

INDUSTRIAL PROJECTS RECOMMENDED BY THE FACULTY OF ENGINEERING,
UNIVERSITY OF DAR ES SALAAM.

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1. Introduction

The developing countries are aware of the fact that their socio-economical and technological conditions are different to those existing in highly industrialized societies. They begin to realize that it is neither appropriate nor necessary to import the technology, product and plant design meant to meet requirements of countries with highly developed technologies and the respective service organizations. When choosing an appropriate technology to be applied the particular conditions of the respective country has to be taken into consideration.

There is however a controversy about the most suitable kind of technology to be applied in developing countries.

On one hand it is stressed that there is a need for technology suitable to be applied in small workshop units spread all over the country to produce simple items for daily use in rural areas. For such workshop units the following advantages are particularly important. Small funds are adequate for their establishment; local resources can be used to some extent and a network of small production centres covering the country will contribute tremendously to training of skills and development of technical thinking.

On the other hand there is an urgent nation-wide demand for such industrial goods which cannot be produced on small-scale level; they need medium-scale industrial facilities. The centralization of production in factories, however, limits the "skill-development-effect" to the relatively small area where the factory is drawing its workers from.

The result of these considerations seems to be that both small-scale production of simple items and industrial production of more sophisticated goods are needed; both will find a

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place in development policy.

2. Faculty of Engineering and Industrial Development

Within this general concept the University of Dar es Salaam has its definite function. As soon as the Faculty of Engineering will be fully established it will contribute to industrialization in terms of:-

- Service activities such as testing of materials and technologies.
- Consulting activities such as identifying and designing consumer and producer goods for local production (product and plant design).
- Educating engineers qualified to solve problems concerning industrialization.

At present the Faculty of Engineering is involved mainly in teaching. The expertise and experience of the staff members and the research facilities available, however, could be utilized now.

3. Identification and Design of Products

In a proposal submitted to the Industrial Research Committee* by the Faculty of Engineering, the production of water-pumps, fittings for water installation, electric motors, and machine tools were suggested to be considered in the coming Five-Year Plan.

Taking water pumps as an example for the time being, pumps of various sizes are imported in large numbers for the supply of drinking water, irrigation and many other purposes. In highly industrialized countries the common practice of producers exporting goods to developing countries is based on commodities developed for the use in their own country; usually they are exported after slight modification or even without any adjustment to the particular requirements of the user.

It is our opinion that sufficient know-how and appropriate facilities are already available in Tanzania for product

* submitted to the Industrial Research Committee on 12th September, 1974.

design and for the manufacturing of prototypes as well. Local production of smaller pumps is desirable and possible as the technology involved is a relatively simple one.

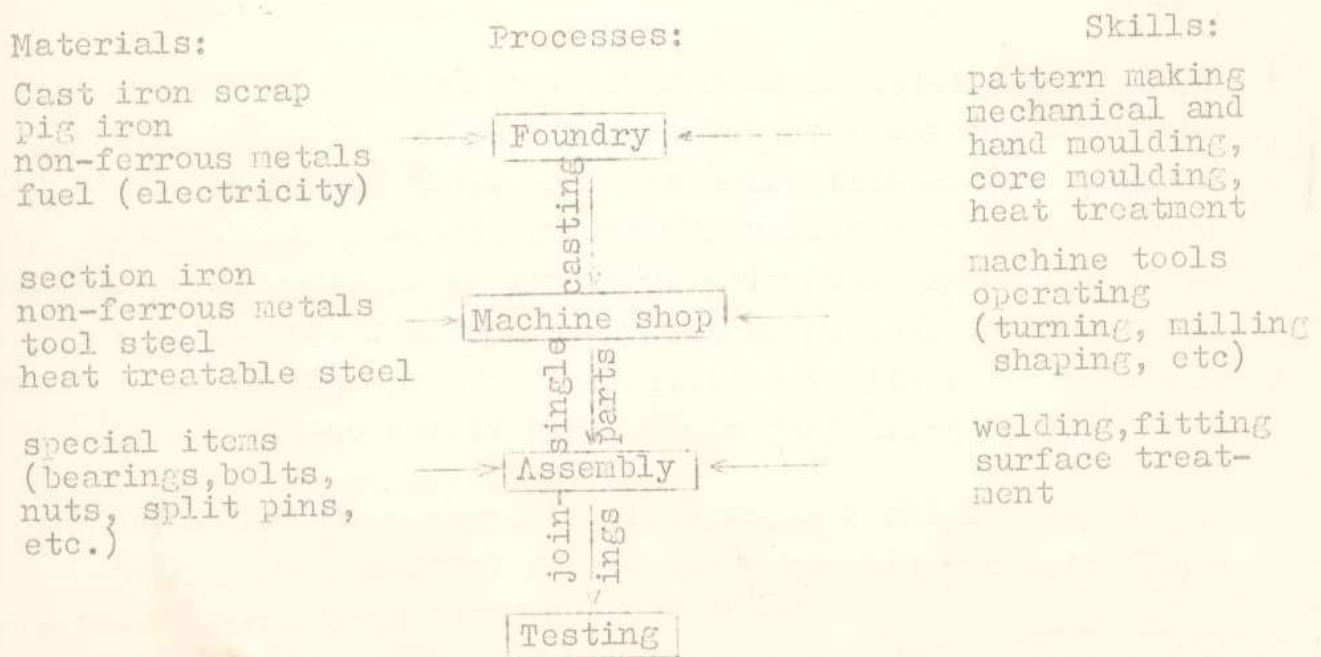
When designing different pumps a modular system should be applied to cover a wide range of water head and pumping capacity with a small number of pump sizes. This system of standardization will help to keep the overall number of spare parts to a minimum.

Highest accuracy is less important than long life. The characteristic of any pump should ensure satisfactory operation under varying load conditions; provision must be made to drive the pumps by electric motors, petrol engines or any other means.

4. Setting up Local Production

The introduction of pump production in Tanzania can start by utilizing already existing facilities; design and manufacturing of a set of experienced smaller pumps needs to be adjusted to local production technology. Using existing facilities, however, means the number of pumps manufactured will be limited.

Hence, the setting up of an extended pump production is a matter of thorough planning taking into consideration capital funds, raw materials and skills as well. It is our opinion that sufficient know-how is already available in Tanzania for consultancy activities with regard to design and establishment of a new plant the general lay-out of which is shown in the sketch below:



5. The Development of Skilled Labour

Industrialization cannot be promoted but by development of a skilled labour force. First steps have already been undertaken by the National Industrial Training Centre (Chang'onbo) providing training courses for a large variety of trades and by industry itself (on-the-job-training).

Some of the skills needed for the production described are not yet provided for by the National Industrial Training Centre. The trades involved are:-

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| Foundry | (hand and machine moulding, score moulding casting, heat treatment) |
| Toolmaking | (jigs, fixtures and special tools) |

Foundry work is being done already in some places up to a certain extent (on the job training) but should be taught on the base of an industrial training programme. It has been understood that "Foundry" will be taught at the National Industrial Training Centre to be established in Tanga. Another training centre is planned in Mwanza.

For the time being all qualified tool-makers are expatriates. As tool making is a key-task for metal working industry, it is strongly recommended to start a toolmaker programme as soon as possible at one of the industrial training centres or elsewhere even if expatriate teachers are to be provided.

6. Integrated Plant for Multipurpose Production

Before implementing the set up of a pump production investigations should be made with regard to other products which could be manufactured by using the same production facilities and skills. Diversification of production is in favour to proper utilization of production capacity and gives flexibility in adjusting production to the various needs of the country.

The production plant described below can produce fittings, simple machine tools and many other items beside water pumps. It consists of a foundry, a machine shop and an assembly. It is not possible to specify the size of the plant or the number

of workers to be involved because reliable figures concerning the demand for each item to be produced are not yet available.

6.1 Foundry

The foundry should supply castings in iron, annealed and nodular cast iron and non-ferrous metals such as aluminium, bronze, brass and copper. To attain this objective the following equipment must be available:-

- Cupola furnace (for cast iron production)
- Low frequency induction furnace (for annealed and nodular cast iron)
- Furnace for non-ferrous metals, normally fired by oil. If natural gas is available operation costs will be cut down
- Preparation plant for moulding sand
- Moulding machines
- Equipment for hand moulding
- Score moulding equipment (drying furnace included)
- Cleaning machine for castings
- Heat treatment equipment (furnace with neutral and CO-atmosphere)
- Carpentry for pattern making (bandsaw, circular saw, panel planing machine, drilling machine, belt grinder)

The carpentry should be separated from casting and moulding area. A pattern store should be attached.

6.2 Machine Shop

This should be furnished with conventional machine tools such as:-

- Lathes (different sizes)
- Universal milling machine
- Drilling machines (multi-spindle drilling machine recommendable)
- Shaping machine
- Universal grinding machine
- Stamping machine
- Dynamic balancing app.
and tools and accessories.

In addition it is recommended to consider the purchase of a broaching machine which might be very useful in spite of the high price of broaches.

The sheet metal department may consist of:

- Guillotine shears
- Edging machine
- Round bending machine
- Beading machine
and accessories.

As for the welding department the following equipment is necessary:

- Gas welding equipment
- Equipment for electric welding

6.3 Toolroom

In connection with the machine shop it must be stressed that proper functioning of this shop and of other sections of the plant will mainly depend on the tool department which is to design and construct jigs, fixtures and other special tools. These tools are designed by the producer for a special operation only and are not available on the market. As these tools must be matched carefully to the machine tool it is not advisable to obtain them from abroad.

The tool department is to be furnished with a set of precision machine tools which should never be used for any purpose other than tool-making. It is doubtful whether tool departments of this kind yet exist in Tanzania. As tool-makers are not yet trained locally the tool department would have to rely completely on expatriates until trained Tanzanians are available.

Equipment for the tool department (all machines for precision work):-

- Lathe
- Universal milling machine
- Universal grinding machine
- Shaping machine
- Drilling machine and accessories.

6.4 Assembly and Inspection

There is not much to be said about assembly as far as minor hand- and power-operated tools are involved.

The inspection department is very important for quality control and its equipment will depend on the type of product to be checked:

- Testing unit for machine tools (including metrological equipment)
- Teststand for centrifugal pumps and other testing equipment.

This unit can also be used in connection with design and development of new types.

7. Implementation and Timing

Plant design is the last step of the planning process before physical implementation can take place. It should not be finalised before prototypes of the product developed according to the particular requirements of the country are tested and approved, and before market investigation including the neighbouring countries have shown a need for this product. Hence the following steps for the development of the project are proposed:-

- Market investigation to decide the type and number of the items to be produced (import figures of the last few years, will be helpful and also predictions for the next few years).
- Product design based on these investigation and taking into account the particular technology and economy of the country.
- Production of prototypes by using existing facilities, testing and redesigning if necessary.
- Plant design.
- Establishment of the plant.

8. Conclusion

There is no reason why the plant cannot be set up step by step. NECO* for instance with its existing facilities and the additional area not yet utilized would be an appropriate place for

* National Engineering Co. LTD

implementation. A new hall provided for the extension of the foundry is already under construction. The machine tool unit could be used temporarily till the final machine shop has been established. The present establishment of assembly facilities should present no problems. The principles mentioned in connection with pump production should be applied to the design of the other products. Design must ensure that the products are solid, durable, and easily maintainable.

As far as machine tool design and production is concerned it is advisable to start with simple models not needing gears (drilling machines, circular saws and other wood-working machines). Gear production needs capital, experience and skills not likely to be available in this country in the starting period. However, importing of gears is expensive, and local gear production must be considered before long. Local gear production is a must on the long run if machine tool production is seriously considered to be a foreign exchange saving or even earning branch of industry.

All arguments point at the necessity to establish "basic industries" in order to increase independence of Tanzania with respect to producer goods. We hope that at least some of the recommendations mentioned may help to do some first steps towards implementation.

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