OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

20535

Distr.
RESTRICTED

ISED/R.5
2 February 1994

ORIGINAL: ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ASSOCIATE EXPERT

TF/KEN/91/002

REPUBLIC OF KENYA

Terminal report*

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

Based on the work of S. Sikkema,
associate expert

Backstopping Officer: E. Khan
Metallurgical and Engineering Industries Branch

* This document has not been edited.

V.94 20554

TABLE OF CONTENTS

ABSTRACT

Author:	S. Sikkema, associate expert
Assignment:	2 years (3 November 1991 - 2 November 1993)
Project no.:	DP/KEN/86/048
Title:	Establishment of an Engineering Development and Service Centre
Duration:	January 1990 - January 1993 (First Phase) There after several bridging finance periods in order to have the Second Phase Document approved.
Purpose:	To assist the Government of Kenya in the achievement of higher utilization of existing industrial capacity through the activity of the Kenya Industrial Research and Development Institute (KIRDI).

My main conclusion is that, in spite of my input, this project is on the brink of collapse due to mismanagement by a non-qualified and inexperienced local management and a CTA who had definitely other priorities.

If there is any Second Phase I would like to recommend to replace this management by a strong, qualified and experienced one. With qualified and experienced, I do not mean people who have been in government services for so many years, but people who gained their experience in commercial companies.

RECOMMENDATIONS

Although not all the points I present over here, are exactly in the scope of my knowledge and experience, but if there is any further extension of this project, it definitely needs a more experienced and more qualified management who understands the need of:

1. Good quality of technical drawings according to the ISO standards. The current National Project Manager and the heads of the design units are not qualified in my opinion because they approve technical drawings with unacceptable errors. In addition to this, even the Chief Technical Adviser did not take action in this situation.

2. Better quality control of all items produced by the workshops. Too many parts do not comply with the technical drawing from the first stages of manufacturing. Since there is no quality control at all, such errors are only discovered during assembling, after the erroneous part passed all other stages.

3. Better marketing methods. A too small number of companies in Kenya which could be a potential customer, know about the existence and the activities of the centre. The customers the centre had, were hardly impressed by the centre's working methods and quality of the products. Especially 1993 was marked by a high grade of idleness in all departments of the project due to lack of orders.

4. More discipline. Many staff members of the project reported late and left early. Meanwhile they took excessive long tea breaks and lunch breaks. Even private matters were solved during office hours. The efficiency therefore was very low.

5. Better safety regulations. The workshop personnel are not provided with necessary safety devices like protective

glasses, protective shoes or ear protectors, while they work with machines producing metal chips, with heavy tools and parts in a noisy environment. The First Aid Kit was stored in another building too far away in case of an emergency. There were no people qualified to give First Aid and there were no protective gloves to prevent AIDS in case blood was spilt.

6. Maintaining delivery times as agreed with the customers. Many customers became disappointed due to repeatedly late deliveries of the centre.

7. Better cost calculation methods. There is no cooperation between the economic unit and other units. The result is that quoted prices are too low, while the workshops and design units exceed the allowed number of hours estimated for a certain product.

8. Impeccable record of service. There are strong rumors that some members of the current local management are involved in the theft of tools and materials from the project site and in unauthorized use of project vehicles. UNDP in Nairobi is aware of this.

9. Test and improve developed prototypes to make the final edition ready for manufacturing. Many prototypes stayed on the site for the purpose of showing them to international and government delegations to make them impressed. These prototypes were never tested, so it is unknown whether they will function properly in practical conditions.

INTRODUCTION

Duration of assignment: 2 years (3 November 1991 - 2 November 1993), including 5 days briefing in UNIDO headquarters in Vienna International Centre, Vienna, Austria.

The project DP/KEN/86/048 started in the beginning of 1990. It is a cooperation between UNIDO and the Kenya Industrial Research and Development Institute (KIRDI). This institute is an autonomous organization under the Ministry of Research, Science, and Technology. The purpose of the project is to assist the Government of Kenya to achieve a higher utilization of the existing industrial capacity. Therefore an Engineering Development and Service Centre was established in two available empty buildings of KIRDI. UNIDO provided the project with several basic metal working machines, vehicles, tools, equipment and international experts. KIRDI provided the project with other personnel varying from messengers to local experts.

For the full history, I would like to refer to reports of the surveys and missions, the original first phase project document and to the numerous proposals of the second phase document. The first phase ended in or around January 1993, but at that time the second phase was still not approved. Since then the project is extended with bridging finance periods with several interruptions. The reason of all the trouble is certainly known by UNIDO. If not, I am willing to give my opinion about this project at your special request.

The result is that all activities of the project went down to an unacceptable level so that it is on the brink of collapse at the time of writing.

I. Main activities

During my assignment as an associate expert in project DP/KEN/86/048 in Nairobi, Kenya, I designed and developed the following spare parts and equipment:

* a motorized variable speed turntable for a pottery
* a chain tensioning arm for a leather treatment machine
* a clay mixer for a pottery
* a maize planter
* a kiln door for a pottery
* a clay filter for a pottery
* an ox drawn multi-purpose wheeled frame for agricultural implements
* an ox drawn multi-purpose toolbar for agricultural implements
* a spiral guide for a bottle filling machine
* two sealing rolls (first and second stage) for tin cans
* a hand operated water pump
* a motorized rice thresher
* a motorized/kick wheel turntable for a pottery
* a hydraulic workshop press, 800 kN
* an electric kiln for a pottery, 0.35 m^3

In addition to this I prepared a course "Design and construction of spurgears", meant to be given as a demonstration of the centre's possible future activities. I also spent quite some time to train the local engineers how to make proper designs and how to apply the ISO standards. In the field of programming, I developed a computer program, Parts List Compiling System, in dBASE IV to simplify parts lists for technical drawings. Meanwhile I gathered useful information on various standard parts like bolts, nuts, electric motors, bearings, wedge belts, toothed belts, chain drives from local and foreign suppliers.

II. DESIGN ACTIVITIES

A. Variable speed turntable for a pottery

The motorized variable speed turntable was a modification of an existing foot driven turntable, constructed in a local workshop. The original drive system consisted of a flywheel and push bar/connecting rod/crankshaft mechanism. The new drive system is based on friction. The original shaft has been replaced by a new one with a large steel disc at the lower end. On top of that disc an electric motor plus intermediate rubber wheel have been fitted in a parallel arm system linked to the frame. The motor drives the intermediate wheel at a constant speed that drives the disc. The position of the intermediate wheel is fixed in relation to the motor. The position of the motor plus intermediate wheel is variable and operated by a foot pedal. The maximum speed of the turntable is achieved after pressing the pedal. The motor and intermediate wheel are then forced to move near the centre of the disc. A small misalignment in the position of the intermediate wheel provides a self retracting movement of the pedal.

The machine was delivered to the client and works satisfactorily.

B. Chain tensioning arm for a leather treatment machine

The chain tensioning arm of a leather treatment machine of KIRDI's (Kenya Industrial Research and Development Institute) LDC (Leather Development Centre) needed replacement after it broke. A new one was not locally available. The original tensioning arm was made of cast aluminum for which welding equipment is not present. Since it would be too expensive to make a mould to cast a new one, the replacement tensioning arm was welded of mild steel flat and round bars and machined afterwards.

The tensioning arm was installed and works without problems.

C. Clay mixer for a pottery

The clay mixer was developed and manufactured at the request of a pottery. It is being used to make a homogeneous mixture of different types of clay in water without clods. It consists of an electric motor with an extended shaft with two impellers. The mixer is provided with a clamping device to facilitate the mounting on the rim of an open top oil drum. The helixes of the impellers are opposite, so one of them creates an upward flow while the other creates a downward flow of the mixture in the drum. This guarantees a thorough mixing process. The machine was delivered to the client and only developed trouble after starting it once in a mixture with a too high viscosity that caused a burnt motor.

D. Maize planter

The design of the maize planter was an attempt to create a locally made machine with low technical requirements that works satisfactorily. The basis of the design consists of a planter unit. One unit can be drawn by a human but multiple units can be attached to an animal or tractor drawn frame. The unit is provided with a seed bin with slanting sides. In the bin on one side a disc is directly driven by one of the wheels. The disc is provided with three small spoons with the size of an average grain. The spoon picks up a seed from the bin and releases it when the hole above the spoon coincides with the hole in the sidewall. The seed is then guided by a duct welded on the outside of the sidewall into a small furrow made by a spring loaded coulter at the front of the machine. The wheels of the machine are positioned so that they close the furrow so that the seeds are covered by soil.

Since some problems might appear in finding the right shape of the spoons and the duct I decided to make a test facility for

these parts rather than to make a whole prototype. After many delays in this test phase I established the best shape, so the completion of the prototype is the next step. Unfortunately lack of funds during the last year and a low priority of this project prevented further progress.

E. Kiln door for a pottery

A design of a kiln door was made at the request of a pottery to ease opening and closing of their gas fired kiln. After loading the kiln with clay pots they used to close the opening in the sidewall of the kiln with refractory bricks bonded by refractory cement. After firing they had to break away the same bricks again.

They asked me to make a proposal for a door suspended in hinges that could reduce the labour of opening and closing of the kiln. The design I made consisted of a steel door lined with refractory bricks, adjustable in all directions to fit properly in the opening and attached to a hinge mechanism that provided full access to the interior when the door was open. The door has not been made yet since the client did not order.

F. Clay filter for a pottery

The same pottery requested me to design a clay filter to separate the clay particles from the water in which it was mixed. These types of filters already exist but are not locally available. Currently the pottery uses outdoor basins in which they allow the particles to sink to the bottom and the water to evaporate. Because this process is rather time consuming, they were looking for a faster process.

The filter I designed, consists of a rectangular, horizontal frame on four legs in which twenty-four square cast iron plates

are pressed together by a hand operated screw spindle at one end of the frame. On both sides of the filter plates there is a grooved recess. The space that appears between two plates is lined with a canvas cloth. There is a hole in the middle of each filter plate, also lined with canvas, to allow the slurry to flow from one compartment to another. Once the plates are pressed by the screw, a special wear resistant pump pumps the slurry into the filter. The water in the slurry passes the canvas and escapes through drain holes. The clay particles remain between the canvas cloths. The process is stopped when the filter becomes blocked. After that the screw is loosened and the clay is removed from the filter manually.

A prototype has not been made yet because the pottery decided to postpone the order.

G. Ox drawn multi-purpose wheeled frame for agricultural implements

The design of the ox drawn multi-purpose wheeled frame was requested by the CTA of the project. It was his idea to make a proposal for a World Bank project on animal drawn implements, especially adapted for African conditions. Due to various reasons, this project was never realized. The design, however is ready. The next step is to make a prototype and to test it in several conditions and circumstances.

The two wheels (standard automotive rims and tires for optimum availability) will be mounted on separate axle stubs. The axle stubs will be welded to an inverted U-frame to create maximum ground clearance and minimum crop damage. The track width will be adjustable from 1.30 m to 1.80 m in steps of five cm to make the frame suitable for use in various crops. The draw bar, welded to the middle of the inverted U-frame, will have several attachment holes for the yoke at different heights to suit

various sizes of oxen. Under the U-frame, a simple hitch will be fitted with a toolbar on which the implements can be attached. The front end of the hitch will be attached to the middle of the draw bar while the rear end will be suspended in adjustable chains, making its height adjustable. A provision will be made to lock the hitch in the highest position to create a transport position of the implements. The angle of the toolbar, attached to the rear end of the hitch, is also adjustable to suit various implements, soil conditions and working depths. The implements I designed for this frame are a plough shear, ridgers, weeders, cultivator and a harrow. Besides this, a tipping platform can be fitted on the frame to carry the harvest from the field.

H. Ox drawn multi-purpose toolbar for agricultural implements

The design for the ox drawn multi-purpose toolbar was designed on my own initiative as a cheaper version of the ox drawn multi-purpose wheeled frame. The implements designed for the wheeled version also would have fitted in this toolbar. It will consist of a straight horizontal bar with an adjustable wheel or skid and an adjustable attachment to the pair of oxen at the front. At the rear end, there is an attachment for the implements. Also at this end, a pair of handle bars will be fitted for the operator, who can walk behind the toolbar.

J. Spiral guide for a bottle filling machine

A bottling company required a replacement for their imported spiral guides. They supplied us an old one from which I was able to make the design drawings. Unfortunately the company has not ordered yet, but the design is ready.

It consists of a stainless steel tube with stainless steel internals machined from round bar. The internals are provided

with a curved shape to make the flowing liquid spin so that it fills the bottle without considerable loss of carbon dioxide gas.

K. Two sealing rolls (first and second stage) for tin cans

The design of the sealing rolls was requested by a local canner of fruits, juices and vegetables. They used to import these rolls from abroad for which they required foreign currencies and therefore permission from the Central Bank.

The rolls are being used to seal tin cans. Before sealing, the cylindrical part of the tin and the lid have straight edges. By pressing the roll against these edges of a rotating can, the edges fold so that the tin is sealed.

I was asked to make this design with the help of a worn out example and a theory on sealing tin cans in Hungarian language. The sealing roll consists of a stationary shaft on which the roll is fitted, born by two tapered roller bearings. In the roll is a groove with a very accurate profile for which I had to determine the mathematical formulas and a coordinate table to define the curve. The curves for the first and the second stage are different. The choice of the material for the rolls was determined by the fact that the rolls must operate in a food processing plant and that they must be wear resistant. Therefore martensitic stainless steel was the best option. A set of these rolls has been made and operate satisfactorily. Now that the curves are known, it is also possible to repair worn out rolls by grinding them again as long as the hardening depth of the material is sufficient.

L. Hand operated water pump

A hand operated reciprocating water pump was designed on my own initiative after I got an idea to make a simple, cheap, reliable and corrosion resistant construction. A prototype has not been made yet but the design drawings are ready.

The pump is designed to lift water from maximum thirty meters below the surface at a rate of two liters per stroke. The pump will mainly be made of standard hard Poly Vinyl Chloride (PVC) tubes and fittings, which are available on the local market. The tubes will be connected by bonding on the building site until the desired length has been achieved and will be supported by a stand, made from construction steel, bolted on the concrete cover of the well. The stand also provides a hinge for the pump lever. The pump rod will be made of round steel bars with threaded ends. Hot dipped galvanizing of these parts is necessary to prevent corrosion. The use of stainless steel would be too expensive. The rod will be provided with rubber centering rings at regular intervals to prevent damage to the tube caused by rubbing of the rod. The pump valve in the lower end can be realized by using a rubber ball (or a rubber lined steel ball) in a conical reducer. The piston can be machined from any plastic bar like PVC, PP, PE or PA. An ordinary leather or rubber seal (O-ring, pneumatic or hydraulic seal) will prevent leakage around the piston. The one-way valve in the piston can simply be made of a rubber disc in top of the piston that closes the holes in the piston when the piston moves upwards and allows water to flow through the holes when the piston moves downwardly. Tests will reveal the necessity of wear resistant lining of the part of the tube where the piston moves up and down and determine the right type of seal.

M. Motorized rice thresher

For the same reason as the maize planter, a rice thresher was designed. The basic design for this axial flow rice thresher is derived from a design of IRRI (International Rice Research Institute) in the Philippines. The separation of the rice grains and the chaff was improved and a wider choice of power sources was made possibly. The thresher can be driven by an electric motor, a petrol engine or a diesel engine. A PTO (Power Take Off) shaft of an agricultural tractor is also usable after some modification of the thresher.

The thresher consists of a rotating drum provided with threshing elements on eighty percent of the length and straw thrower blades on the remaining part. The drum is housed in a shell from which the upper half is provided with slanting guide plates to transport the rice straw in axial direction and the lower half is provided with a sieve to separate the straw from the rice grains and chaff. The upper half is also provided with an opening at one end to feed the unthreshed rice stems, while the lower half has an opening at the opposite end to throw out the threshed straw. After passing the sieve, the rice and chaff fall down, passing a horizontal air flow, generated by a fan on the motor shaft. This air stream separates the chaff from the rice grains. The rice is not affected and falls down in a hopper while the chaff is blown away in the same direction as the straw.

A prototype of this machine has been made and is ready for testing since October 1992. Unfortunately and in spite of my attempts to urge the management to arrange test facilities, nothing has been done yet so far. A demonstration of the machine on the agricultural show in Nairobi last year was promising, but more intensive tests must be made to determine its maximum capacity, its efficiency and durability.

N. Motorized/kick wheel turntable for a pottery

Only two prototypes of the turntable with motorized start up were made in the workshop for two different potteries. The owner of one of them is fully satisfied with the machine while the other was definitely not. While she had approved the concept earlier, she did not want an electric motor fitted on the machine when it was ready for delivery. The turntable was modified then and accepted by the client.

The turntable consists of an A-frame with a tray on top. A vertical shaft is born in self aligning bearing units with a modeling disc at the upper end and a concrete filled flywheel at the lower end. Around this flywheel, a bicycle rim and tire is fitted. Also mounted in the frame is a hinged sub-frame with a foot pedal. An electric motor is mounted on this sub-frame. The shaft of the electric motor is provided with a bush to increase the diameter. Once the operator presses the foot pedal of the sub-frame, the electric motor starts while its bush is being pressed against the tire around the flywheel, so the speed of the flywheel increases.

P. Hydraulic workshop press, 800 kN

The hydraulic workshop press was designed on my own initiative because the institute lacks facilities to assemble press fitted parts and to bend round bars and sheets thicker than five mm. Besides this, some dies made by the tool design unit need to be tested under this type of press rather than under an eccentric press, which is already present in the institute. Therefore the prototype of this press was meant to be installed in the institute's workshop too. Once designed and tested, the design could be sold to a constructing company who could start manufacturing. Lack of funds prohibited the manufacturing of the prototype.

The design however is ready. The maximum force will be 800.000 N at a design pressure of forty MPa. The press will consist of a steel structure on four legs. Underneath the steel structure, a vertical hydraulic ram will be fitted. A table, from which the height is adjustable, will be fitted between the legs. The ram will be activated by a hydraulic hand pump unit with two pistons of different diameters, one for fast movement at a low pressure and one for slow movement at a high pressure.

Q. Electric kiln for a pottery, 0.35 m^3

A design for an electric kiln with a net volume of 0.35 m^3 (700 mm *700 mm *700 mm) was requested by a pottery to replace an old imported kiln that was nearly written off. The interior of the kiln should be made of refractory bricks with good insulation properties that are not locally available. Ingredients for these bricks, however, are available in large quantities in Kenya. KIRDI's Ceramic Section was asked to find the best composition of refractory material. Unfortunately until now the Ceramic Section has not been cooperative. It has only been arguing about their share of the value of this order. Meanwhile, the owner of the pottery informed me that since the CTA of this project, Mr R. Cvijanovic, has gone, she is going to cancel the order because she has no confidence in the local managers.

The design however is ready. The kiln will be provided with grooved sidewalls to accommodate coiled heating elements. The kiln will be insulated by one layer of Kaolin fibre blanket (heat resistant up to thirteen hundred degrees Centigrade) and one layer of glass fibre blanket. The shell will be made of steel sheets. Instruments and temperature controller will be housed in an instrument panel on the front. A lockable, spring assisted lid on top will cover the kiln. A safety switch in the locking mechanism will switch off the power if the kiln is opened during the firing process.

III. TRAINING ACTIVITIES

A. Design and construction of spurgears

At the request of the CTA and the NPM, I prepared a course "Design and construction of spurgears". This course was to be given to young engineers as a demonstration of one of the future tasks of the centre. It appeared that there was no ready to use book available. Many theory books lacked practical information how to make a technical drawing of gearwheels. Therefore I combined information from several books and ISO standards to make a complete handbook which describes the design of spurgears from the beginning (calculation, choice of material, etc.) till the end (technical drawing, specifications and tolerances etc.) including clear examples. The actual demonstration course was postponed and postponed.... In fact it was never given during my presence. I left some copies of the handbook in the design units and with the NPM.

B. On the job training

During the time I was designing, I assisted local designers and draughtsmen as much as possible to raise the quality of their work. It appeared that most designers and draughtsmen lacked experience and could not make a proper design or drawing. In most cases they applied wrong tolerances, wrong representation methods, wrong or no standards and prescribed wrong or inefficient production methods. This situation could continue to exist because the Heads of the Design Units, the National Project Manager and even the Chief Technical Adviser approved nearly every drawing from the design units without any comment! So they never corrected or even guided the young draughtsmen and designers. When I started to instruct them about proper use of ISO standards, I got the strong feeling that the Head of the Design Unit felt as if I tried to undermine his authority. In such cases he interfered by giving his own opinion on the matter, which was completely opposite to my opinion. In other cases he did not bother about it at all.

IV. PROGRAMMING ACTIVITIES

A. Parts List Compiling System in dBASE IV

During the periods in which there was no design work for me to do, due to a lack of orders, I started making the Parts List Compiling System. The reason to make the PLCS was the method used so far. A parts list used to be written in the lower right-hand corner of a technical drawing with the aid of a letter template and a technical pen. This method has several disadvantages. For example, this method is rather time consuming. In case of an assembly drawing of a complicated machine, the number of parts might be so high that there is not enough space available on the sheet. If a modification of a description of a part is required, the whole drawing must be reprinted and redistributed to the various departments. Many companies worldwide use therefore separate parts lists attached to the assembly drawing. I decided to make a computer program for making separate parts lists because this has certain advantages for making modifications. Besides this the use of a computer allows additional manipulation of the data once the drawings have been registered in the database of the program. For example, the System can make production lists, it can show on which assembly drawings a certain part is applied, or it can show all the drawings that have been made for a specific order or project. In the future the System can be extended with software to control the stock of parts in the store.

The PLCS has been tested thoroughly, is provided with a clear manual with a printed list of the software and is ready for implementation. I only hope that members of the local management, who have never worked in a production company and who have never had to make a modification, soon realize the importance of a good way of making parts lists and start the implementation. I left all the documentation and back-up diskettes with the software on the NPM.

ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION
TF/KEN/91/002/11-01

Post title	Associate expert in design engineering
Duration	12 months
Date required	March 1991
Duty station	Nairobi, Kenya
Purpose of project	To assist the Government of Kenya in the achievement of higher utilization of existing industrial capacity through the activity of the Kenyan Industrial Research and Development Institute (KIRDI).
Duties	The associate expert will work within the context of project DP/KEN/86/048, under the guidance of the Chief Technical Adviser. He will be expected to:

(a) undertake design work within the Design Unit of the Engineering Development and Service Centre;

(b) draw up plans, detail drawings, inventories;

(c) co-operate in consultancy services in respect to standardization of component parts, types, etc.;

(d) make estimates and documentation of related data for the products to be manufactured;

Applications and communications regarding this Job Description should be sent to:

PRAS/DIO
UNIDO, Vienna International Centre,
P.O. Box 300, A-1400, Vienna, Austria

(e) design special spares for machinery, agricultural machinery, machine parts and implements; and

(f) conduct course in design.

Qualifications — He must be a mechanical engineer with design experience. He must have worked in a design office in an organized production concern.

Language — English

Background information

The engineering sector of Kenya in general and the machinery and metalworking sub-sector (MMW) in particular is the basic supporting and service sector for all other existing and future sectors of the industry as well as for the park of equipment and machinery handled by major sectors of economy such as agriculture, construction, transport, public works, energy, etc.

In Kenya, the engineering activities are limited primarily to metal fabrication, machining, welding, non-complex castings, simple forgings, sheet metal work and assembly work. The material base is limited to medium carbon billets (0.15 - 0.22 per cent carbon) and to H.C. steel which is M.S. grade with 0.45 per cent carbon. These materials are primarily for fabrication as well as construction work for which selected sections are rolled through rolling mills.

The number of establishments operating in the MMW sub-sector is around 635 as of 1985-1986. Most of these establishments are small and employ less than 50 persons each. 21.2 per cent of the establishments employ at least 50 persons and account for 82.2 per cent of employment in the MMW sub-sector.

This sub-sector is producing agricultural implements, domestic appliances, construction equipment, office equipment fabricated items, structures, irrigation equipment, automobile components, hardware, parts for processing machinery, components for transport equipment, instruments, etc.

The machinery and metalworking sub-sector - although it is the basis for the development of all industries and for ascertaining all capital goods and industry maintenance of the national park of equipment, machines and vehicles- has no institution in Kenya for development and promotion. The Ministry of Industry/KIE, the Ministry of Research, Science and Technology, the Ministry of Training and Applied Technology and the Ministry of Education are some of the ministries involved and the Engineering Section of the Kenya Association of Manufacturers (KAM) and KIE represent the industries.

The Engineering Development and Service Centre (EDSC) will be established at KIRDI, which has a Design and Engineering Division. KIRDI is an autonomous organization under the administrative control of the Ministry of Research, Science and Technology of the Government of Kenya.

The Ministry of Research, Science and Technology, the Ministry of Training and Applied Technology and the Ministry of Education have an inter-ministerial co-ordinating group. The KIRDI is under the first Ministry. Training institutions under the second Ministry, KIE is under the third Ministry and polytechnics under the fourth Ministry. In addition, KIRDI and the National Council of Science and Technology have a close association. It facilitates the co-ordination of activities. KAM's relationship with all the Ministries is very dynamic. Therefore, the Engineering Development and Service Centre (EDSC) as an institution will interlink ministries in the field of technical development, service, training and education and will have an effective liaison with industry.

Backstopping officer's comments

1. The expert has highlighted engineering and production problems with a refreshingly blunt honesty that has allowed us to understand the specific areas of weakness of EDSC with regard to designing and producing a specific part or product. However, it is clear from his report that his strength is primarily in design engineering and less in production engineering, which correlates to his job description anyway.

2. Mr. Sikkema has pointed out that drawings are created with wrong tolerances and manufacturing specifications and that there is no quality assurance procedure in plan to control such errors. As the functionality and maintainability of a product as well as the majority of its cost is generated in the design phase, this is a serious and fundamental problem for EDSC that must be addressed in an urgent manner. The blame in such situations invariably rests with management.

3. Mr. Sikkema has pointed out that there is no quality control in the production process which allows defects to go undetected until the product is assembled. This is an unacceptable state of affairs that creates a large and unnecessary cost. Again, the problem needs to be urgently addressed by management!

4. It is clear from the listing of design work carried out by the expert that he was quite busy. However, it appears that this was on his own initiative rather than at the request of management or the CTA. His effort to create parts lists on dBase IV is commendable and should be strongly followed up by the management of EDSC.

5. We strongly recommend that this report is read by all relevant parties including the technical staff of EDSC.