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Joint UNIDO/ECWA Meeting on Special Problems and Requirements of Industrial Development of Selected Countries of the Middle East

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MAINTENANCE AND REPAIR [1/]

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Chapter I :

The Importance of Maintenance and Repair for Economic Development

A. The situation of maintenance and repair in least developed countries

One of the characteristics of least developed countries is the great scarcity of capital. It should be expected, therefore, that capital goods in these countries are maintained better than in industrially developed nations which have a relative abundance of capital goods. Besides, the natural conditions in many developing countries call for special care of machinery and structures. Tropical climate, extremely high or low humidities pose their own maintenance problems unknown in temperate zones.

Unfortunately, the actual situation is anything but adequate to the conditions prevailing. Since many years, experts have stressed the lack of proper maintenance and repair in developing countries. In 1958, Hirschman wrote in his Strategy of Economic Development:

> "This is perhaps one of the most characteristic failings of underdeveloped countries and one that is spread over the whole economic landscape. Eroding soils, stalled trucks, leaking roofs, prematurely run-down machines, unsafe bridges, clogged-up irrigation ditches - all testify to the same pervasive and paradoxical trait: the inadequate care for existing capital in capital-poor countries." 1

In the same year, the United Nations Secretariat stated:

> "Because of inadequate maintenance, industry in many underdeveloped countries suffers from an unduly high rate of depletion of capital assets and a chronic waste of production capacity which even economically stronger countries could hardly afford." 2

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1 Albert O. Hirschman, The Strategy of Economic Development, Yale University Press, New Haven and London, Tenth Printing (Paperbound), 1966, p.141.

2 United Nations, Management of Industrial Enterprises in Underdeveloped Countries, para. 84, as cited in Industrialization and Productivity, Bulletin 2, United Nations, Department of Economic and Social Affairs, New York, March 1959, p.55.

The situation has hardly changed since this was written. The same complaints about neglect of maintenance and inadequacy of spare parts supply which were made in a report of United Nations Technical Assistance Experts in 1959 [1] reappear in a case study of the steel industry in a developing country, published in 1966 [2]. So the United Nations Secretariat's suggestion for urgent action made in 1958 has nothing lost of its topicality:

> "The attention of governments and industry is drawn to the urgent need for adopting proper maintenance methods and practices, and to establish proper facilities for training of maintenance personnel." 3

The lack of proper maintenance practices has serious consequences for the economic development. Possible losses in production and growth resulting from, and possible gains forgone by, inadequate maintenance and repair are the subject of the following section.

B. Possible losses in production and growth due to poor maintenance and repair

a) Destruction of equipment

The most eye-catching loss caused by poor maintenance or inadequate repair is the premature deterioration or total destruction of productive capital.

Since capital is scarce in developing countries, the relative importance of capital destructions is much greater than it would be in industrialized country. Thus, the marginal impact on growth is likewise greater.

b) Production losses

Deterioration or destruction of equipment leads to losses in production. These losses are twofold: a falling-off in product quality and frequent disruptions of the production/work process (or even a combination of both).

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1 "Some Problems of Industrial Management Reported by Technical Assistance Experts", Industrialization and Productivity, Bulletin 2, United Nations, Department of Economic and Social Affairs, New York, March 1959, pp. 53-57.

2 William A. Johnson, The Steel Industry of India, Harvard University Press, Cambridge, Massachusetts, 1966, pp. 174 ff.

3 United Nations, Management of Industrial Enterprises in Under-developed Countries, op.cit., as cited in Industrialisation and Productivity, Bulletin 2, op.cit., p.57

Undetected or unredressed wear and tear of machinery, or lack of care for control devices, typically results in deterioration of product quality. In other cases, inadequate maintenance or incompetent repair causes frequent breakdowns of machinery leading to disruptions in the production/work process. During downtimes, when the production factors do not render productive services, wages of idled labour and capital cost for idled equipment still have to be paid. The consequent effects are enhanced if the repair cannot be carried out, or the spare parts cannot be delivered, immediately. The economic penalty for stoppage of operation is highest in continuous process-type industries. The cost of interruption of operations is lower in the case of fabrication of assembly of descrete units. [1]

c) Induced (secondary) losses

Primary production losses caused by poor maintenance and repair have negative effects on those firms which are customers of the firm in question.

Poor quality of intermediate goods deteriorates the quality of the final products as well - or requires additional treatment of processing by the final manufacturer. If the quality is so poor that the material cannot be used at all but is still passed on to the customer, the waste is even greater because of needless haulage by railways or trucks. [2] Again, it should be mentioned that the losses through waste impair economic growth and development relatively more in a developing country, where resources are particularly limited and the industrial sector is only small.

Induced losses occur because of bottlenecks in the supply of spare parts, be it that their import is restricted or that their shipment is just impossible without lengthy delays. [1] The consequence is that many firms try to hold an abnormally large stock of spare parts. From the individual firm's point of view, this is an absolutely rational policy, but for the overall national economy this is a waste of resources detremental to growth; it might be overcome by a revision of the country's spare part supply policy.

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1 Cf. "Better Way to Compare Your Plant's Maintenance Practices", Factory, Management and Maintenance, August 1958, p.14.

2 Cf. W.A. Johnson, op.cit., p. 163

The cannibalization of machines belongs to the category of disguised losses due to excess capacity: parts are stripped from idle machines in order to obtain the spares needed for broken machinery. Again, this can only be a short-lived practice averting from the real problem: shortcomings in the country's development policy to provide for an adequate supply of spare parts, and, as a consequence, uneconomic investment decisions on the part of the single firm.

d) Foreign exchange losses

The developing countries generally have to import most of their industrial equipment for investment and most of the spare parts to maintain this equipment. Inadequacy of maintenance makes it necessary to replace parts excessively often, sometimes even to exchange the whole machine before it reaches the end of its normal life. This implies an unnecessary loss in foreign exchange; it is an absurd situation in countries which suffer notoriously from severe shortages in hard currencies.

Chapter II :

The importance and objectives of maintenance engineering

The importance of maintenance engineering is great, particularly in least developed countries.

(a) Prolonging useful life

One objective of maintenance is to extend the useful life of a machine or piece of equipment. This is possibly the most widely accepted reason for carrying out maintenance but it is especially important where the equipment is very expensive or difficult to obtain. It may be particularly significant where there is a shortage of a certain kind of currency. In this special case the cost of maintaining the equipment might become substantially higher than the cost of replacing it; the maintenance costs can, however, be paid in local currency.

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1 Cf. e.g. "Some Problems of Industrial Management Reported by Technical Assistance Experts", op.cit., pp. 55-56.

Prolonging the useful life of equipment may therefore be extremely important. Lubrication, cleanliness, proper training and preventive maintenance should therefore be given full attention.

(b) Optimizing availability for use

Under the objective of 'prolonging useful life' an attempt has been made to examine the importance of preserving the value of the equipment. Even though the equipment may be well preserved, however, it will serve little useful purpose if it is not available for productive use when it is so required.

It is this objective - that of optimizing availability for use - which underlines the importance of better maintenance management. The right amount of maintenance has to be carried out at the right time of the right items of equipment. Not all items will demand the same amount of attention; and decision-making, planning and scheduling will need most careful attention if the objective is to be achieved. It should be noted that availability is not necessarily being maximized. There is an economic limit to the availability of equipment.

(c) Readiness for use

One of the most important objectives of maintenance in some circumstances may be to keep the equipment in a state of readiness for instant and efficient use in case of emergency. Examples include the equipment in a hospital operating theatre, fire fighting appliances, rescue vehicles, etc. In such cases the question of economics becomes of considerably less importance. It is common practice to make use of stand-by equipment or ancillry services in order to ensure instant availability of the emergency facilities.

(d) Wise expenditure - To repair or replace ?

An essential objective is the wise expenditure of money, time and effort, in other words the wise utilisation of resources. The time will come with all equipment when consideration must be given to the relative merits of repair or replacement. Deterioration of certain parts of the equipment may be so advanced that repair would serve a very limited purpose and it might be wiser to invest rather more money in complete or partial replacement.

(e) Reducing production costs

Good standards of maintenance will often reduce the cost of operating the equipment. Correct lubrication and adequate cleaning can, for example, make significant reductions in the power consumption. But it is the indirect savings which are of most significance; good maintenance can reduce the amount of sub-standard production. In precision engineering industries it has been found possible to link the quality control of the product with the standards of maintenance. If the quality of the product begins to deteriorate, immediate attention is paid to the condition of the machine producing it. Similar control can be exercized in the manufacture of chemicals, foodstuffs paper, and many other materials the quality of which can be influenced by the state of the equipment. With a universal demand for both greater productivity and production quality, the profitability of an enterprise may be substantially influenced by its maintenance standards.

(f) Avoiding of consequential damage

If a piece of equipment breaks down it may cost relatively little to repair - it is not only the cost of repairing it which must be considered. The breakdown of relatively small component may start a chain reaction the cost of which could be out of all proportion to the original damage.

(g) Keeping production safe

In human terms, the most important objective of maintenance - and one which must be complementary to any of the others - is that the plant or equipment shall operate safely. There are many ways in which lack of maintenance can lead to accidents, injury and loss of life. No excuse is offered for dealing in some detail with this objective. Maintenance and safety are therefore closely related.

Chapter III:

National action, international and regional co-operation in improving maintenance and repair facilities in least developed Arab countries

While the principal responsibility for initiating and establishing adequate maintenance and repair facilities in developing countries should be the concern of these countries themselves, regional and international co-operation has acquired increasing significance in this area. In this context, two major considerations should be taken into account:

a) The bulk of different equipment in developing countries is supplied and will continue to be supplied in the foreseeable future from industrialized countries. As suppliers, these countries take upon themselves certain responsibilities as regards repair and maintenance of such equipment, and thus have an important role to play in this field.

b) In the promotion of their industrial activities (including maintenance and repair) developing countries depend and will continue to depend for some time to come to a great extent on bilateral assistance from industrialized countries and multi-laterial and international co-operation with international bodies and United Nations agencies.

Given this inter-relationship of factors and the involvement of the various bodies - industrial enterprises, national and international organizations - the contribution each of these bodies can and perhaps ought to make towards improving repair and maintenance facilities in developing countries, should be closely examined. This is rather a complex subject which this meeting may wish to discuss fully so as to put forward practical conclusions and recommendations which would enable the least developed Arab countries to derive full benefit which regional, bilateral and international co-operation offer in this field.

There are, however, many ways and means that could be applied by the least developed Arab countries to improve the maintenance and repair activity. These include:

a) Operating and Maintenance Manuals and Other Technical Documents:

Their availability is usually very limited and, if available, in the ori-

ginal language only. The text is prepared for customers in advanced countries. Such manuals are usually not suitable for the level of education, skill and experience of nationals in developing countries. An effort should be made to request from suppliers of machinery to have specially prepared technical documents available to developing countries in the local language. Such manuals may, however, be already available in other, particularly neighbouring countries.

b) Training and Personnel:

This is inadequate and practically concentrated at the labour level. Shortage and skilled personnel, particularly at the management level, is a major bottle-neck in maintenance activities. Suppliers of machinery cannot usually accomodate a sufficient number of personnel for training on their premises. Therefore the possibilities at the regional and national level should be fully examined.

c) Local Agencies:

Local agencies are, as a rule, not properly equipped and do not have competent personnel to look after maintenance problems. It is generally agreed that better service is usually obtained from suppliers or their local office, if the latter is a part of the supplier organization, than from local agencies. In other cases the local agencies must be upgraded as soon as feasible.

d) **Assistance after Guarantee Periods: Apart from large reputable firms, most suppliers lose interest after the guarantee period expires.**

→ ROLE OF INDUSTRIALIZED COUNTRIES

Donations, long-term loans and technical assistance are being given by many industrialized countries to least developed nations. While it is outside the scope of this paper to discuss whether the magnitude of the help is satisfactory, the meeting offers an opportunity to discuss whether the assistance given could be directed towards specific areas, e.g. repair and maintenance, where it could be more effective to promoting industrial development.

a) Obligations of supplying firms:

... The needs as outlined are justified, but meeting these needs is costly. Most supplying firms appear to be willing to cope with these needs if reimbursed for the additional expense.

Governments of industrialized countries can help in resolving this impasse. Part of their assistance intended for the purchase of equipment from their respective countries, could be allocated, instead, to the financing of the following undertakings, either supported entirely by the governments or in cooperation with the suppliers:

- the preparation of suitable technical manuals
- studies of local conditions and the initiation of suitable maintenance techniques,
- training of personnel on the premises of the supplying firms or other technical and training institutions,
- supplying developing countries with a larger number of personnel during and after the guarantee period, until the ability of developing countries to maintain new equipment has reached a satisfactory standard.

b) Help in establishing technical and design centres: Maintenance prevention, through change and adaptation of design to suit local working conditions is a considerable factor in meeting maintenance problems in developing countries. Establishing design and technical centres is a major step in this respect.

c) In-plant training programmes in maintenance and repair: As indicated by answers received from developing countries, one of the major obstacles to establishing adequate maintenance and repair facilities is lack of the adequate number of Part of the technical assistance allocation could be directed towards establishing in-plant training programmes in advanced countries, perhaps on a regional basis. Many industrialized countries have already sponsored such courses and it is hoped that other industrialized countries will follow suit.

→ Role of Developing Countries:

The primary responsibility for establishing adequate maintenance and repair facilities lies within the developing countries themselves. The assistance received from industrialized countries and international agencies would be of little value unless the developing countries

themselves establish their own programmes of action and regard outside assistance as only a help in implementing such programmes. At the same time the developing countries must also build up their indigenous capacity to absorb such help as is extended to them.

The role of developing countries comes under two main categories, that of government and that of enterprises:

a) Role of Government. One of the main reasons for lack of adequate maintenance and repair facilities in developing countries is the lack of understanding and appreciation of the essential role these facilities play in the industrialization process. The building up of an adequate technical know-how and consciousness in this area is of utmost importance. In most developing countries government guidance and support to create and maintain a proper awareness is essential.

b) It is the duty of industry of safeguard this valuable capital asset and to ensure that these facilities will contribute to industrial development. Industry should recognize efficient maintenance as an important industrial function, train maintenance personnel, encourage know-how, and provide the proper tools and spare parts.

Chapter IV:

Evaluation of Aspects of Maintenance Given Priority in UNIDO's Maintenance and Repair Programme with Emphasis on Least Developed Countries

The various aspects of maintenance are inter-dependent and none of them can accomplish its objective singly without the support of the others. Engineering activities cannot cope with maintenance problems unless they are preceded and supported by a number of other activities, such as planning, scheduling, determining level of maintenance required and other facilities. All of these measures are pre-requisites to the actual work of maintenance and repair which is the task of the engineering personnel, whether at the ordering and design stage or after production has started. Programmes such as those of repair operations, correction or replacement of parts, and details of preventive maintenance, are also their concern. At the same time, economic and organisational policies and plans cannot be implemented unless efficient engineering facilities are made available.

Some of the requirements which need examination in this context are:

a) Technical and design departments/centres at the enterprise level and/or at the central level.

One of the major problems facing developing countries is that of building up skills and acquiring equipment at the rate required. This problem is particularly acute in the field of maintenance and repair. Little attention has been given so far to this aspect of industrialization. In the meantime the volume of maintenance and repair work to be coped with has exceeded by far the services present facilities can render. Maintenance prevention has thus become extremely important in order to cope with this problem.

Design and technical centres represent an important part of the industrial infrastructure, not only for maintenance, but for all aspects of industrialization. Such centres exist already in many developing countries, and part of their efforts could be applied towards meeting maintenance requirements.

Such central technical offices would demonstrate the usefulness of this activity and encourage industrial enterprises to start technical offices of their own, and at the same time serve as a nucleous for future activities in this field, such as the local manufacture of spare parts. Design of spare parts and elaboration of technology for producing spare parts would be a crucial aspect of their manufacture. At a laterstage, developing countries could aspire to develop their own indigenous designs and plant layouts, for which such centres would be a pre-requisite. Additionally such centres would raise the competence of developing countries to examine and select any offers made by foreign suppliers, and to propose changes and modifications to suit local conditions.

b) Adequacy of maintenance and repair facilities to cope with modern equipment.

Modern equipment with its fine tolerances and finer finishes cannot be serviced with outdated tools and by a traditional work force. Machinery today must be assembled, adjusted and attended to according to

precise specifications if it is to give the expected performance. Furthermore, if proper maintenance procedures are not observed, the life span of modern equipment will be very much reduced and equipment failures are bound to occur. Up-to-date repair equipment is, therefore, essential for proper maintenance.

One solution would be to establish central specialized workshops which would serve major sectors of the national economy. Such central shops would do repair work which is beyond the scope or economical means of each individual enterprise. These central shops would also cope with the heavy repair work of many enterprises; thus heavy repair equipment would be more economically used and would enable central shops to employ highly skilled labour. It would be sound policy, and of substantial help to industry if developing countries were to sponsor such centres at least until such time as these centres could become self-supporting.

c) Consideration of maintenance problems in design and procurement of installations.

The proper choice of equipment at the ordering stage is an important factor in maintenance prevention. Most of the equipment produced in industrialized countries is designed to suit their own conditions and not those of developing countries. Consultation and cooperation between local and technical personnel and suppliers at the procurement stage may well result in many cases in useful modifications and adaptations which would considerably reduce maintenance problems and work load.

Also, in deciding upon offers or bids submitted, preference should not always be entirely determined by the purchase price of equipment, but also take into account operating and maintenance expenses. In many developing countries, such expenses as fuel for instance, are taken into consideration while little or no attention is given to future cost of maintenance. This neglect of the maintenance aspect is costly in the long run since it is known that maintenance and repair costs of most equipment, even with proper organisation, equal and, in many cases, exceed the purchase price of the equipment.

d) Foundry and forging facilities.

Lack of adequate foundry and forging facilities in many developing countries is a considerable handicap in repair work and particularly in the manufacture of spare parts.

Chapter V:

Summary of Suggested Action

I. Recognize the importance of maintenance in the plan of industrial development of the country

1. Take legal steps to regulate policies on import of equipment and spares;

2. Introduce guidelines controlling purchase of complete installations to include maintenance at design and tendering stage;

II. Implement the following steps to improve the maintenance activity (governments, public and private industry sectors, institutions, schools, etc.)

1. The establishment of design centres and technical offices at the country level and the enterprise level should be encouraged. Such central design centres are particularly useful at early stages of industrial development. Financial and technical assistance should also be given to enterprises in establishing their own technical offices;

2. Financial, fiscal and other incentives to induce industry to establish adequate maintenance and repair facilities, rational maintenance policies and adequate training facilities should be provided;

3. Since lack of spare parts is a major problem in most developing countries, a rational import policy for spare parts should be formulated. Additional measures would include the introduction of efficient customs clearing procedures and th establishment of duty-free zones to ease the financial burden on enterprises;

4. Arrangements for assisting enterprises to obtain and disse-

minate information on maintenance and repair, including the establishment of technical libraries and information centres, the holding of seminars, etc., should be made;

5. The establishment of spare parts manufacturing centres should reduce the drain of foreign exchange. In the long run such centres would add materially to the country's ability to promote industrial development. The operation of such centres would contribute to the creation of a pool of skills and experience which could serve other ancillary industries.

6. Arrange that sufficient funds are allocated in budgets of government, private, and public sectors for maintenance and repair purposes.

7. Evaluate the usefulness of applying mobile workshops as an interim solution to improving maintenance and repair in the short run.

Chapter VI: Proposed Projects

The following projects are submitted for consideration and implementation:

1) Establishment of a Design and Product Development Centre;

2) Establishment of a Regional Maintenance and Repair Workshop for Industrial, Agricultural, Construction and Transport Equipment.

* * *

The details corresponding to the abovementioned projects encompass:

1) Establishment of a Design and Product Development Centre

A. Objectives

The purpose of the project is to assist the Government in facilitating further industrial development in selected industrial branches. This development can be influenced though the creation of national design and product development capabilities (facilities) and by training local specialists. Such a Centre would provide the country with facilities to develop a large variety of improved and new product designs for industry and commerce and would also engage in the design of models and spare parts and maintenance of machinery and equipment.

B. Description of the project

This is a type of a "service-to-industry" project with close contacts with the local enterpreneurs and owners of different kinds of machinery and equipment. To fulfil this function the Centre will be organized in to the following four divisions:

(i) A Development Division, which will be responsible for the overall planning, product costing, marketing and will co-ordinate the work of other divisions.

(ii) An Engineering Division, comprised of industrial and mechanical engineers to advise on modern technology and production techniques. The use of new materials and equipment for achieving optimum results will also be investigated and evaluated.

(iii) A Product Design Division, which will modify old designs and create new ones in its product development activities. Training of graduate engineers will be directed towards advanced industrial design methods through real work exercises.

(iv) A Research Division which will make models, as well as inspect and test production prototypes. It will also concern itself with the execution of practical and appealing packaging.

C. Execution of the project

The Government (i.e. the responsible Government authority) and UNIDO will jointly be responsible for the implementation of the project.

Experts

Under the expert component a total of 214 m/m will be needed:

(i) an industrial designer/economist who will also act as Project Manager;

(ii) a team of four experts in product development, marketing, production and costing;

(iii) a number of specialists for short term consultancy.

Training

In addition to on-the-job training six fellowships for a total of 36 man-months should be approved for specialization of local personnel in all the aspects of this project.

Equipment and Supplies

This component will consist of:

- basic machinery and equipment for model making and production as well as laboratory (machine tools; workshop equipment; woodworking and plastics machinery; welding equipment; heat treatment; etc.)

- office machinery and equipment;

- library

D. Financial Data

	man/months	Cost in US$
Experts	214	535,000
Fellowships	36	22,000
Equipment		143,000
Total		700,000

Other local costs and contribution in local currency, an equivalent of US$ 150,000 plus land and buildings.

E. Conclusion

In the beginning, the project will be based upon and assisted by the enterprises existing in the country. In the course of its implementation, the project will gradually begin to render help to the same enterprises enabling them to produce more and better products, to achieve greater series and lower costs, and to form the nuclei for further industrial development.

2. Establishment of a Regional Maintenance and Repair Workshop for Industrial, Agricultural, Construction and Transport Equipment

In order to implement the programme and leave a permanent impact on the local industry a four year duration of the project is envisaged.

The project will have the following components:

- physical facilities incl. the industrial complex;
- experts and consultants
- fellowships and trainees

The activities of the project would develop within the physical facilities of the project as well as within the different selected enterprises associated with this project, both at the location of the project and in other localities.

The estimated value to the project is about $ 1 million and will depend on:

- the number of enterprises to be associated with the project;
- the scope of proposed activities;
- the technology applied; etc.

The following distribution of the funds is envisaged:

1. Physical facilities, (the industrial complex, incl. equipment, laboratories, supplies, etc.): 55% of the project value.

2. Experts and consultants 45 % of the allocated funds

3. Fellowships and trainees 5 %.

The main phase of the project would start with the completion of the

buildings and the installation of equipment. For these tasks short-term assistance will be provided from the project funds.

Physical facilities

Physical facilities will include the built up and open areas. The built up area will house the industrial complex, offices, laboratories, spare parts and the energy supplying facilities. The open area will be used for certain types of repair and transport activities and for the temporary storage of equipment.

The industrial complex will consist of the following facilities:

1. Design Office;
2. Mechanical workshop and laboratories;
3. Electrical workshop
4. Assembly area
5. Inventories

The design office will work on the technical documentation for the new products to be manufactured by the project and the participating enterprises; for the products that need modifications; for the manufacture of spare parts; for the serial production of specific products, etc.

The mechanical workshops and laboratories would engage in maintenance and repair of industrial, agricultural, construction and transport equipment relying heavily on the enterprises participating in this project, as well as in training. (Here we understand maintenance of equipment in enterprises and for customers.) The laboratories would engage with the questions of testing of materials, quality control (both within the project and in the associated enterprises).

The electrical workshop will, in addition to the activities normally performed, demonstrate the activities and work usually neglected in the less industrialized nations such as galvanising, electroplating and others. These activities are of importance in the production, use and maintenance of a number of products which are frequently imported but can easily be done locally.

The assembly area and the inventories will be designed and maintained to best serve the needs and to reflect the scope of the project.

The industrial complex as proposed is capable of handling a large spectrum of metal products, some types of agricultural, electrical, transport and other equipment. The scope of activity of the industrial complex must be agreed upon with the Government as the first step in the planning of this project's implementation.

Financial Data

Experts	US$	550,000
Equipment	US$	400,000
Fellowships	US$	50,000
Total	US$	1,000,000

Duration: 4 years

Conclusion:

This new approach to maintenance of various types of equipment on regional basis has for its purpose:

- the upkeep of available equipment in various branches of activity;
- upgrading of maintenance in the enterprises participating in the project;
- offering assistance in maintenance to enterprises outside the project, particularly to small and medium-sized ones;
- upgrade the manufacturing capabilities of certain enterprises;
- assist in specialization of a number of participating enterprises; and,
- offer consulting services.

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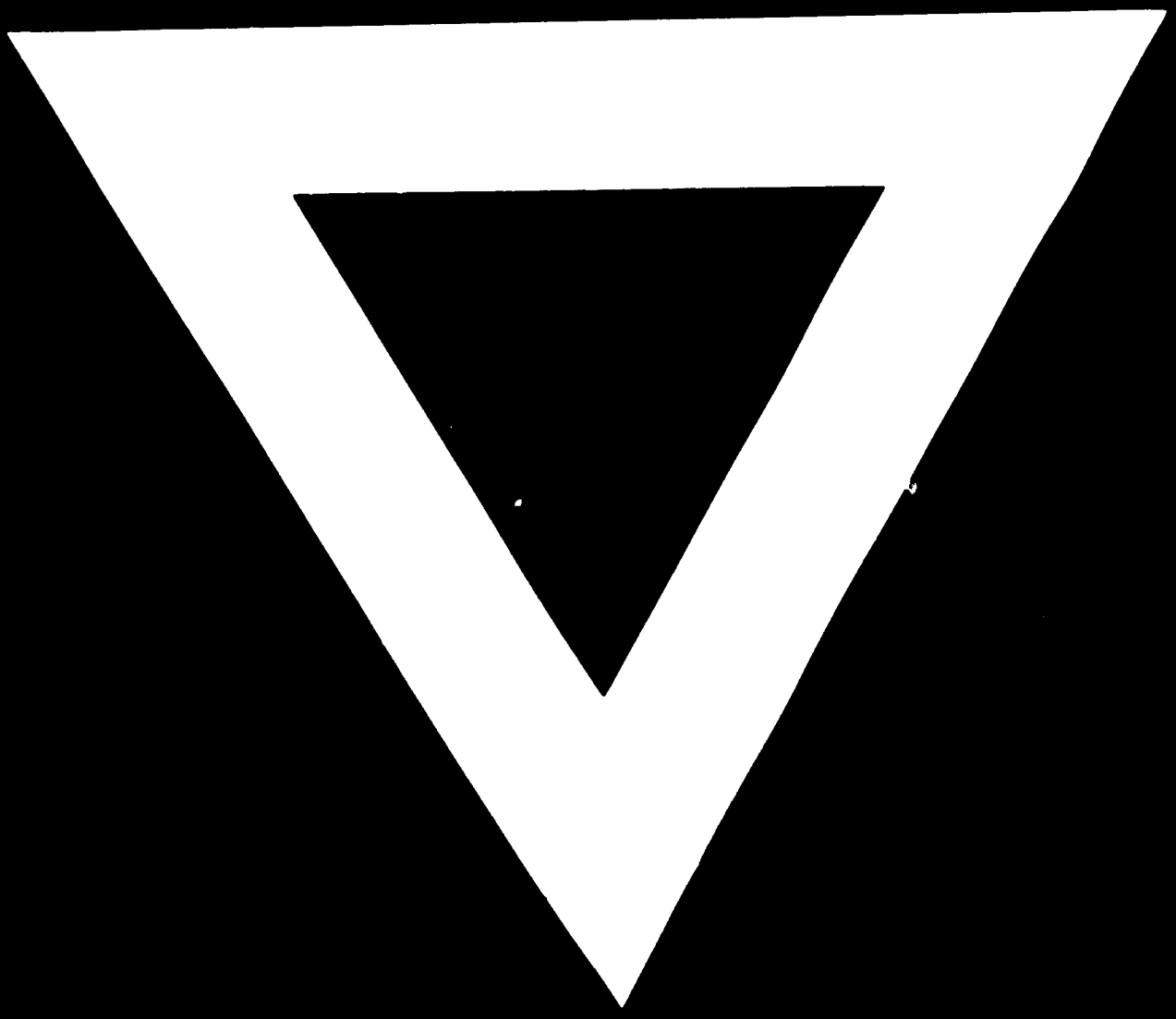

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