of a recent order for 2000 sisal knives. Knives that were formerly produced by the Okapi factories in Germany, factories that went into bankrupcy in 1987.

Although exporting knives to neighbouring countries (Zambia, Moçambique, Rwanda, etc.) has been on TAMECO's mind for some time, the quality of the knives hitherto has made this impossible.

Last but certainly not least, there is the quality problem. With respect to quality there are two aspects of concern: the blade and the handle.

With respect to the blades, customers have already for a long time complained about the blades being rusty even before use. As early as 1983, it was tried to curbe the rust problem but this never led to a lasting success.
Mid 1987, the situation became so desperate that the matter was looked into again.
Various manufacturers were consulted and members of TAMECO's technical staff were send to The Netherlands and Germany to try and solve the rust problem.
As a result a number of interacting measures were taken:
- *grinding at lower speeds thus improving the surface structure of the blade (N.B. this reduces the machine output!);*
- *stacking of the blades in the polishing machine with the cutting edges facing each other. In this way even the part near the cutting edge becomes well polished;*
- *carefull removal of all polishing paste, by rubbing the blades with saw dust, prior to further processing.*

The results, as appeared during the March 1988 visit, have been beyond expectation. The knives are clean, shiny and smooth and provided they are well oiled and wrapped prior to packing, the rust problem should no longer occur.

The handles consitute a different problem that is also related to quality. Presently handles are made from Garvelia wood according to the process described in paragraph 4.1. Garvelia is a medium priced wood, although prices are rising, that has long fibres hampering the milling process. It has a yellowish brown colour.
According to TAMECO, most customers prefer handles made from black wood, but this is difficult to get and it is expensive. In addition, the process of handle making is complicated, contains many steps and is difficult to control from both the quantity and quality side. If the knife production was to exceed 300.000 pieces, it would be doubtfull whether the present process could cope both in quantity and quality.
By now, 'plastics' have become common in Tanzania, not only in the forms of buckets, hoses, etc., but also as components of various tools and appliances.
TAMECO is of the opinion that black poly-propylene handles will boost the sales of knives and make the knives compatible on the export market.

Whether or not poly-propylene handles will indeed boost local sales is difficult to prove, or disprove for that matter. There are however strong indications that black poly-propylene handles will go well with the customers:

- *the German Okapi factories have marketed black poly-propylene handled sisal knives successfully for some years. The German factory has now shut down and TAMECO could fill the gap in the market;*
- *in 1986, TAMECO had some 5000 knives fixed locally with a 'soft' black plastic handle.*
  Although the quality of these handles was below standards, the knives sold well.
  The process used was however too labourious and expensive;
- *a limited consumer test, carried out in March 1988, showed that women buyers preferred black poly-propylene handled knives (see paragraph 4.6).*

Two other considerations are important related to the issue of poly-propylene handles.
Firstly, in the TAMECO scrap yard there are approximately (see photograph) 40 tonnes of punched out steel strips of which at least 2.000.000 small knives and paper knives could be made. These knives are too small to conveniently fix wooden handles, but with the poly-propylene process this could be easily done.

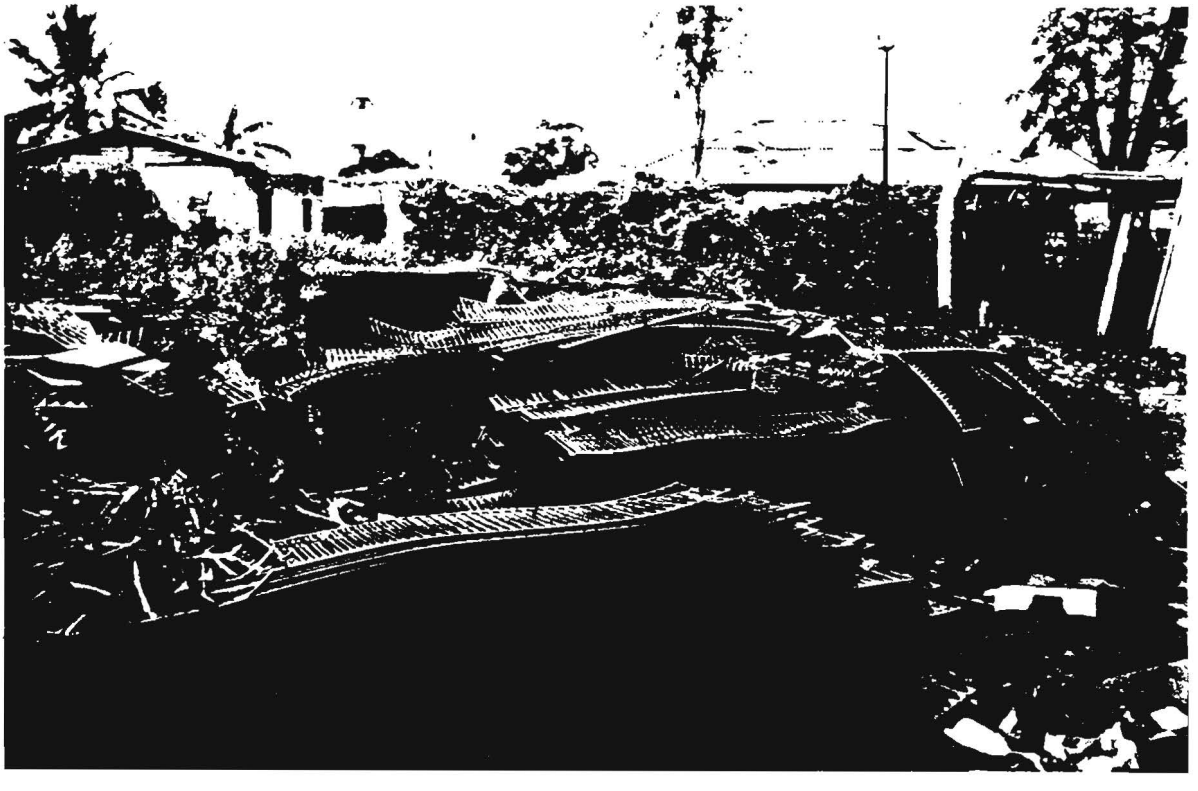

Figure 1. Some 40 tonnes of punched out steel strips in TAMECO's scrap yard.

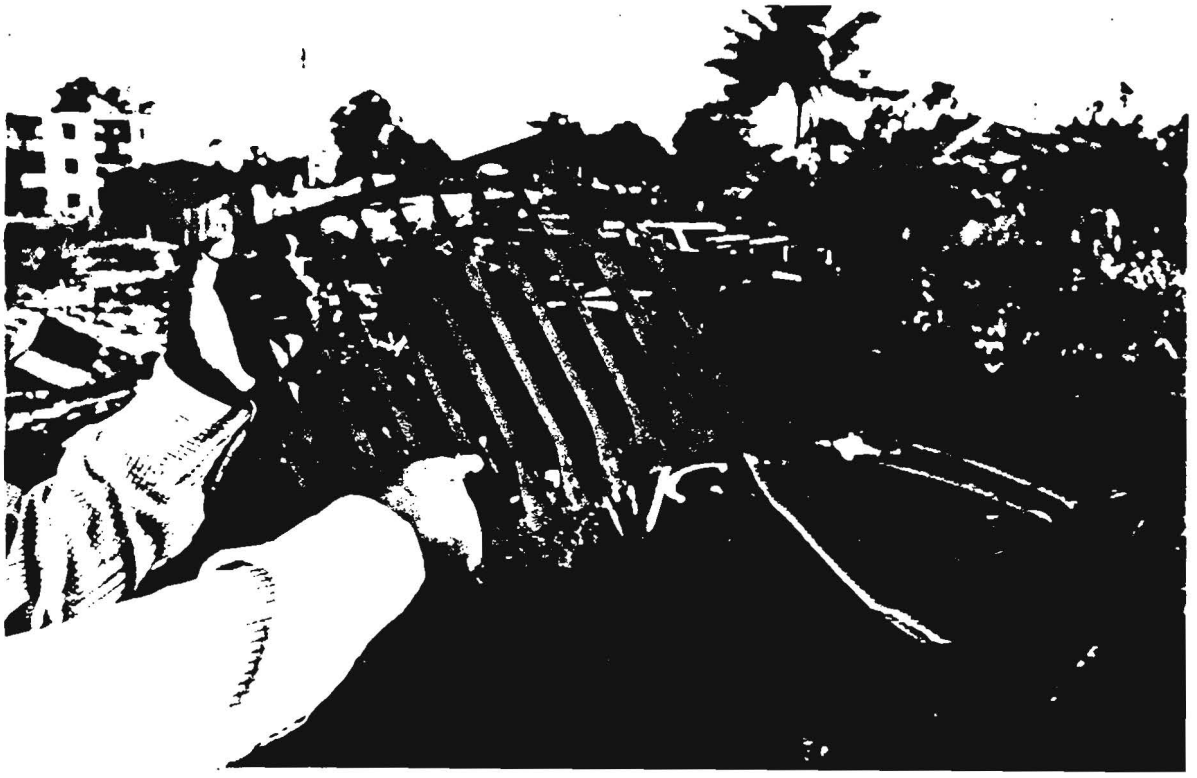

Figure 2. Punched out steel strips as a possible raw material source for small knives and paper knives.

Secondly, the production of poly-propylene handles would make the present wood workshop of TAMECO available for other work in the field of carpentry. This would be a diversification of TAMECO's present activities with the advantage that good use is going to be made of available knowledge and skills.

4. THE HANDLE ISSUE.

4.1 Description of the present handle making process.

In the present production process the following steps are distinguished:

1. *Open air stacking of the wood in the TAMECO compound.*
2. *Planing the wood in order to get a smooth surface.*
3. *Sawing the timber into small planks out of which two handle halves can be obtained.*
4. *Selecting the broken and torn planks.*
5. *Milling for getting the shape of the handle.*
6. *Separating the two halves by means of sawing.*
7. *Selecting the broken and torn pieces.*
8. *Drilling the three holes for rivetting.*
9. *Cutting aluminium wire into pieces suitable for rivetting.*
10. *Rivetting the two handle halves to the blade by means of hammering three pieces of aluminium wire.*
11. *Grinding the two sides and the back side by means of an emery disc.*
12. *Grinding the front side by means of a grinding stone.*
13. *Oiling the handle as well as the blade.*

By using the present wood-working machines no other or better handles can be produced and all the 13 steps mentioned are essential. In this process some twenty three people are employed. Handle making now is a part of the total production process that is almost working at full capacity. Since TAMECO will be provided with an additional set of automatic grinding machines through the Friedrich Ebert Stiftung (FES) the present way of handle making will become a production bottle-neck in the near future.

For a further analysis of the handle making issue it is important to look into the cost related elements of handle making.

Wood(Garvelia).
The estimate of the wood consumption for making handles is based on measuring the volume of a standard TAMECO collection box for wood strips ready for milling.

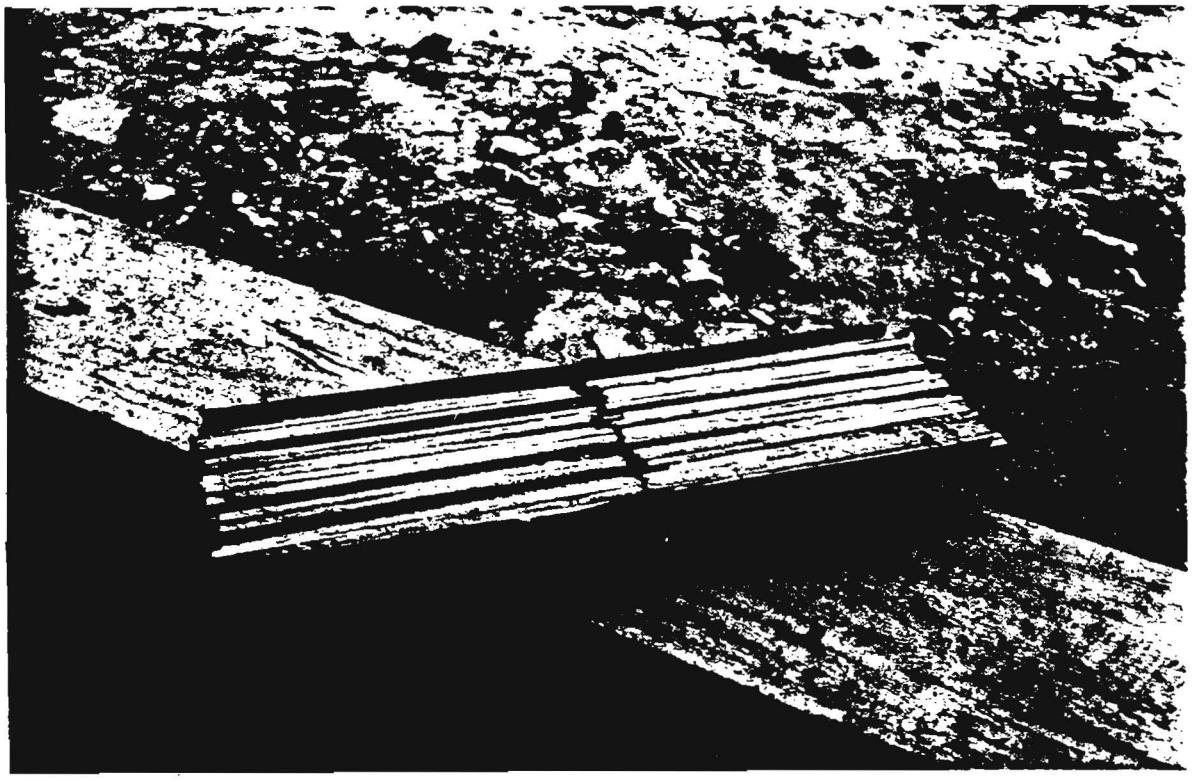

Figure 3. A standard TAMECO collection box for wood strips ready for milling.

Measures of the box: 0.14 x 0.04 x 0.51 cm= 0.002856 m^3. Each box contains 44 strips of wood of which 88 handle halves can be made for making 44 complete handles. Based on the volume of the standard box, 1 m^3 of woodstrips provide handles for 15.500 knives (44 x 352).

To manufacture handles for 300.000 knives, 19.4 m^3 of wood strips are required.

The quality of the wood is such that milling produces handle halves that are far from perfect. The milling cut is not clean and many loose wood fibres are still attached to the handle halves. Furthermore, many wood strips split or are otherwise damaged during milling.

Figure 4. Many loose wood fibres are still attached to the handle.

It is, on basis of observations on a large number of handle halves and the wood refuse dump, estimated that 30% of the handle halves leave the milling machine seriously damaged and consequently have to be discarded. To eventually produce handles for 300.000 knives, a total of 25 m^3 of wood strips are required.

Figure 5. Some 30% of the handles halves leave the milling machine seriously damaged.

Figure 6. The wood refuse dump: sawing and planing losses.

Considerable wood losses also occur when making wood strips from planks. Wood for handle making is bought as rough planks, appr. 7 to 10 cm thick, 15 to 20 cm wide and 700 cm long. The planks are stored in the open without any protection from rain and sun.
The wood therefore appears to be in a dubious condition: bend, cracked and twisted.
Also there is a considerable variation in the dimensions of the planks as they are delivered to TAMECO.

Figure 7. The wood appears to be in a dubious condition: bend, cracked and twisted.

Last but not least, the intrinsic quality of the wood appears to be far from optimal for the milling process: rather soft with long, loose fibres.

Taking al this into consideration a 50% loss when transforming planks into woodstrips appears to be a fair estimate.

Therefore, eventually, a total of 37.5 m^3 of planks is required to make handles for 300.000 knives. Since all previous reports use ft^3 as a measure, m^3 are changed to ft^3 as follows:
1 ft^3= 0.3 x 0.3 x 0.3 m= 0.027 m^3.
1 m^3= 3,7 ft^3.
To make handles for 300.000 knives, therefore a total of 37.5 x 37= 1388 ft^3 of rough wood is required. For the purpose of easy calculation say 1400 ft^3.

Prices of wood are been reported to have increased dramatically recently.
According to information provided by TAMECO the following prices are recorded:
1986 206 Tsh per ft^3.
1987 255 Tsh per ft^3.
1988 350 Tsh per ft^3 (estimate).

The nett woodprice per handle per knife is therefore as follows:

1986 206 x 37= 7622 Tsh/m^3 x 37.5 = 285825 Tsh per 300.000 handles= 0.95 Tsh per handle.

1987 255 x 37= 9435 Tsh/m^3 x 37.5= 353813 Tsh per 300.000 handles= 1.18 Tsh per handle.

1988 350 x 37= 12950 Tsh/m^3 x 37.5= 485625 Tsh per 300.000 handles= 1.62 Tsh per handle.

<u>Rivets.</u>
The wooden handle has 3 holes through which iron or aluminium wire is rivetted to joint the handle with the blade.
At the time of the working visit, aluminium wire was used.
To rivet 300.000 handles per annum, 1200 kg's of wire is required at a cost of 350 Tsh/kg. This makes a total of 420.000 Tsh, or 1.4 Tsh per knife.

<u>Surface treatment of handles.</u>
The rivetted knife handle needs to be made smooth. This is done with grinding disks, using emery cloth and glue.
To make 300.000 knives smooth, 4500 emery cloth discs are required at a price of Tsh 126 a piece. This makes a total of 567.000 Tsh, or 1.9 Tsh per knife.

Glue, to put the emery cloth on the disks, is used at the rate of 700 l. per annum at a price of 356 Tsh is 249200 Tsh, or 0.8 Tsh per knife.

Other materials.
In the process, also other materials are used such as:

- hacksaw blades and frames.	tot.	cost	8.000 Tsh
- drill bits	"	"	17.000 Tsh
- circle saws	"	"	50.000 Tsh
- miscellaneous items	"	"	50.000 Tsh
		tot.	125.000 Tsh.

This amounts to 0.5 Tsh per knife.

Labour.
Precise figures are not available, but 23 persons are on the book for this part of the process.
They do however not work continiously on handle making.
For the sake of the current calculation, 19 persons with an average wage of 1400 Tsh/per month are included.
12 x 19 x 1400= 319200
or 1.1 Tsh per knife.

Electricity.
Estimated at 15.000 Tsh
or 0.005 Tsh per knife.

Machine repair and maintenance.
Is difficult to estimate, but has been taken at 8% of the total for the knife production = 52.000 Tsh
or 0.2 Tsh per knife.

Depreciation of machines.
p.m.

Summarizing, the production costs per handle in the old process are:

wood	1.6	Tsh per handle
rivets	1.4	" " "
emery cloth	1.9	" " "
glue	0.8	" " "
other materials	0.5	" " "
	6.2	Tsh per handle
labour	1.1	Tsh per handle
electricity	0.05	" " "
machine repair and maintenance	0.2	" " "
depreciation machines	p.m.	" " "
	1.3	Tsh per handle
Total	7.5	Tsh per handle.

4.2 Alternative handle making processes.

Looking to the European market it can be concluded that knife handles are either produced by means of milling wood in such a way that one piece handles are obtained or by means of moulding poly-propylene. Both techniques will require equipment different from that presently used by TAMECO. In order to get a clear view, both techniques of handle making are elaborated on in chapters 4.3 and 4.4.

4.3 One piece wooden handles.

By discussing this subject with knife producing companies in Germany and with Verboom B.V. at Renswoude, supplier of woodworking machinery, it is concluded that an acceptable product can only be produced by means of the rotation milling method. This method however requires highly sophisticated equipment. The basic principles of this production process consist of a rotating table on which pieces of wood are fixed and while turning around, the different milling operations are fully automatically executed. After milling a saw cut must be made by means of an exactly adjusted circular saw. Before starting this process, planing and sawing like it is presently done by TAMECO, will remain a necessary treatment of the wood.

The following calculations are based on information provided by Verboom B.V. and on own observations at TAMECO.

Investments.

1. Purchase of a rotating milling machine	ƒ 168.000,-
2. Purchase of hand-operated circular saw	- 11.000,-
3. Transport and insurance	- 7.500,-
	ƒ 186.500,-

Costing.

1. Wood	T.sh. 1.9
2. Rivets	- 1.4
3. Emery discs	- 1.9
4. Glue	- 0.8
5. Other materials	- 0.5
6. Labour	- 1.1
7. Electricity	- 0.1
8. Repair and maintenance	- 0.4
9. Depreciation 13%	- 3.9
Cost price per handle	T.sh 12.0

Capacity.

According to Verboom's information, 4 handles per minute can be produced. Based on an 8 hours working day and based on 200 working days per year, 384.000 pcs. of one piece wooden handles can be produced. If a higher number of handles will be required, working in more than one shift can be considered. In the latter case however 2 x 19 labourers are required.

4.4 Poly-propylene handles.

The basic principles of this production process consist of the combination of high pressure and heating of the raw material, poly-propylene grains. The high pressure is obtained by a hydraulic system and the high temperature by means of thermo-elements. These techniques are brought together in one moulding machine, with which 4 handles in one shot can be produced.

The following calculations are based on information provided by a division of the Eindhoven Philips factories, with the experience of mass production of these products during many years.

Investments.

1.	Purchase of a used 130 tons Netstal moulding machine with a screw 0 45, shot volume 254 cm^3, weight of the shot 180-200 gr.	ƒ 40.000,-
2.	Overhauling	- 30.000,-
3.	Equipment for drying the raw material	- 8.000,-
4.	Temperature control units (2 pcs.) for the tools	- 8.000,-
5.	Equipment for reducing the waste of the poly-propylene into re-usable grains	- 12.500,-
6.	Tools	- 58.000,-
7.	Cooling unit for the cooling water to 14°C	- 5.000,-
8.	Colour mixing and dosing machine (not strictly necessary)	- 20.000,-
9.	Installing the equipment at TAMECO by a Philips engineer. Salary and expenses for 2 weeks	- 11.700,-
10.	Transport and insurance	- 12.500,-
	Total investments	ƒ 205.700,-

Costing.

1.	Raw material price ca. ƒ 2,50 per kg. For one handle ca. 43 gr is required = ƒ 0,1075 waste 3% = - 0,0032	ƒ 0,1107
2.	Labour (5 operators)	- 0,0056
3.	Electricity and water	- 0,0168
4.	Repair and maintenance	- 0,0213
5.	Depreciation 13% per annum	- 0,0891
	Cost price per handle	ƒ 0,2435

Capacity.

Cooling time	45 seconds
Inspection, dosing, opening and closing time	10 seconds
Laying the steel blades into the machine	15 seconds
	70 seconds

Thus 4 handles can be produces in 70 seconds, 204 in one hour, 1.632 in a 8 hours day and 326.400 in a year with 200 working days. The type of machines mentioned is suitable for continuous operation and if the production has to be increased, working in more than one shift can be considered.

4.5 A comparison of the various handle making processes.

The following handle making processes have so far been described:

(1) present process of making two wooden handle halves to be rivetted together (par. 4.1);
(2) one piece wooden handles made by rotation milling (par. 4.3);
(3) poly-propylene moulding (par. 4.4).

The following table presents a summarized comparison of the costs related to the three different processes of handle making.

Component	cost per handle in Tsh based on 300.000 pieces per annum		
	(1)	(2)	(3)
wood	1.6	1.9	-
poly-propylene	-	-	5.5
colouring agent	-	-	p.m.
rivets	1.4	1.4	-
emery cloth	1.9	1.9	-
glue	0.8	0.8	-
miscellaneous items	0.5	0.5	
	6.2	6.5	5.5
labour	1.1	1.1	p.m.
electricity	p.m	0.1	1.0
machine repair and maintenance	0.2	0.4	1.0
depreciation	-	3.9	4.5
	1.3	5.5	6.5
total general	7.5	12.0	12.0

The calculations in the table are based on an annual production of 300.000 knives. For the present production process, depreciation at the rate of 13% per annum is not accounted for, since the machines are more than 7 years old. If new machines would be involved with a value of fl. 100.000, the depreciation would amount to 2 Tsh per handle added to the cost price of 7.5 Tsh.

From the table, it is apparent that processes (2) and (3) are slightly more expensive (20%), than the process currently used. At an exchange rate of 1 Tsh= Fl. 0,02, processes (2) and (3) add fl. 0,05 and fl. 0,09 per handle to the cost price, depending on whether or not depreciation in process (1) is accounted for or not.
In other words, whether or not a certain process is eventually selected, will depend on other factors than its effect on the handle cost price.

The present handle making process (1) and the rotation milling process (2) have a number of negative elements in common. The main raw material used for the handles is wood.

Good quality black hard wood is difficult to get, the supply is irregular and the price is high and ever rising. In addition, black hard wood is difficult to process and its use will result in extensive wear of the cutting implements of the milling machines. Cheap wood is easier to get (Garvelia), but due to certain properties of the wood, handle halves leave the milling machine in a scruffy state. Also the price of this wood is rising.
Both milling methods require at least 13 process steps (paragraph 4.1), a large variety of machines and at least 19 labourers with specialized skills to execute the work. Consequently, the process is extremely difficult to control from both a quantity and quality point of view. It is presently the main bottle neck in the entire production process.
In addition, both processes require a variety of other materials such as e.g. emery cloth, glue, rivets, saw blades.
The main advantage of the two processes lies in the fact that TAMECO has developed all the necessary operational skills.

The poly-propylene moulding process (3) has two obvious negative elements:
- *the machines to be used have a complicated electronic regulation system with which TAMECO has no experience;*
- *the process is sensitive with respect to the accuracy of the operators and the fact that the machines have to be kept spotlessly clean.*

The main advantages of the process lie in the fact that the number of process steps is drastically reduced, thus making the process much more easy to manage. Increasing the total knife production becomes feasible.

Processes (2) and (3) have an additional cost advantage in the fact that the steel part of the knife can be reduced by 30% in weight of steel. This due to the fact that the handle side of the blade can be considerably shortened.
It is estimated that for the production of 300.000 knives, 40 in stead of 60 tonnes of steel will be required. At a price of fl. 1800 per tonne this will amount to a saving of fl. 36.000 on the annual production costs, or fl. 0.12= Tsh 6 per knife produced.

4.6 *Market considerations and consumer preferences with respect to multi purpose knives and various types of handles.*
Up to the end of 1987 HOSCO has been the main customer of TAMECO's knives. About 90% of the knives produced was sold to HOSCO and for this reason TAMECO was strongly dependant on the willingness of HOSCO as far as prices and quantities were concerned. Due to a change in the national policy and due to the marketing activities of TAMECO, like radio advertising, other companies have shown their interest in TAMECO's knives and have placed orders for quantities for more than TAMECO can produce (see annexes). This new market situation makes TAMECO less dependant on HOSCO and therefore TAMECO comes in a position from which it can sell knives to the customer who is willing to pay the best price. Since it is TAMECO's strong wish to become a self-reliant company, it now is studying export possibilities through which foreign currency can be obtained, in the end leading to importation of raw materials paid for by own financial means.

For an export market however, a knife must be produced of such a quality that it will be fully compatible with the knives presently imported from Germany, Japan and China. Now the problem of rusting has been solved, there is one remaining aspect in the production that needs attention: handle making. Not only the quality of the handle plays a role in marketing, but also the shape and the colour, in other words the look of the product, is of great importance.

A consumers test was carried out by giving women the opportunity to make a free choice out of the following types of knives

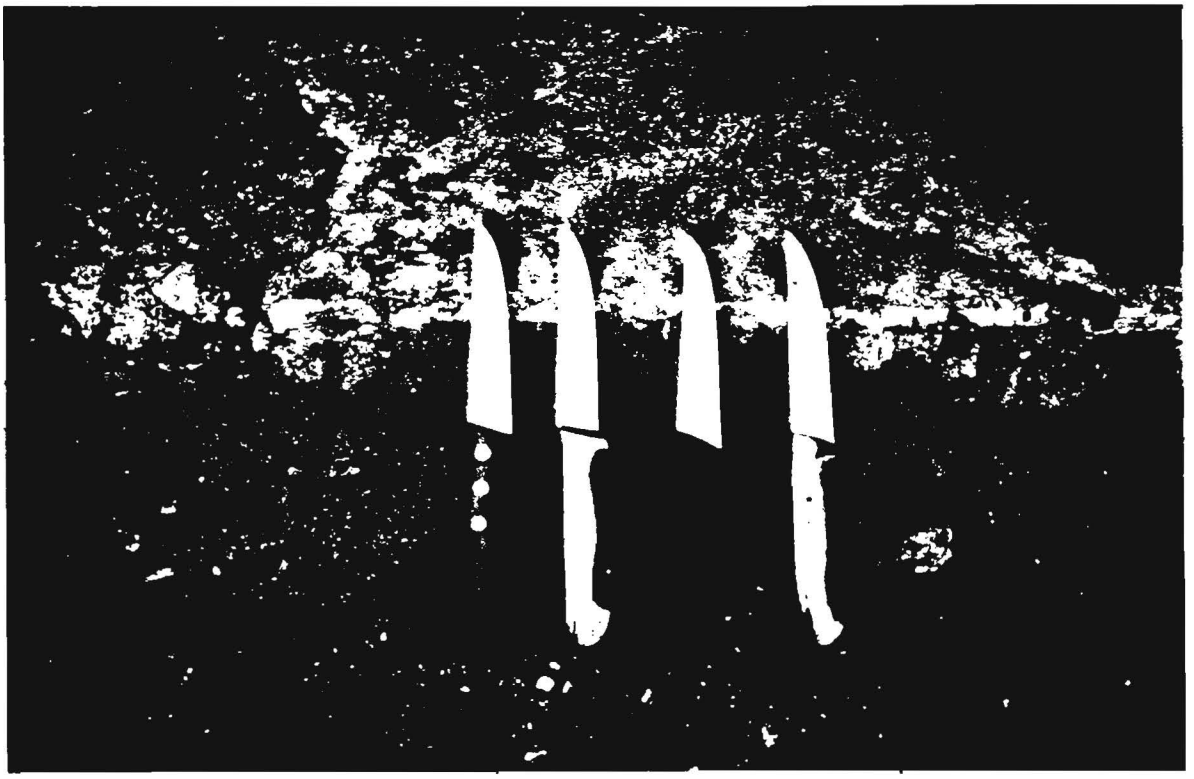

Figure 8. A free choice out of 4 types of knives.

1. *a knife with a wooden handle made in Germany;*
2. *a knife with a poly-propylene handle made in Germany;*
3. *a knife with a wooden handle with the shape of the handle as mentioned under 1 made by TAMECO;*
4. *a knife with a wooden handle with the shape of the handle as mentioned under 2 made by TAMECO.*

The shape of the steel blades was the same for all the 4 types. 70% of the women preferred the type mentioned under 2. and only 30% selected the type as described under 1.
None of the women selected one of the types produced by TAMECO as mentioned under 3. and 4.

After the women had made their selection, the following two questions were answered by each woman individually:

1. *Who in your family will buy a knife? Is it the man, the wife or one of the children?*
2. *Why did you prefer the knife you have selected?*

On the first question ,80% of the women answered that in their family the wife will buy the knife and 20% answered that the man will buy the knife.

On the second question, the women who had selected a knife with a wooden handle answered that they made their choice because of the shape of the handle, the colour and the preference for timber. The women who had selected a knife with a poly-propylene handle answered that their choice was influenced by the durability, strongness, colour, the decent look and the fact that the polish will not wear off when using the knife like is the case with wooden handles.

After the test all the women involved were given the knife they had selected as a free gift.

4.7 *Building infrastructure at TAMECO.*

When the project was formally handed over to the Tanzanian authorities in 1981, the building infrastructure of the metal working section of TAMECO consisted of:

- *a stone building with a corrugated iron roof, 30 x 10 m, for the new production line;*
- *a corrugated iron shed for the wood working;*
- *a corrugated iron shed for the stores and the various offices, including that of the General Manager.*

During the March 1988 visit, the situation was found to be more or less the same as in 1981.

The stone building was still used for the original production line. Apparently however, it had gradually filled up with raw material stocks and offices for the production staff, in addition to the existing equipment and machines. All in all it made a crowded, although organized, impression. Part of the original currugated iron shed had been torn down, the central offices part, and a new currugated iron office had been build.

Apart from these minor changes, it was observed that TAMECO is building a completely new stone building with a corrugated iron roof, 36 x 15 m.

Figure 9. The new building under construction.

The building is nearly completed, apart from the roofing and the necessary inside work and fittings. Stones were made by TAMECO by means of a hand operated stone press, using cement and sand from the TAMECO compound.

Figure 10. The hand operated stone press and the sand fit.

The roof construction consists of welded metal beams and the entire building is apparently constructed on a low cost budget. However it looks, and most likely is, a well constructed hall that will last for many years.

It can solve a number of obvious problems:
- *storage of raw materials, particularly steel.*
  This steel is presently stored in the open air and this is extemely detrimental for the quality.
  Once the steel strips are rusted, it will take a lot of effort to produce a shiny and good looking knife;
- *floor space for wood working and for poly-propylene moulding machines;*
- *floor space for other machines if and when TAMECO decides to diversify its production.*
  The latter may e.g. be the case if the poly-propylene moulding is introduced and the wood working section specializes in e.g. making broom handles, furniture, etc.

The mission members however doubt whether TAMECO will be able to install the necessary indoor infra structure such as electricity, water, switchboards, etc., without external aid. It may be wise to discuss the possibility to include this aspect in a possible new contract with TAMECO.

Figure 11. Steel stored in the open.

4.8 Financial considerations.

A review of TAMECO's financial situation and prospects was given in the report compiled by mr. H. op het Veld in November 1987. Reviewing this situation was not included in the present mission's brief and financial aspects were only considered in detail with respect to handle making.

Nevertheless, it is impossible to resist making a number of general remarks that have financial implications.

Discussions with the FES-representative in Dar es Salaam brought to light that TAMECO has virtually concluded its negotiations with FES for the purchase and financing of two additional grinders. When these grinders become available, the last capacity bottle neck in the metal working section has disappeared.
The next bottle neck then lies in the wood working section: handle making. If this bottle neck could be solved, e.g. by installing a poly-propylene moulding machine, a significant increase in production becomes possible.

From the annexes it is clear that there is a potential internal market that will well exceed 300.000 knives per annum.
In addition, the Tanzanian Government is very keen to stimulate exports and there would appear to be a substantial market for knives in countries like Uganda, Rwanda-Burundi and particularly Moçambique.
However, both on the internal market (but this is a recent phenomenon) and the external market, the TAMECO knives will be in competition with high quality knives from other origins.
Therefore, the TAMECO knives will have to be shiny and straight as far as the blades are concerned (this with the recent improvements has now been achieved) and the handles need to be black, heavy, smooth and resistant to wear and tear.
The latter can be achieved by introducing a new process of handle making.

Although TAMECO's loan situation appears tight as it is, the extra investments necessary to improve handle making (paragraphs 4.1, 4.2, 4.3, 4.4 and 4.5) can be earned back quickly. This is confirmed in the Op het Veld report.

5. RECOMMENDATIONS.

During the March 1988 visit, 3 possible alternatives for improving handle making were investigated:

1. present process of making two wooden handle halves to be rivetted together;
2. one piece wooden handles made by rotation milling;
3. poly-propylene moulding.

Improvement of the present handle making process is not feasible. It would require a constant supply of high quality and therefore expensive black hard wood. Since this wood is extremely hard, new and heavier wood working machines would be required (circular saws, planes, milling machines).

Besides, it leaves TAMECO with a complicated production process that is difficult, if not impossible, to control from a quantitative and qualitative point of view.

Introducing rotation milling is technically feasible as explained and elaborated upon in the paragraphs dealing with handle making. Apart from the saving of raw material (steel: 20%), the process has the same disadvantages as the present process.

The most attractive alternative therefore appears to be poly-propylene moulding. The handle cost price is compatible with the cost price of the present handles. Moulding produces smooth, heavy, black handles that are highly in demand in Tanzania (see consumers test).
The difficulties to control wood milling process, consisting of at least 13 steps, can be abandoned.
The skills of the people in the present wood workshop can be employed in the diversification process TAMECO wishes to initiate (hoe and broom handles, furniture components, etc.).
Since TAMECO has an outstanding record in dealing with technical innovations, the introduction of a moulding process should not create more than ordinary problems. Proper training of operators will be necessary and has been included in the calculations presented in paragraph 4.4.
In addition, moulding by now has become an accepted technique in Tanzania and local expertise is available, be it of course at a price.

Summarizing, it is recommended that TAMECO receives assistance to purchase and finance equipment and raw materials to introcuce the poly-propylene moulding process.
Although TAMECO's loan situation is tight, the prospects of rapid repayment, according to our calculations, are there.

Foreign exchange to buy raw materials however, remains a problem and this issue was discussed with the Dutch Embassy in Dar es Salaam. It is recommended that EUT and HIVOS take joint action in order to incorporate the raw material component in the Dutch raw material supply programme for Tanzania.
TAMECO, assisted by the Dutch Embassy in Dar es Salaam, is to try to get a priority rating from the Tanzanian Government.

H. V. HINDOCHA LTD.

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... TRADERS LTD
... TEL. ...
... ES-SALAAM

P. O. BOX: 1797
TEL. OFFICE: 21066
RES: 26587

YOUR REF:

OUR REF:

DAR ES SALAAM 15TH FEB 1988.

TO,
TAMECO LTD.
BOX 40057
D'SALAAM.

TO,
THE SALES DEPT.

RE: SOCK OF TAMECO KNIVES.

Dear Sir,

I would like to request you to supply us 500 sock of tameco knives every month on name of M/S JALARAM TRADERS LTD BOX 1797 D'SALAAM. I hope you agree with me.

Thanking you

Yours faithfully,

Mayur

5c cartons = 7.200
66.400 units per annum.

... TRADERS LTD
... TEL. ...
... ES-SALAAM

INDENT No. 090/0022/L/88

DATE 21st March, 1988

HOUSEHOLD SUPPLIES
Company Limited
Head Office INDEPENDENCE AVENUE DAR ES SALAAM
P.O. Box 4794 Telephone 29381 Telegrams HOUSEHOLD

TO M/S. TANZANIA MECHANICAL ENGINEERS CO-OPERATIVE LIMITED
P.O. BOX 40057,
DAR ES SALAAM.

Please supply the following goods in accordance with the general terms and conditions set out overleaf and with the undermentioned special terms

Signed _____ General Manager

TERMS OF PAYMENT	AFTER DELIVERY OF GOODS			CURRENCY	T.SHS.
SHIPPING MARKS	HOUSEHOLD 090/0022/L/88 DAR ES SALAAM	IMPORT LICENCE NO.	EXPIRING	Ex C.I	
REQUIRED DELIVERY	IMMEDIATELY TO HOSCO KURASINI GODOWN	INSURANCE SUPPLIER'S A/C.		PRO-FORMA INVREF.	

DISCRIPTION OF GOODS REQUIRED	UNITS OF QUANTITY	UNIT PRICE	QUANTITY REQUIRED	c.i.f VALUE (In Suppliers currency)	
MANECO KNIVES 1x1x12 Dozen.	CARTONS	9,295/20	100 Ctns	929,520.	00
			TOTAL	TSHS. 929,520.	00

FOURWAYS TRADERS

GENERAL MERCHANTS

MARKET/AGGREY STREET
TELEPHONES { Resd. 2764
Office 22207
P.O. Box 3307

Ref. No. .....

Dar es Salaam, 18th January 19 88.

The General Manager,
Tanzania Mechanical Engineers Coop Society Ltd.,
P.O.Box No. 40057,
Daressalaam.

Dear Sir,

Re:ORDER FOR AGRICULTURAL KNIVES .

As you know we are your regular customers for purchase of Agricultural knives manufactured by you.
We hereby place an order with you for the continous supply of these knives to us upto 150 Ctns. x 12 Doz.every month.
Thanking you.

Yours faithfully,

L.B.Babla.

Fourways Traders.

1 carton = 144 knives
150 cartons = 21,600 knives
259200 knives per annum.

MBONI LIMITED
P.O. Box 117
TANGA

ORDER A 06197

T.O. Copy-Order File

Supplier : BP (T) LTD.

From DSM. OFFICE. Date 4/8/68. (To be Completed by T.O.)

Quantity Number	Packing	Weight Measure	Goods	Invoice or Stock No.	Quantity	Amount
2000	Pcs.		SISAL KNIVES (FOR SISAL ESTATES)			

Approved by A:O.

Purpose

Suggested Supplier:

Remarks:

Do not write beyond this line

A/c. No.

Order Received | Order placed

Goods Despatched on

Ordered by: Estate Manager

1

UTA-(NPC)-Kalamazoo-S-090531-68