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SOME ASPECTS OF THE DEVELOPMENT OF THE METALWORKING INDUSTRY IN THE AFRICAN COUNTRIES AND THE USSR TECHNICAL ASSISTANCE TO DEVELOPING COUNTRIES UNDER UNIDO AUSPICIES 1/

by

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1. Some Problems of the Development of the Metalworking Industry in the African Countries

Africa occupies one-quarter of the area of the globe, it is inhabited by 10 per cent of the world's population, but it accounts for only one-hyndredth of world industrial output, and its per capita output is only one-thirtieth that of the developed capitalist countries.

Industrially, all the developing African countries*) lag behind the developing countries of other continents. Whereas, overall, the share of industry in the gross national product (GNP) of the developing countries was around 25 per cent at the beginning of the 1970's (as compared with 40 per cent in the developed capitalist countries), in Africa it was 14 per cent, with only Egypt above the average for the continent, at 17 per cent.

The main reason for Africa's economic backwardness today is its exploitation by the capitalist countries in the colonial period. During the period of colonial dependence, the economies of many African countries were artificially specialised in raw material production, with the countries themselves relegated to the role of markets for the industrial produce of the capitalist monopolies. The history of the economic relations of the developed capitalist countries with the new states shows that the ruling circles of the former seek to retard the development of the latter's manufacturing industries. Between 1950 and 1970,

*) That is, all the countries of the continent with the exception of racialist South Africa.

the share of the manufacturing industries in the industrial output of the African countries fell from 66.9 to 45 per cent, and in all developing countries of the world, from 77.6 to 70.1. That is why most African countries, like other developing states, see industrialisation as the best way to overcome the economic backwardness inherited from the period of colonial and semicolonial dependence.

On the whole, the manufacturing industry of Africa is characterised by a low level of production, which is reflected, among other things in its structure. The most typical enterprises of the manufacturing industry are textile, foot wear, tobacco, beer, flour, sugar and soap manufacturing factories, and engineering and metalworking plants.

In the course of 20 years, from 1950 to 1970, the average annual rate of growth in the metalworking industries of the developing countries of Asia, Africa and Latin America was higher than the growth rate in other manufacturing industries. During the 1961-70 period, it was 8.2 per cent, while in the period from 1951 to 1960 it was as high as 11.6 per cent. The annual growth rate of the metalworking industry in African countries was, however, only 5.6 per cent in 1951-60, and 3.2 per cent in 1961-70.

The development of the manufacturing industries in Africa increases the demand for metal, and this in turn requires the establishment of national metallurgical industries, especially the iron and steel industry, as a basis for the engineering and metalworking industries. The experience of industrial development of a number of countries

has shown that the construction of small metallurgical works is uneconomic; it leads to a dissipation of resources and higher production costs. On the other hand, the establishment of large enterprises is beyond the means of many African countries since, in addition to raw material resources, this requires large investments and, what is especially important, a large market. One solution of the problem is the creation of an all-Africa market, multinational enterprises, and the development of specialisation and co-operation.

The iron and steel industry in the developing countries of Africa is represented in Egypt, Algeria, Ghana, Tunisia, Morocco, Nigeria and also in countries of East Africa. Non-ferrous metallurgy is represented by the aluminium and alumina works of Ghana, Guinea and Cameroon, and copper, lead, zinc and tin works in other countries. Some countries have integrated metallurgical complexes. In the Cameroon, a metallurgical plant serves as the basis for the development of the production of aluminium articles, kitchen utensils and other products of the metalworking industry.

At the beginning of the 70's the share of metalworking in the manufacturing industries of African countries was, at 11.1 per cent, lower than in other developing countries. This is because the industry of most developing African countries is at a lower technological and organisational level than in the developing countries of Asia and Latin America.

Some countries have assembly plants using imported parts and units coupled with local manufacture of some items; they produce passenger cars and lorries (Algeria, Egypt, the Ivory

Coast, Ghana, Benin, Cameroon, Kenya, the Malagasy Republic, Morocco, Nigeria, Senegal, Tanzania, Tunisia and Uganda); tractors and other farm machinery (Algeria, Cameroon, Morocco, Senegal, Tanzania, Tunisia and Uganda); motorcycles and bicycles (Egypt, the Ivory Coast, Upper Volta, Zaire, Cameroon, Senegal, Tanzania and the Central African Republic); railway trucks are manufactured or assembled in Algeria, Egypt, Kenya, Cameroon, Morocco, Senegal and Sudan. Electrical engineering works specialising in assembling transistor sets from imported parts have been set up in countries of East Africa, Benin, Zaire and some other countries.

In Algeria, a machine-tool plant, a farm machinery plant, a factory for the manufacture of nuts and bolts, a radio engineering plant, and other engineering and metalworking enterprises are due to go into operation shortly.

The largest manufacturing industry in the developing countries of Africa is in Egypt. Among other items, it manufactures general-purpose lathes, drilling, milling, shaping, and tool-grinding machines, and small eccentric presses. The largest factory manufacturing metal-cutting machine tools is at Helwan and was built with the help of the Soviet Union. In 1975, the Helwan plant, with a rated capacity of 725 machine tools per year, put out 1,328. Expansion of the plant was begun in 1976 to bring the rated output up to 1.620 machine tools per annum.

Development of the metalworking industry depends in large measure on the numbers, types and ages of the machine tools in operation, and on the availability of power hammers,

forging presses and other equipment required for industrial production. Despite some increase, the number of machine tools in the developing countries is still not great. More than 60 countries of Asia, Africa and Latin America, including such large countries as India, Brazil, Argentina and Mexico, possess a mere 10 per cent of the world stock of machine tools and forging equipment. The other 90 per cent is located in 25 industrially developed countries. Most African countries are very short of machine tools, and many more are required. They need to pay special attention to a correct choice of types and to the most efficient utilisation of available industrial plant.

Ill-chosen equipment occupies factory space without turning out produce, thereby lowering the efficiency of factory plant as a whole. Representatives of private firms from developed capitalist countries occasionally try to pass off, onto developing countries obsolete plant which can in no way promote technical progress in the developing countries.

Some theoreticians have developed the concept of so-called "intermediate technology" to advocate the use of simple machine tools with low productivity and the lowest possible degree of mechanisation and automation so as to ensure more employment for unskilled labour. This view totally rejects the idea of introducing modern machines capable of assuring high labour productivity, high machining precision, and, accordingly, high-quality products for which there is a demand on the external as well as the domestic markets of the countries concerned.

The highly efficient machines manufactured by the industrially developed countries meet the basic requirements of technological progress of those countries. The development of some special, low-efficiency equipment for supply to developing countries would push up its cost. Furthermore, the development and manufacture of such equipment is a thing of the past for the industrially developed countries and it is hard to imagine any of them returning to it.

The right combination of highly productive up-to-date equipment and labour-consuming operations (for example, assembly work) is an essential prerequisite for overcoming the backwardness of the majority of the developing African countries.

The most widely used machine tools in unit and small- and large-scale production are general-purpose lathes suitable for machining a wide range of items for the metal-working industry. They are relatively cheap, possess wide speed and feed ranges and are simple to adjust and maintain. For this reason more extensive use should be made in African countries of general-purpose lathes, drilling, milling, planing, grinding, jig-boring and gear-cutting machines. It is estimated that in 1980 the demand for metal-cutting machine tools in African countries will amount to US $110,000,000.

With the increase in the quantity of machine tools in plants, the developing countries will have to give more attention to the question of a better utilisation of production capacities. In many developing countries to day it is no more than 30 to 50 per cent.

An important prerequisite for better utilisation of production capacities is the strengthening of the state sector. It has greater opportunities for increasingly detailed studies of national demand and appropriate planning of industrial output. The state sector is in the best position to ensure the harmonious development of interrelated branches of the national economy with due account of all available manpower, energy, fuel and other natural resources. Because of the possibility of marketing difficulties, owing to the smallness of the domestic market, producer countries must study marketing opportunities abroad. There are enterprises in developing countries which market their produce in other countries. In this connection it should be noted that, in collaborating with developing countries in setting up and consolidating their industries, the Soviet Union does not restrict itself to merely building industrial projects. It is also concerned with ensuring their efficient running and helps to find markets for them.

In view of the specifics conditions of African countries, differences in demand for industrial produce, in natural resources and in energy and manpower resources, it is worthwhile considering the possibility of specialisation and co-operation in the output of their metalworking industries. To successfully resolve their economic problems, win time, increase efficiency and accelerate progress, African countries should take a more active part in international division of labour with other countries of the world and the region.

At present the developing countries, which are inhabited by more than half the world population, account for only seven per cent of world industrial output.

At the beginning of the 70's, the developed capitalist countries accounted for 95.1 per cent of the total output of the metalworking industry in the capitalist world. The share of the developing countries was 4.9 per cent, and that of African countries a mere 0.3 per cent.

In African countries the metalworking industry is represented mainly by small enterprises manufacturing farm implements, wire, fittings and structural elements, galvanized iron and aluminium kitchenware; by assembly works for automobiles, bicycles, sewing machines and refrigerators, and by repair works, railway workshops and other enterprises.

In those countries where there is no clearly defined metal-working industry its development should be begun with the establishment of repair and manufacturing services. As industry expands it often becomes increasingly advantageous for developing countries to repair or manufacture worn-out or broken machine parts and units on their own. The establishment of repair and maintenance services and the training of local personnel for industry is an important stage for many countries of the region. The efficiency and lifetime of equipment depends upon how it is used, and on timely maintenance and repairs. Frequent breakdowns and the malfunctioning of equipment are costly because of the ensuing stoppages and the need to spend hard currency on importing spare parts and materials.

Repair and maintenance personnel should be encouraged to acquire design and technological know-how, which will enable them to make the drawings and blueprints of machine parts requiring replacement and to manufacture them locally using, where possible, local materials. As experience accumulates it is necessary to set up special services at industrial enterprises to design and develop the technologies for the production of simple items, units, tools, and jigs and fixtures for local industries and agriculture.

In some countries it would be expedient to set up centralised repair and maintenance services equipped with mobile workshops to provide repair and maintenance for agricultural and road-building equipment across the country.

As a money-saving device, thought should be given to the establishment of regional research and design institutes which could carry out orders for design and development work for several countries of the region. These institutes could elaborate and introduce a unified system of standards and set general technological guidelines for several countries of the region. UNIDO jointly with ECA could study the question closely and try setting up such a regional centre in one of the developing countries of Africa.

Currently the industries and agricultures of most African countries use machinery and equipment imported from industrially developed countries. But no modern technological methods and know-how passed on by the developed countries can be of use to the developing countries, and may even prove an additional burden to them, if they do not have the skilled

local personnel capable of successfully adapting the new technologies to local conditions. Therefore one of the prime tasks in setting up and developing the metal-working industry in African countries is the training of local personnel, workers as well as engineers and technicians.

The experience of developing the engineering and metalworking industry in the Soviet Union shows that the correct training and placing of skilled workers and engineers and technicians is of decisive importance. At the time when Soviet machine-tool engineering was in the making, with new factories being built and old ones reconstructed, there was an acute shortage of trained personnel. People with little or no experience of operating machines manned the shops of machine-tool and tool-making factories. The shortage of engineers and technicians, coupled with inadequate management experience, created serious obstacles for development. Work was begun to provide technical training. Schools and advanced training courses were set up, extensive use was made of team and individual methods of worker-training with a system of examinations in the required minimum of technical knowledge. An important part in providing worker personnel was played by the factory schools set up by some enterprises and by vocational and trade schools where young people were trained in the trade of their choice. Institutes and technical schools turned out large numbers of engineers and technicians of various specialities for factories, design and technological bureaus, research institutes and other organisations in the industry. Today the

development of science and technology and the economics of the machine-tool and tool-making industry requires not only more personnel but also a continuous development of skills and improving of qualifications. There are advanced training courses for executives and managerial personnel, designers, technologists, inspection department personnel, economists, electronics and computer experts. All of this made it possible to train a nucleus of skilled workers, technicians and engineers for the industry within a short period of time. The establishment of a highly developed machine-tool and tool-making industry in the Soviet Union capable of supplying all branches of the economy with metalworking machine tools and tools became possible only thanks to the high standard of technical training of workers, engineers and technicians, and research and design personnel. Today the machine-tool and tool-making industry is one of the leading branches of the Soviet engineering industry, well staffed with excellent designers, technologists, skilled workers, scientists and researchers.

Whereas before the revolution tsarist Russia accounted for little more than 4 per cent of world industrial output, at present the Soviet Union accounts for 20 per cent. In absolute figures this is more than the world's total output in 1950.

The developing countries display ever greater interest in the tremendous experience of the Soviet Union, which was able to transform from a backward agrarian nation into a mighty industrial power with advanced science and technolo-

gy within a historically short time. Under bilateral agreements concluded as of January 1, 1977, the Soviet Union is engaged in economic and technological co-operation with 60 developing countries in the construction or expansion of 998 projects in various branches of the economy; of these, 555 have already gone into operation. Out of 53 projects in the machine-tool and metalworking industries 41 are in full production.

The Soviet Union helps developing countries in training personnel on the basis of bilateral agreements with the governments of those countries and on the basis of multilateral agreements under UN auspices.

As of January 1, 1977, since the beginning of co-operation between the Soviet Union and developing countries, Soviet specialists have helped train more than 600,000 persons - 400,000 at technical co-operation projects; 175,000 at educational centres built with Soviet help; 20,000 at higher educational establishments and technical schools built with Soviet assistance; 12,000 people have undergone vocational and trade training in the USSR; 24,000 people finished colleges or technical schools in the USSR.

More than 9,000 people from developing countries studied in the Soviet Union under the auspices of the United Nations and its specialised agencies.

2. Technical Assistance of the USSR to Developing Countries In the Metalworking Industry Under UNIDO Auspices

As one of the founding members of the United Nations Industrial Development Organisation (UNIDO), the Soviet Union takes an active part in its efforts aimed at giving technical assistance to the developing countries in promotion of their metalworking industries.

The main lines of such technical assistance are: the sending of Soviet specialists to the developing countries, training national personnel through group or individual instruction in the Soviet Union, deliveries of Soviet-made equipment, the preparation of scientific and technical reports, and conducting various feasibility studies. These measures are financed from Soviet contributions to the United Nations Development Programme (UNDP) and the Regular Programme, as well as its voluntary contributions to UNIDO.

Since 1968 the Soviet Union has been making annual voluntary contributions to UNIDO of 500,000 roubles. These funds are used mainly to finance the organisation of symposiums, seminars, in plant group-training programmes in the Soviet Union, study and information tours of specialists from developing countries, and also for deliveries of equipment.

2.1. In Plant Group-Training Programmes and Advanced Training Courses for Specialists from Developing Countries in the USSR

The Soviet Union sponsors two-month to six-month in plant group-training programmes and advanced training courses

for specialists from developing countries run on a permanent basis under UNIDO auspices.

Instruction under UN scholarships is conducted on a high organisational and scientific level, and by leading Soviet specialists, scientists and executives. UN fellows attend lectures, do laboratory work, visit factories, and become acquainted with modern production methods in the engineering and metalworking industries. At the end of the course the students submit reports on their work, pass examinations and receive graduation certificates.

At the Zaporozhstal iron and steel works a three-month UN in plant group-training programme in metallurgy has been conducted every year since 1965. It has been attended by 425 persons from 40 countries. In 1976 the programme was attended by 25 metallurgical engineers from 12 countries. The trainees attended lectures by highly qualified specialists and became acquainted with the achievements of Soviet metallurgy at works in Krivoi Rog, Zhdanov and Lipetsk.

In response to a growing demand for education in the developing countries, the UNIDO Secretariat forwarded a request to the Soviet side to take on a second group for the 1977 metallurgy-training programme.

Since 1969, the Patrice Lumumba Friendship University in Moscow has been conducting annual four-month UNIDO advanced training courses for engineers in the metalworking industry. In this time 123 specialists from developing countries have received advanced training. In 1976, the courses were attended by 20 people from developing countries,

including Ghana, Egupt, Nigeria, Sudan, Tanzania and Uganda. Highly qualified specialists gave lectures on questions of general engineering, interchangeability, machine-tool kinematics, testing, adjustment and maintenance, adaptability for industrial production, machine-tool design, tools, jugs and fixtures, and other topics. In addition to theoretical knowledge, the curriculum of the courses provides for practical experience. Participants in the courses attended practical classes in technology selection and calculation of cutting conditions, and also visited some 20 engineering works in Moscow, Leningrad, Kiev, Yerevan and Tashkent. At present the UNIDO Secretariat is considering the possibility of a special programme on the designing of jigs and fixtures.

The UN in plant group-training programme in electric welding for engineers from developing countries, conducted every year at the Paton Electric Welding Institute of the Ukrainian Academy of Sciences, has trained 95 specialists from 35 countries since 1972. It includes lectures on the selection of technologies and equipment for welding steel, cast iron and nonferrous metals, practical laboratory classes with real-life equipment, and excursions to industrial enterprises.

Since 1971, the USSR State Standards Committee has annually been sponsoring a four-month UN in plant group-training programme on standardisation under which UN fellows are given advanced training in standardisation, quality control and metrology. In 1976 the programme catered for 19 specialists from 12 countries, including Egypt, Liberia

and Sudan. That year the first four-month in-plant group--training programme in metrology was separated from the standardisation programme. It was attended by 15 specialists from 15 countries, including Egypt, Ethiopia, Ghana, Nigeria and Tanzania.

In response to a request from UNIDO and UNESCO, the Soviet Union has been sponsoring annual interregional courses on industrial information and documentation for specialists from developing countries since 1970.

In 1976 a UNIDO-sponsored five-month in plant group-training programme in steel smelting was conducted at the Cherepovets Iron and Steel Works for 24 metallurgists from Sri Lanka.

The international agencies and the UN fellows themselves speak highly of the educational facilities provided by the USSR for in-plant group-training of personnel from the developing countries.

The training courses listed above will continue in 1978, and those wishing to attend these and to take part in in-plant group-training programmes may address inquiries to the UNIDO Secretariat.

2.2. Symposiums, Seminars, Tours and Conferences Held in the USSR for Specialists from Developing Countries for Exchanging Experience and Know-How

In 1966, an Interregional Symposium on the Metal-working Industry was held in Moscow with the participation of 88 specialists from developing countries of Asia, Af-

rica and Latin America, and 12 specialists from industrially developed countries. They discussed such important questions as the importance of the metal-working industry for the economies of developing countries, demand for its produce, carrying out an inventory of plant in hand, the role of regional co-operation, industrial planning and management, and many other questions pertaining to the development of this industry in developing countries. Recommendations aimed at encouraging the development of metalworking were made to the developing countries as well as to UN agencies engaged in co-ordinating the development of the industry in the "Third World".

In 1968 a UNIDO seminar on the spacial distribution of industrial capacities in developing countries was held in Minsk. It was attended by some 60 persons, including 35 specialists from developing countries. The seminar considered such important questions as determination of the region, the role of the spacial distribution of industry in the development of a region, decentralisation of industry and the expansion of the national economy, the role of the infrastructure, external sources of financing and accumulation, co-ordination of sectoral and regional plans, the methodology of planning and programming, policies aimed at preventing further concentration of industry, and other questions. The participants in the seminar had the opportunity to visit a number of industrial complexes in Byelorussia and see Soviet achievements in industrial organisation and pro-

duction.

The second interregional symposium on ferrous metallurgy held in Moscow in 1968 was attended by 148 representatives from 43 countries and 9 international agencies, including 60 steel industry specialists from 32 developing countries. The symposium discussed questions connected with the further development of the iron and steel industry in "Third World" countries, the exchange of information on the latest technological achievements in the industry, and technical assistance to developing countries in the field of iron and steel production on the part of UNIDO. During the symposium visits were organised to the Novolipetsk, Krivoi Rog, Zaporozhye and Cherepovets iron and steel works, and to the Moscow Institute of Steel and Alloys, the State Design Institute of the Iron and Steel Industry, and the Central Scientific Research Institute of the Iron and Steel Industry of the USSR.

In 1970, a UNIDO seminar on copper production in developing countries was held in Moscow. It was attended by 54 specialists from developed countries and 14 from developing countries. It was noted at the seminar that the development of the copper industry has been characterised by a substantial increase in world copper production and consumption; this has been accompanied by a growing trend to process ores with low copper content and with side recovery of lead, zinc, iron, molybdenum and other metals. Hydrometallurgical and pyrometallurgical technologies for recovering copper from complex ores are being developed. Oxygen

is being increasingly employed in smelting copper.

The symposium recommended that developing countries give more attention to the question of environmental pollution, taking advantage of the achievements of the developed countries. The seminar was a school for representatives from developing countries in the study and utilisation of the latest achievements in the technology of copper production.

In 1970, a UNIDO seminar on the organization and management of industrial services in countries of Asia and the Middle East held in Tashkent. It was attended by 21 specialists from 16 countries of the region, mainly directors and department chiefs of industry ministries, research institutes, industrial development corporations and other establishments. They discussed the question of the role of industrial services in promoting industrialisation and came to the conclusion that measures should be taken to improve the organisation and management of industrial servicing in the countries of the region. It was noted that a specail place belongs to industrial information services, for the development of which it is necessary, with help from UNIDO and developed countries, to set up information centres capable of supplying local industries with the necessary industrial information on equipment and technologies best suited for a particular type of industrial production.

In 1974, a conference of experts and executives on the encouragement and development of the machine-tool industry in the developing countries of Asia and the Pacific was held in Tbilisi. Sponsored by UNIDO in collaboration with the

Economic and Social Committee for Asia and the Pacific (ESCAP), it was attended by 60 specialists from 20 countries. It was noted at the conference that some developing countries of the region had attained an extremely high quality standards as a result of which their produc,s had become competitve on the world market. In some countries the levels attaind only meet the requirements of small local companies which do not impose strict reliability or precision demands on their wares. The participants in the conference supported the idea of a common co-operation programme in the development and expansion of the machine-tool and tool-making industry. At the conference representatives of ESCAP countries discussed some specific development projects with representatives from industrially developed countries with an eye to their possible participation in those projects. Also, requests for technical assistance on the part of UNIDO were determined and drawn up. Representatives of the developing countries visited Soviet machine-tool and tool-making plants where they saw production organisation in action and became acquainted with new technological processes in manufacture, assembly and quality control.

Detailed accounts of all the above-mentioned undertakings held in the USSR have been publishod by UNIDO and can be obtained on request.

At present, at the request of the UNIDO Secretariat, Soviet agencies are working on the question of a technical conference and a tour of the country for 20 specialists in farm machinery repair and maintenance from African countries.

2.3. Deliveries of Soviet Equipment

At the request of governments of developing countries, since 1970 the Soviet Union has delivered, as part of its voluntary contribution to UNIDO, 26 GOSNITI-2 mobile repair shops for the servicing and maintenance of farm and road-building machinery. In a number of developing countries these mobile stations have become a component part of existing or newly established maintenance services.

Mobile maintenance stations have been supplied to Tanzania, Cameroon, Algeria, Gambia, the Central African Republic, Equatorial Guinea and other countries.

Soviet equipment has been supplied for a number of UN-sponsored projects in developing countries.

For example, Soviet metal-cutting machine tools have been supplied for the Industrial Development Centre in Cairo, Egypt, and for two stationary farm machinery repair shops at Dodoma and Iringa, in Tanzania.

2.4. Preparation of Technical Reports, and the Carrying out of Feasibility Studies and Laboratory Research

As part of its voluntary contributions to UNIDO, the Soviet Union prepares scientific and technological reports and publications for the needs of developing countries and on request forwards Soviet technical literature and documentation to them.

A group of Soviet specialists headed by Professor A.P. Vladziyevsky, D.Sc. (Engineering), Honoured Science and Technology Worker of the RSFSR, prepared for publication a practical handbook for specialists from the developing countries, "The Selection and Acceptance Testing of Metal-Cutting

Machine Tools in the Developing Countries" (ID/ 22, UN , New York, 1972).

At the request of the government of Egypt and the UNIDO Secretariat, Soviet organisations provided Soviet technical books in English and Russian for the Industrial Development Centre in Cairo, which is a UNDP/UNIDO project.

The Soviet Union carried out laboratory research and feasibility studies of the expediency of developing ilmenite ore deposits (the so-called "black sands") in Brazil, India, Egypt, Ceylon and Madagascar. Laboratory studies were also carried out for Gambia and Senegal.

Such work for the development of the natural resources of African countries is of great importance for the development of their industries.

Conclusions and Recommendations

1. The modern industries of the majority of the developing countries cannot develop successfully without the establishment of metalworking industries in those countries.
2. The metalworking industry of most African countries is at a lower technical and organisational level than in the developing countries of Asia and Latin America. African countries account for only 0.3 per cent of the output of the metalworking industry of the capitalist world.
3. In those African countries where machine-building and metal-working have developed it is necessary to expand existing stocks of metal-cutting machine tools and forging and pressing equipment through the acquisition of modern plant and general-purpose machine tools.

4. In countries with no metalworking industry it is desirable to lay its foundation with the establishment of repair and maintenance shops for industrial and farm equipment. The stock of machine tools should be built up through imports mainly of the general-purpose metal-cutting machine tools and forging and pressing equipment most widely employed in unit, small-scale and series production.
5. Along with the setting up of repair shops at industrial enterprises, centralised repair and maintenance shops should also be set up where necessary, equipped with mobile workshops for providing repairs and maintenance for farm and road-building machinery.
6. Metallurgy is an important element in the development of the metalworking industry in Africa. Countries wishing to encourage the metalworking industry should, where possible, develop the manufacture of castings, forgings, fastenings and other items required for making up complete units.
7. The experience of a number of countries in the sphere industrial development shows that it is uneconomic to build small metallurgical plants as this leads to a dissipation of resources and higher production costs. At the same time, many African countries cannot afford to set up large enterprises since, in addition to raw material resources, they require large investments and, even more important, a big market. One solution of the problem is the formation of an all-Africa market, the establishment of multinational enterprises, and the development of specialisation and co-operation.

8. In building new and reconstructing old engineering enterprises, the developing countries must study prospective markets for their produce, and the possibilities for specialisation and co-operation of production.
9. Special attention should be devoted to the training of national personnel for the engineering and metalworking industries of African countries. In this it is essential to make use of the experience of countries of other continents.
10. The development of designing and technological skills among local specialists should be encouraged. As experience is gained it is necessary to set up special technical services at enterprises for the design and technological development of necessary items, equipment, tools, and jigs and fixtures for local industries and agriculture.
11. For the sake of economy the countries of Africa should study the possibility of setting up regional research and design centres in engineering which would be able to carry out orders for design and development work for countries of the region, promoting a common technological policy in those countries, and which would also be able to train specialists for African countries.

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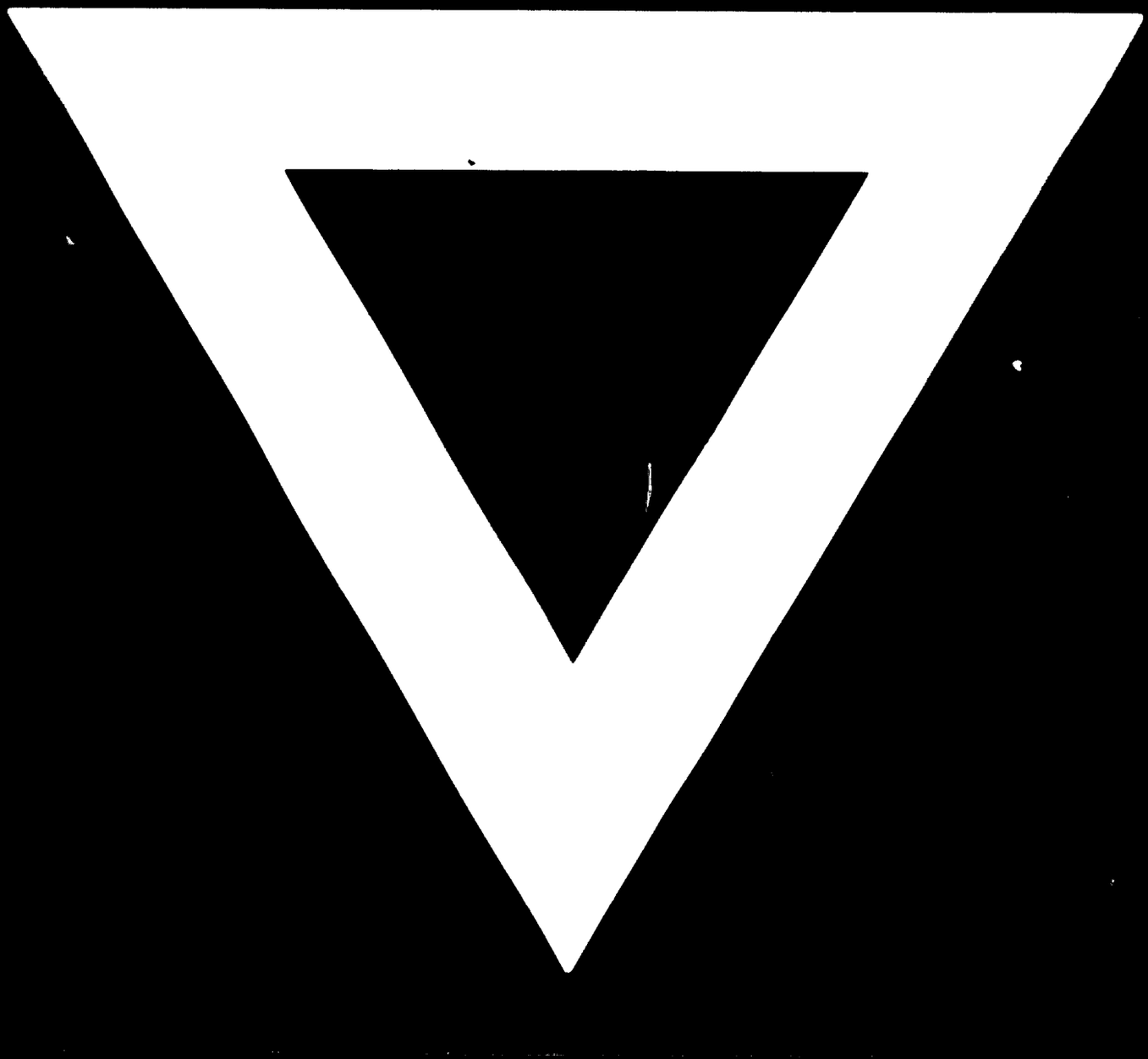

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