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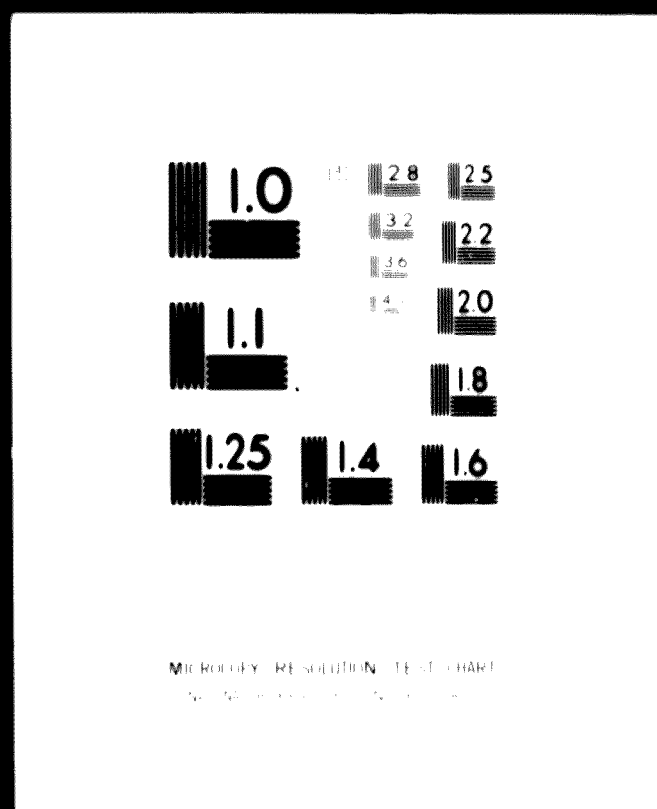
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REPORT ON THE ADVISORY MISSION TO IRAN ON THE
PROGRAMMING OF METALWORKING (ENGINEERING)
INDUSTRIES WITH A SPECIAL VIEW TO THEIR
EXPORT POTENTIAL

23 January - 6 February 1971



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1. Following the recommendations adopted by the UNIDO Expert Group Meeting on Metalworking Industries as Potential Export Industries in Developing Countries,^{1/} the Government of Iran requested the services of a UNIDO SIS advisory mission. The terms of reference of the short-term mission as agreed between the Government and UNIDO were as follows:

- (a) to advise the relevant authorities on the most effective ways of assessing the potential role of metalworking industries for improving the country's balance of payments in terms of both increased exports and furthered import substitution;
- (b) on this basis, to assist in identifying the technical assistance requirements in this field.

2. This mission was composed of:

Richard S. Lissak, Lecturer, Queens College,
City University of New York,
consultant to UNIDO;

Jaroslav Schejbal, Export Industries Section,
Industrial Policies and
Programming Division, UNIDO.

3. During its stay in Iran, the mission held discussions with Government officials, representatives of various institutions active in the field of industrial development and exports and with some industrialists. It also met most of the UN technical assistance experts in the field of industrial development. Finally, the mission visited three industrial plants in the metalworking sector. List of persons visited appears in Annex 1.

4. The mission wishes to express its sincere gratitude to the Government and other officials for the most useful orientation and information given by them. It is especially grateful to H.E. Dr. J. Ashrafi, Under-Secretary, Ministry of Economy and to Mr. H. A. Mehran, Director General, Research Division and Deputy Managing Director of the Research Centre for Industrial and Trade Development. Consultations with them and working contacts

^{1/} See report on the meeting, document ID/23 Vol. 1,
Sales No. E.70.II.B.16

with the Centre's staff made it possible to formulate the proposal on planning for the long-term development of metalworking industries in Iran with a view to exports. (Annex 2).

5. The mission is also grateful for the support extended by the UNDP Resident Representative Mr. N. Shallon, Senior Industrial Development Advisor Mr. M. A. Aghassi and by the Second Deputy Resident Representative Mr. E. Cacouris.

6. It is also grateful for comments and suggestions received from UNIDO experts working currently with the Ministry of Economy under the Special Fund project IRA-16.

INTRODUCTION

7. The UNIDO Expert Group Meeting on Metalworking Industries as potential export industries reviewed a number of planning techniques that have been implemented in the metalworking sector and listed criteria that may be used for constructing comprehensive production and export programmes. It considered the methodology developed by UNIDO ^{2/} and concluded that the methodology was suitable for introduction in developing countries. The Group agreed in particular that the methodology represented a useful link between the overall economic planning and planning on individual project level, thus bridging the gap between these two approaches. It also agreed that the best way in which UNIDO could assist developing countries in introducing the proposed methodology would be through technical assistance projects. A model project of this type and the criteria for the set of data needed was also adopted by the Expert Group Meeting.

8. Mr. H. A. Mehran, Deputy Managing Director of the Research Centre for the Industrial and Trade Development, Ministry of Economy took part in the above Expert Group Meeting. The Government of Iran expressed interest in receiving technical assistance from UNIDO on the basis of the approach developed. Subsequently, the Government invited a UNIDO short-term advisory mission to consult on the ways of implementation of a long-range technical assistance project in Iran.

FINDINGS AND CONCLUSIONS

9. The Government of Iran assigns high priority to the development of the metalworking sector. The sector is viewed as one of key importance for the country's economy, as it produces and maintains equipment for all productive sectors and

^{2/} The methodology is described in the working papers prepared for the meeting - ID/WG.10/1 and 2.

is the locus of most technical progress. Its potential in gradually developing sizeable exports is also realized. Next decade has been declared Export Promotion Decade in Iran. It is realized that present dependence on export earnings from the oil sector and traditional export categories is self limiting and new ways should be opened in metalworking sector.

10. The conclusions reached in the discussions held by the mission can be briefly summarized as follows:

(a) In order to achieve the desired expansion of the metalworking sector in Iran, the need exists for orienting the sector towards specialization in promising branches and product lines. This would enable to make use of inherent economies of scale, develop a sound structure of the sector and improve the level of its competitiveness on foreign markets. This can only be done on the basis of a sectoral approach as distinct to the project-by-project approach. A sectoral approach would enable to reveal intrasectoral linkages between project complexes and individual projects. It will also give an overview of the sector required for the identification of promising branches and product lines along which a dynamic expansion for domestic market and exports could be centred.

(b) Based on the sectoral approach, a coherent system of project complexes' identification should be developed that would allow to assess the impact of a given project complex on the country's economy. Linkages on capital account are especially important in this connection.

(c) Existing macro-planning in the Centre is based on the preparation of a 29 x 29 input-output matrix, in which the metalworking (engineering) sector is represented by one grouping. The need exists and desire was expressed to expand the matrix, particularly with regard to the metalworking sector. The aim is to assure consistency between the development programmes for various sectors and to allow for analysing the impact of various project alternatives in the sector.

(d) Emphasis is placed by the Government on developing resource-based industries, at increasing domestic value added, improving the balance of payments and on skill formation. It is a declared Government policy to develop capital and intermediate goods industries. Metalworking industries have an important role to play in the implementation of these policies (backward linkage to basic metals sector, manufacture of machinery and equipment, formation of skills etc.)

(e) Existing metalworking industries in Iran are to a high degree autarchic (highly vertically integrated). The economic advantages of subcontracting cannot be therefore utilized. With the expansion of the sector, the economic level of subcontracting should become one of the important components in planning for the sector's development.

11. The mission was asked to prepare, on the basis of the Government's objectives and policies, a discussion paper outlining the ways in which long-range policies can be implemented. The paper (see Annex 2) was discussed at a final meeting with Mr. H. A. Mehran, Dr. Rao, Project Manager IRA-16 and Dr. Abu El-Haj, expert of the same project. It was agreed that the mission's proposal is of particular interest to Iran.

12. At a subsequent meeting with H.E. Dr. J. Ashrafi, Under-Secretary, Ministry of Economy, H.E. Dr. Ashrafi requested that preparations for UNIDO technical assistance project on the above basis are initiated as soon as possible in order to start the implementation stage early in 1972. It was considered that the duration of such long-range technical assistance project should be three years.

13. As the set of techno-economic data for planning the sector to be collected in an industrially developed country represents an important component of the above technical assistance project, it was considered urgent that an expert who would be directing the work on collecting the data, visit Iran in March or April 1971. The aim of the expert's visit is to consult on the priorities of data collection, and on the ways of constructing data for typical products as well as inputs. A request for SIS short-term assistance will be submitted to UNIDO through the usual channels.

RELATIONSHIP TO THE SPECIAL FUND PROJECT IRA-16

14. The Centre for Industrial and Trade Development is at present assisted by a team of international experts under the Special Fund project IRA-16. The request for the above project was approved by the UNDP Governing Council in January 1967, while the Plan of Operations was signed in January 1968. The project's duration is five years.

15. The aim of the Special Fund project IRA-16 is to strengthen and assist the Research Centre in carrying out its diverse functions and responsibilities as an advisory body to the Ministry of Economy. The activities performed by the Project fall mainly into the following three categories:

(a) Preparation and, even more particularly, evaluation of individual industrial projects (usually new plants):

(b) Preparation of Master plans (demand) for various industrial and mining sectors;

(c) Preparation of a macro-economic model.

16. It is felt that a re-orientation of the Centre's work is needed at present. Particular stress is laid upon the preparation of a much larger number of pre-feasibility and feasibility studies for new investment projects to be generated by the Centre itself. These studies should be integrated into the sectors' development programmes.

17. A mid-term review meeting of the Special Fund Project IRA-16 will be held in the last week of February 1971, with the participation of the Iranian Government's, UNDP and UNIDO representatives. The re-orientation of the Centre's activities and consequently modified priorities will be discussed at the above meeting, together with the proposal in the field of metalworking industries as suggested by the present mission.

18. Final formulation of the technical assistance project on planning for the development of metalworking industries with a special view to their export potential will thus be based on the conclusions reached at the mid-term review meeting.

List of Contacts

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Research Centre for Industrial and Trade Development,
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Export Promotion Centre, Ministry of Economy:

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Technolog, Inc.:

Mr. F. Sid Askari Managing Director
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Mr. Ali Ardahali Economic Department

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Mr. J. Semsch	
Prof. V. L. Bassie	
Mr. P.C. Alexander	Project Manager, IRA-11
Mr. S. T. Sforza-Chrzanowski	

UNDP SPECIAL FUND PROJECT

(Draft Outline)

BACKGROUND INFORMATION

The economy of Iran has been making rapid progress over a broad front since about 1962. Industrial production increased at an average annual rate of 17 per cent, agricultural production at 4.6 per cent and investment at about 19 per cent. Per capita income doubled from \$162 in 1962 to \$311 in 1970. In recent years, gross national product maintained the rate of growth envisaged in the Fourth Plan (at about 10 per cent a year) and the consumption and investment both in the public and private sectors remained at a high level.

Despite the extraordinary rate of growth experienced so far, pressures on the price level and the balance of payments have become noticeable recently. The basic strategy which promoted the growth of the industrial sector involved necessarily fast growing imports. As a result, imports have been increasing **faster** than overall income, namely, by about 11-14 per cent. Growing requirements of the industrial sector for imported raw materials and intermediate goods, demand for imported machinery and equipment and repayment of foreign loans are in a large measure responsible for this trend. The balance of payment's deficit was increasing steadily from 1965/66 to reach the amount of \$487 million in 1968/69.

I. GOVERNMENT'S INDUSTRIAL DEVELOPMENT POLICY

The Government's attention has become increasingly focused on the objective of achieving a sound industrial structure that would enable to limit the consequences that assembly-type operations have on the country's balance of payments. The declared Government's policy aims at the development of capital goods and intermediate products, at increasing the domestic value added in the industry and domestic resources utilization and at increasing the non-oil industrial exports. The Decade of 1970 - 1979 has been declared the Export Promotion Decade.

New industrial development policy has been formulated recently with the aim that both private and public sectors have well-defined guidelines in industrial development. Greater emphasis is placed upon encouraging the private sector to invest in industry. Private sector is to play a major role in industrial development. The Government will concentrate more on infrastructure and other sectors of national economy. Unless otherwise dictated by the exigencies of national interest, it will refrain from launching industrial projects wholly-owned by the State.

In the next few years, efforts will be pursued to raise industrial units to economic size, to increase efficiency and productivity, reduce costs and to start producing intermediate, engineering and capital goods. Value added in new industries should not fall below 35 per cent of the ex-factory price of their products; or domestic resources utilization not less than 65 per cent of the ex-factory price. New industrial units could not ask and be granted protection in excess of 35 per cent of the cif price.

The Government intend to continue actively to encourage the industrialization process by offering protection for a specified period of time, tax exemptions, import duties exemptions as well as other incentives such as industrial credits and technical assistance. To encourage industrial exports, incentives are given in the form of a refund on customs duties and commercial profit tax paid on imported components, profit tax exemption, reduced rates for local transportation and port charges. All city and local taxes on export cargo have been abolished. Export financing credits are available on softer terms and at lower interest rates.

A more equitable geographical distribution of industries among various regions of Iran will also be endeavoured. No new industries will be established within 120 km of Tehran unless absolutely necessary from the point of view of the products' nature.

II. THE INSTITUTIONAL SET-UP IN INDUSTRIAL POLICY AND PLANNING

Iran has a long history of planning for economic development. The First (Seven-year) Plan was elaborated in 1948 by the Plan Organization. The present, Fourth Five-year Plan's period covers March 1968 - March 1973.

Plan Organization, is the central body for aggregate planning. It is responsible for the disbursement of a major part of Government resources for development projects, for developing inter-sectoral relationships and for the formulation, evaluation and financing of industrial projects in the public sector.

Ministry of Economy is responsible for the detailed planning of the industrial and mining sectors' development, for the identification and evaluation of projects in specific industrial and mining branches, promotion of private investment, licensing new private sector investments, promoting export-oriented industries and for the formulation and implementation of policies to achieve goals established in the Development Plan.

Autonomous bodies within the framework of the Ministry of Economy carry certain specific functions under its guidance and supervision. These are among others Industrial Development and Renovation Organization (IDRO) Research Centre for Industrial and Trade Development Export Promotion Centre Institute of Standards and Industrial Research Affairs Industrial Management Institute, to name only a few.

IDRO is responsible for establishing and running of certain public industries such as the Arak Machine Building Plant, Iran Tractor Co., Tabriz Machine Building Plant etc. It is also responsible for recruiting and training managers and labour for the running of the Industrial Management Institute and of the consulting firm Technology Inc.

Research Centre for Industrial and Trade Development acts in advisory capacity to the Ministry of Economy. In carrying out its functions the Centre co-ordinates and co-operates with the Plan Organization and other institutions in the field of mining, industries and trade.

The functions of the Centre include in particular the following:

- (i) The formulation, in co-operation with the Plan Organization, of national and regional industrial and mining programmes, which will form an integral part of the overall development plan of the country.
- (ii) Preparation of industrial studies by sectors in the light of which a list of priorities of industrial and mining projects may be prepared.
- (iii) Preparation of projects for the public sector with due regard to their technical as well as economic feasibility, so that the Ministry can give substantive advice to other Ministries and Government Organizations in the fields of industry, mining, and trade. Such projects will be submitted by the Ministry to the Plan Organization for approval.
- (iv) Preparation of projects for the private sector which may be referred to the Centre by the Ministry, the Industrial Banks, other similar bodies or private entrepreneurs in order to assist the responsible department of the Ministry in issuing licenses and the industrial banks in assessing the appropriate projects for financing.

- (v) Evaluation of feasibility studies as may be requested by or channelled through the Government from time to time.
- (vi) Undertaking economic and other studies aimed at the formulation of policy measures and at the setting out of economic criteria for the evaluation of projects in the fields of industry, mining and trade; co-ordination of such policies with those of other Ministries and organizations within the framework of the overall development plans.
- (vii) Training of competent research staff.

Although the Centre is one of the major divisions of the Ministry and functions under a Deputy Minister of Economy, who is also currently its Managing Director, it has an administrative and financial autonomy.

Export Promotion Centre carries out promotional and advisory activities with a view to diversify and increase the country's exports. The Centre undertakes studies and analyses of world markets, prepares publications for foreign purchasers on Iranian export goods and for domestic producers on export possibilities, organises commercial and marketing missions abroad, invites foreign traders to Iran, co-operates in holding exhibitions in Iran and in Iranian participation in international fairs and exhibitions, proposes various measures and assistance conducive to the growth of export to the Ministry of Economy gives recommendations on granting credits by commercial banks to exporters, etc.

Institute of Standards and Industrial Research Affairs formulates and supervises the implementation of industrial standards, advises industrial enterprises on quality control procedures, operates quality control testing laboratories and carries out applied industrial research.

Industrial Management Institute renders assistance oriented towards strengthening management and increasing productivity and growth of Iranian industry.

Industrial Development and Mining Bank of Iran is a privately owned joint stock company with the Government's financial support. The Bank supplies equity and loan finance for medium and large-scale enterprises in the private sector.

Industrial Credit Bank is a joint stock company established by the Plan Organization. It provides equity and loans finance to medium and small-scale enterprises in the private sector.

III. PRESENT STATUS OF METAL-WORKING INDUSTRIES IN IRAN

For the purposes of the project, the term metalworking or engineering industries is understood to cover the manufacture of simple metal products (ISIC Group 35), the manufacture and assembly of non-electrical machinery, equipment and spare parts thereof (ISIC Group 36), the manufacture and assembly of electrical machinery, equipment, appliances and spare parts (ISIC Group 37), and manufacture and assembly of transport vehicles and equipment (ISIC Group 38). Although important linkages exist to the basic metals sector (ISIC Group 34), this sector is not directly involved.

The existing metalworking sector in Iran represents still a small but growing proportion of manufacturing industries. Its share in value added in total industry reached 14.6 per cent in 1967. Employment in the sector was increased from 14.9 per cent of total manufacturing in 1962 to 15.3 per cent in 1967. During the same period, total capital investment in machinery for industrial sectors more than tripled. The sector consists of a large number of small establishments (shops) producing mainly simple metal products and of a limited number of enterprises engaged primarily in the assembly of domestic appliances and of transport equipment.

Main existing industries in the simple metal products group produce welding electrodes, various types of metal containers, steel structures, cranes, steel bridges, steel and cast iron radiators, black bolts, nuts and washers, water pipe valves. Many small foundries in Tehran and Isfahan produce spare parts for the maintenance of machinery and equipment.

Present production of black bolts, nuts and washers from three units in Tehran amounts to some 5,000 ton/year and meets about 50 per cent of consumption. Estimated consumption in 1977 is about 24,000 tons.

Domestic production of welding electrodes totalled 1,500 tons in 1969/70, 500 tons of which was exported to the neighbouring countries. However, special electrodes are imported to cover local needs.

Spiral and leaf springs are produced in the amount of 300 tons/year, covering thus 50 per cent of consumption. License was issued for another 300 tons/year.

Licenses were also issued to produce 5 million pieces a year of 120 different sizes of roller and ball bearings meeting practically the total local needs (except for special items to be imported), as well as for the production of 500 tons/year of general purpose hand tools.

Main industries in the non-electrical machinery and equipment group produce simple chemical machinery (some 20,000 tons/year), domestic boilers, space heaters, gas ranges, coolers and water coolers, and deep well pumps for irrigation purposes.

There are four units at present producing simple chemical machinery having total capacity of 20,000 tons/year. Five producers engage in the manufacture of domestic boilers 30/45 gals. capacity totalling to 78,000 pieces a year, 14 producers of space heaters - 155,000 per year, 15 producers of gas ranges - 105,000 per year, 9 producers of coolers - 100,000 per year, and 2 producers of water coolers - 4,500 per year.

Plants are under construction, or licenses have been issued for the production of the following:

Machine tools plant at Tabriz to produce bench drills, radial and column drilling machines, centre lathes, shapers, milling machines, and grinders. This plant is more than 30 per cent completed and will start production during 1971. Production of 2,150 tons/year of stationary and portable conveyors, screw conveyors, elevators, etc. is planned to start in 1972. A plant is being established for the manufacture of cranes, crabs, lift and hoist gears and reduction gears (planned capacity 700 t/y). Another plant for manufacture of construction and earth moving machinery (planned capacity 5,200 tons/year) is expected to start production in 1972/73. A plant is being established for the production of eccentric presses to start in 1972 (planned capacity 350 units per year). Plants are further being established for the manufacture of air stationary and mobile compressors (capacity 1,000 units per year), agricultural implements (6,000 tons/year), centrifugal pumps (10,000 units/year), etc.

Electrical Machinery and electronic industries have recently been introduced in Iran, and as such, the existing plants are mainly of assembly manufacture nature and consumer goods orientation.

A plant under the collaboration with Siemens manufactures distribution transformers ranged 50 up to 1600 KVA, voltage 200,000 V./400 V./231 V. Production in 1969 included 305 units of 630 KVA, 100 units of 350 KVA and 10 units of 250 KVA. Present production meets local demand.

Low Voltage Transformers are also being manufactured locally by eleven plants, but there are no statistics concerning annual production.

Low voltage cables (up to 1 kV, 120 mm²) and telephone cables (up to 250 pairs) meeting total local demand, are manufactured locally by two large and seven small plants using imported copper rods.

Aluminium conductor steel reinforced and aluminium alloy conductor (A.C.S.R. and A.A.C.), production has started recently, meeting all local demand and planning for export of about 35% of annual production. Present production is about 4,000 tons/year by two plants, planned capacity is 8,000 tons/year.

A plant manufacturing measuring instruments (meters, single phase, voltmeters, ammeters and relays) was established with the collaboration of A.E.G. Present production is about 70,000 meters, single phase and 15,000 units for voltmeters, ammeters and relays. Expansion plans exist for 280,000 single phase and 50,000 three phase meters.

Electric lamp shades and lighting fittings are produced by eleven large and small plants, meeting local demand and some export.

Switch boards up to 20 KV are assembled locally, by three plants with the collaboration of Siemens, A.E.G. and Brown, Boveri.

Four plants manufacture electric wiring equipment and accessories (lamp holders, light switches, plugs, etc.). Combined production of these plants meets the local demand.

Fifteen plants produce at present about 200,000 radio and radiogram sets per annum, meeting local demand. TV sets are produced by 18 units also meeting local demand.

Planned capacity of two present plants producing telephone sets and equipment is 60,000 telephone sets, and 45,000 lines of exchange units. Capacity expansion is necessary to meet the local demand.

Plants are under construction, or licences have been issued, among others, for the manufacture of the following products:

high voltage and telephone cables;

electric motors up to 14 KW (Government-owned plant in collaboration with Czechoslovakia);

carrier telephone equipment and radio relay system;

licenses have been issued for the manufacture of various electrical appliances (such as electric fans, fruit juicers, electric stoves, electric heaters).

Transport equipment industries have started in Iran in 1960, with the assembly of cars, trucks, buses and trailers from imported components and parts. There are 12 factories now in the automotive sector and three more are under construction. Tabriz Tractor Factory is nearly completed.

In 1969/1970 the output of passenger cars reached 23,000 units of three makes. A total of 1,500 buses were produced and the production of trucks reached 3,300 units during the same period.

Some components and parts are being at present already produced in Iran such as radiators, leaf springs, batteries and brake linings). In future, local production will meet demand for helical springs, ball bearings, pistons, piston pins and rings, cylinder liners, gaskets, shock absorbers, spark plugs, air filters, wheel rims, discs and covers, starters with accessories, generators, switches and relays etc.

IV. FUTURE DEVELOPMENT OF THE METALWORKING SECTOR IN IRAN

The sector has been assigned high priority in the Fourth Development Plan (average yearly production growth of 18%). Starting from the relatively limited base, the sector is experiencing a very dynamic development. Government owned new plants in the sector are nearing completion and the response of the private sector with regard to investment is gradually increasing. It may be noted that out of the total loans extended by the Industrial and Mining Development Bank of Iran (IMDBI) in the period 1959/1960 - 1969/1970 totalling 14,475.1 million Rials, 3,079.0 million Rials, i.e., 22 per cent was assigned to this sector.

Total demand for machinery and equipment excluding automobiles is expected to more than double to \$1 billion by 1973 and to reach about 1.5 billion by 1977. Over 70 per cent of present consumption is being met from imports.

Recent discoveries of "porphyry" copper in Iran rival some of the world's biggest copper mines. Refined copper will in the future create a base for the development of electrical machinery and equipment industries, such as cables and transformers.

Rational development of the metalworking sector can thus in the future ease the pressure on balance of payments through further import substitution and, the more important, through exports of engineering products to foreign markets, particularly to neighbouring countries and RCD. However, no developing country could and should develop the whole spectrum of metalworking industries. Specialization in most promising lines is needed in order to achieve efficiency and being able to compete at foreign markets.

Identification of such promising branches or lines is of crucial importance for the future development of the sector. The methodology for planning the development of the metalworking sector with a view to exports as developed for UNIDO and approved by the Expert Group meeting in December 1969 (see the report of the Group) is particularly suitable for Iran. A proposal for the implementation of a technical assistance project based on the above methodology is described in the following chapters.

V. AIM OF THE SPECIAL FUND PROJECT

The aim of a Special Fund Project is to aid in the determination of the size and future direction of the metalworking (engineering) industries in relation to the national economy of Iran, and in the identification of specific industries within the sector with export potential. The main tasks are:

1. The continued development of an Input-Output matrix for the national economy with special emphasis on the branches of the engineering industries;
2. A detailed technical - economic description of existing productive facilities and their degree of capacity utilization based on the resource element concept introduced in the methodological paper ID/WG.10/1.
3. The construction of a set of data for the engineering industries in an industrialized country (Czechoslovakia) with consideration for the known natural resources of Iran and the future direction of development of the sector;
4. Analysis of the existing industrial structure and for the formulation of a clear short-run programme for the utilisation of excess capacity emphasizing missed export opportunities as well as domestic demand.

5. The development of a long-run comprehensive programme for the sector, identifying the branches and industries most appropriate for investments in new productive facilities. The criteria for choice of industry shall include: known natural resource; impact on the national economy; potential for technological upgrading of the sector; lessening of dependence on imported technology and creation of indigenous research and development capability; management and manpower training; and domestic and export potential. Particular stress will be laid on opportunities for specialization in those branches chosen for their export potential.
6. The preparation of project profiles (pre-feasibility studies) and feasibility studies based on the programme for sectoral development. The analysis and evaluation of projects initiated by private entrepreneurs. All projects shall be appraised for their effect on exports.

The methodology to be employed is described in two of the working papers adopted at the Expert Group Meeting on Metalworking Industries as Potential Export Industries in Developing Countries, Vienna, 12-19 December 1969. It cuts across the great diversity of the sector, in terms of equipment and of products, by representing each production process by a limited number of standard tasks, defined by size of workpiece and length of production series. Each of these tasks is in turn associated with one or more standard shops (processes) or resource elements that have a typical machine park. The resource-element concept permits the reduction of the great variety production facilities to a limited number of typical shops. On the demand side, a number of sample products that are typical of the sector in terms of physical characteristics and production processes involved are selected in order of importance in total demand. On the basis of the resource requirements obtained from these sample products, total sector inputs are estimated for sector-wide product lists.

The technical description of the sector proceeds in different levels of detail. Semi-quantified programming data aim primarily at defining lists of products and productive processes and at establishing incidences between them, i.e. specifying whether or not a given process is used in the manufacture of a particular product. Fully qualified programming data would quantify, in sufficient detail, the pattern of physical inputs and outputs associated with the production of a particular product. Fully quantified data would therefore represent an intermediate position between the two extremes of semi-quantitative data and the final stage of project engineering data and are intended for techno-economic description of the sector. On the basis of input and output patterns, approximate estimates of production costs could be undertaken. Estimates of domestic and of export demand will then complete the quantification process.

The main classes of resource elements are: casting, forging, machining, stamping, setting, welding and structural steel

work, heat treatment, assembly, winding, and testing. Certain specialized productive functions performed by groups of professional and technical personnel - product design, production engineering, scheduling and operations research, marketing, research and development - can also be treated as resource elements. Such groups may also have a minimum critical size.

The tasks may be divided into two stages, although in practice there are always important overlaps. In the first stage, it is desired to complete the input-output matrix in its present form, describe the existing sector and determine the short-run programme for it, and construct the set of data. In the second stage, the input-output matrix will be expanded to emphasize the engineering sector, a map of the intra-sectoral relationships will be developed based on the set of data and the comprehensive programme for the sector will be formulated. It is expected that task 6 (see above) will occur during both stages of this project.

A. Stage I

1. Input-Output Matrix - At present a 29 x 29 matrix for Iran is under construction by the Economics and Statistics Sections of the Research Centre for Industrial and Trade Development of the Ministry of Economy with the assistance of Dr. R. Abu El-Haj of the UNIDO Project Staff. It is desirable that this work continue to be supported and developed as it represents, at present, the only vehicle for assuring consistency between expansion programmes in various sectors of the Iranian economy. The expected date for completion of this matrix in its present form is 1972. The engineering industries are represented by one grouping.
2. The Existing Sector: The Engineering Industries in Iran are still a small but growing proportion of manufacturing. Employment has increased from 14.9% of total manufacturing in 1962 to 15.3% in 1967. During the same period, total capital investment in machinery for industries more than tripled. Production is largely concentrated in simple metal products used in construction, transportation equipment and domestic appliances. Plants under construction include:
 - a. A steel mill of about 500,000 tons and a plant for the production of aluminum ingots, (although these plants are not in the sector under study, their existence has important implications for the supply of raw materials for the engineering industries);
 - b. A machine tools plant;
 - c. A machine building plant;

- d. Rolling and pipe company
- e. Ball and roller bearing plant
- f. Hand (Black) Tools
- g. Refrigerator compressor plant. (This plant is noteworthy as all manufacturers of refrigerators have agreed to standardize on the same motor-compressor unit, thus increasing both annual capacity and seriality for this sub-assembly).
- h. Electric meters
- I. Batteries
- j. Various small domestic appliances

Data collection for new plants should be comparatively simple as the most important of these are in the public sector and design capacity information is readily available. Of particular importance here will be the collection of data for the construction of learning curves.

The main emphasis of data collection for existing plants will be to determine what capacities (resource elements) exist and their rate of utilization. Any resource element that requires investments resulting in large percentage additions relative to the installed capacity of the other portion of the machine park may lead to severe over-capacity or bottleneck problems. We are interested in the structure and balance of productive capacities within an enterprise and between enterprises. Are they sufficiently complementary? Where would subcontracting within an industry or across industries improve capacity utilization? We should also determine the structure of inputs into typical products for comparison with data bank information.

On the basis of this analysis we should recommend a short-run programme to more fully utilize existing capacity or ease bottlenecks. Our basic aim is to reduce costs with a view to widening the possibilities for import substitution, exploiting any export potential and to increase the degree of interdependence amongst firms.

A programme for data collection has been discussed with Mr. Shahin, Chief of the Statistics Section. Its main points are:

- a. Determination of important plants using the plant portfolios consisting of the completed census of manufactures questionnaires
 - b. Preparation of a questionnaire adapted to local conditions:
 - c. Test questionnaire and revise where necessary.
 - d. Print questionnaire and take census, using engineers as enumerators;
 - e. Tabulate and programme for computer print-out;
 - f. Define resource elements and compare with data bank.
 - g. Programme resource element matrix to determine which product clusters are attractive for further study.
3. Set of techno-economic data (To be collected in Czechoslovakia)
At present little useful information is available for planning production and exports from the metalworking industries of developing countries. Input-output co-efficients exist, but these are of an aggregate nature and there are also capacity expansion planning factors from the United States by class of industry. Other than these, there is only the usual material from industrial censuses.

The set of data proposed to be collected for this project and computerized in Iran would conform to a tested methodology for planning production and exports in the sector and would have the added advantage of computerization for ease of use. It is suggested that these data be collected in an industrially developed country so that they would refer to good practice in the sector. Also, instead of the aggregated information referred to above, use would be made of the concepts of typical sample product and resource element developed in documents ID/WG.10/1 and ID/WG.10/2. By increasing the level of dis-aggregation, a project can be evaluated by representing its output in terms of a few typical products and its inputs by process group.

As it is proposed to use this set of data from the early stages of this project, initial product selection should emphasize present or explicitly planned production in the near future. It is the policy of the Government of Iran to develop its indigenous resource base, the products of the ferro-alloys (ferro-chrome, ferro-silicon and ferro-

manganese), aluminum, lead, zinc, and copper, in addition to iron require careful attention, particularly as they have export potential. However, at this stage the order of priorities for data collection requires clarification. (A partial list of prospective projects for the Fifth Five Year plan is appended.) In addition, the survey of existing capacity may help to indicate the order of data collection.

The selection of the plants or enterprises to be surveyed for the purposes of data compilation should be based on two factors: (a) the lot size or seriality of production; and (b) the level of technology. Data collected should also indicate: (a) the growth of productivity over time (or with the number of units produced); (b) the effects of new techniques on productivity; and (c) the long term growth of productivity for various product and process classes. It is particularly important to separate effects concerned with capitalization (degree of automation and vintage of capital equipment), with the quality of the labour force and internal management.

Criteria for the Collection of Data

1. Classification of the Standard Resource Element

- (a) A set of data for standard shops or departments comprising similar processes or similar products (elements, parts, sub-assemblies) manufacture will be developed.
- (b) The weight of the workpiece and labour qualification criteria will be indicated for the individual standard resource elements classified.

2. Description of the Standard Resource Elements

- (a) Output: Amount and assortment (unit of measurement will always be manhours but also, whenever possible, tons or other physical units). Capacity limits under one, two and three-shift operation and technical minimum downtime for maintenance will be given.
- (b) Composition of machine tools and equipment (percentage of number and value).
- (c) Size indication in terms of number of machine tools, floor space (minimum, maximum, actual, optimum and so on).

- (d) Capital investments data per square meter of floor space (machine tools, construction);
- (e) Fixed costs data (in physical units) on power, water, personnel and so on;
- (f) Labour input requirements on yearly basis by skill class;
- (g) Approximate changes in (e) and (f) as output changes.

Note: Alternatives should be given for different serialities, scales (that is, different first-shift capacities) and for different degrees of automation for given degrees of seriality. Functional relations between different alternatives should be indicated wherever possible.

3. Typical products selection

An effort will be made to cover all the major branches or product lines of metalworking (engineering) industry with concentration on those of major importance to Iran.

Major design alternatives of a given product will be treated as separate typical products.

4. Description of typical products

- (a) Descriptive information: Technical standards comparable foreign-made products, fields of use, spare parts and type of technical service.
- (b) Scale of production: Number produced, the lowest recommended scale of production, with what other products it can be produced jointly.
- (c) Other information: Organizational resource elements may be related to the line or branch - for example, research and development.
- (d) Component tree and design tree: Sub-assemblies and components at several levels of depth will be given for each product as required. Major design alternatives will be indicated where appropriate. Probable make-or-buy choices for individual sub-assemblies or components, especially as a function of total seriality (when shared between several products) will be given.

(e) **Material requirements:** For each component (or for each sub-assembly or component group if treated as a unit without further decomposition) gross material requirement(s) and net weight(s) will be given. Each material will be specified closely enough to permit attaching to it a world market or local price. Shapes (for example, T-sections, I-sections and tubes) will be treated as materials, and purchasing specifications and amount needed (in physical units) will be specified.

(f) **Manufacturing inputs:**

(i) **Resource-element inputs:** For each kind of resource element used, amounts needed for set-up and for operation will be given in hours of labour time and also in physical units (for example, tons) if possible. (When different manufacturing input patterns are required, as with changes in seriality, the alternatives will be treated as separate products).

(ii) **Assembly:** Instead of defining a great many assembly resource elements, floor space, labour and auxiliary machinery inputs may be given directly.

5. Long list of products:

An average of 100 products per branch, as classified in document ID/WG.10/1, will constitute the long list of products. In respect to the listed products, the following information will be given:

- (a) Names of products.
- (b) Fields of use.
- (c) Number produced (or the share in production volume).
- (d) The share of sub-assemblies and components between groups of specified products.
- (e) Major specifications (as factors of deviations from the typical product and from standard resource element).
- (f) Recommendations for extrapolation of typical product data to the listed products.

It will be necessary to provide an international comparison for the data collected in Czechoslovakia. Rather than construct resource elements and decompose sample products in another country, it is suggested that selected portions of the Czech data be provided for revision in the United States, with regard to resource element composition and activity level.

B. Stage II

1. Input-Output Matrix:

The completion of the data collection effort both for existing industry, resource elements and sample products will allow us to expand the matrix, so that the impact of large projects or complexes of smaller projects may be evaluated on an economy-wide basis. In particular, the data collected in Czechoslovakia will allow us to calculate marginal capital coefficients by sector, capturing the effects on capital as well as current account. This is of particular importance for the engineering industries as they are the chief suppliers of capital goods for the economy. This could be checked for local adaptation by examining the technical coefficients of the loan applications at IMDBI and licensing applications at the Ministry of Economy.

2. Sectoral Programme - The Research Centre for Industrial and Trade Development is in the process of developing demand estimates for a wide variety of products of the engineering industry. With these estimates, the Input-output matrix (later expanded), and the data bank we propose to pass from total existing demand (sum of domestic production plus imports) to the scale of domestic production. This step requires a decision on what to manufacture versus what to import, and also a correct anticipation of export markets. The main line of attack will be the selection of attractive project alternatives arising from estimates of resource level utilization (which is costed out) and the impact of these projects (or project complexes) on other sectors of the economy and vice-versa.

These analysis will enable us to identify those branches and lines with export potential that will benefit from concentrated promotional activities.

It is expected that in the course of analysis certain resource elements will prove to be indispensable to the growth of the sector and yet not be capable of being utilized at a reasonable level. The identification of these lumpy investments (e.g., a heavy forge) and the evaluation of the effect of their introduction (or non-introduction) is an integral part of the methodology.

Emphasis will be placed on high levels of capacity utilization and clear formulations of the potential for specialization - that is, increasing the degree of interdependence within the sector by developing the advantages of subcontracting.

In line with the policy of the Government of Iran, both resource based and export-oriented industries will be stressed.

An analysis of the problems of local adaptation of resource elements and sample products will be undertaken.

The following policy issues are also important for the proper development of the sector:

- (a) Tariffs and the level of effective protection.
- (b) Export incentives.
- (c) Quality control for exports.
- (d) Potential for mergers and combinations.
- (e) Licensing.
- (f) Monopolistic practices.

Project profiles (pre-feasibility and feasibility studies) will then be prepared on the basis of the sectoral programme.

EXPERTS - JOB DESCRIPTIONS

The following professional personnel are envisaged for this project:

1. Industrial Economist or Engineer (Project Manager or Team Leader) - Responsible for the overall implementation of this project. This individual should be well versed in the planning and programming of the metalworking (engineering) industries, the construction and use of Input-Output matrices, the design of technical economic surveys, and the

policy problems related to industrial growth with an export orientation (full time.)

2. Industrial Engineer (Deputy Project Manager) - Responsible for aiding in the design and undertaking the technical-economic surveys, liaison with and provision of overall direction of the collection of data in Czechoslovakia, testing it in the United States and establishing the Data Bank in Iran. He would participate in sectoral surveys and identification of branches and product lines suitable for Iranian development. He should be experienced in systems analysis, have had some exposure to the problems of a developing country, and participated in the formulation of capital budgets and expansion plans for a corporation (full time).
3. A Mechanical and an Electrical Engineer - These engineers should have a broad range of experience in their respective subsectors as they will participate in the surveys, identify promising branches and product lines develop project profiles, provide advice for the technical upgrading of existing industries and the level of new facilities with export orientation. They would be responsible for control of the data bank and local adaptation for their respective sub-sectors. Engineers with production line experience who have subsequently moved into positions connected with financial analysis, acquisitions, mergers and new products are particularly suitable for these positions (full time).
4. Cost Analyst - Responsible for the construction of Cost Centres from programming data, analysis of the profitability of various projects and project complexes and the introduction of the use of cost centre planning into Iranian industry. A minimum of five years experience in the construction of cost centres in the engineering industry (probably in the United States) and a degree in accounting are necessary (full time).
5. Marketing Experts - One expert responsible for matching domestic production and demand, local adaptation of new products and expansion into the markets of neighbouring countries (RCD and others). A second expert advising on export possibilities for the world market with emphasis on resource based industries. These experts would be required as needed for specific industries. (Short-term).

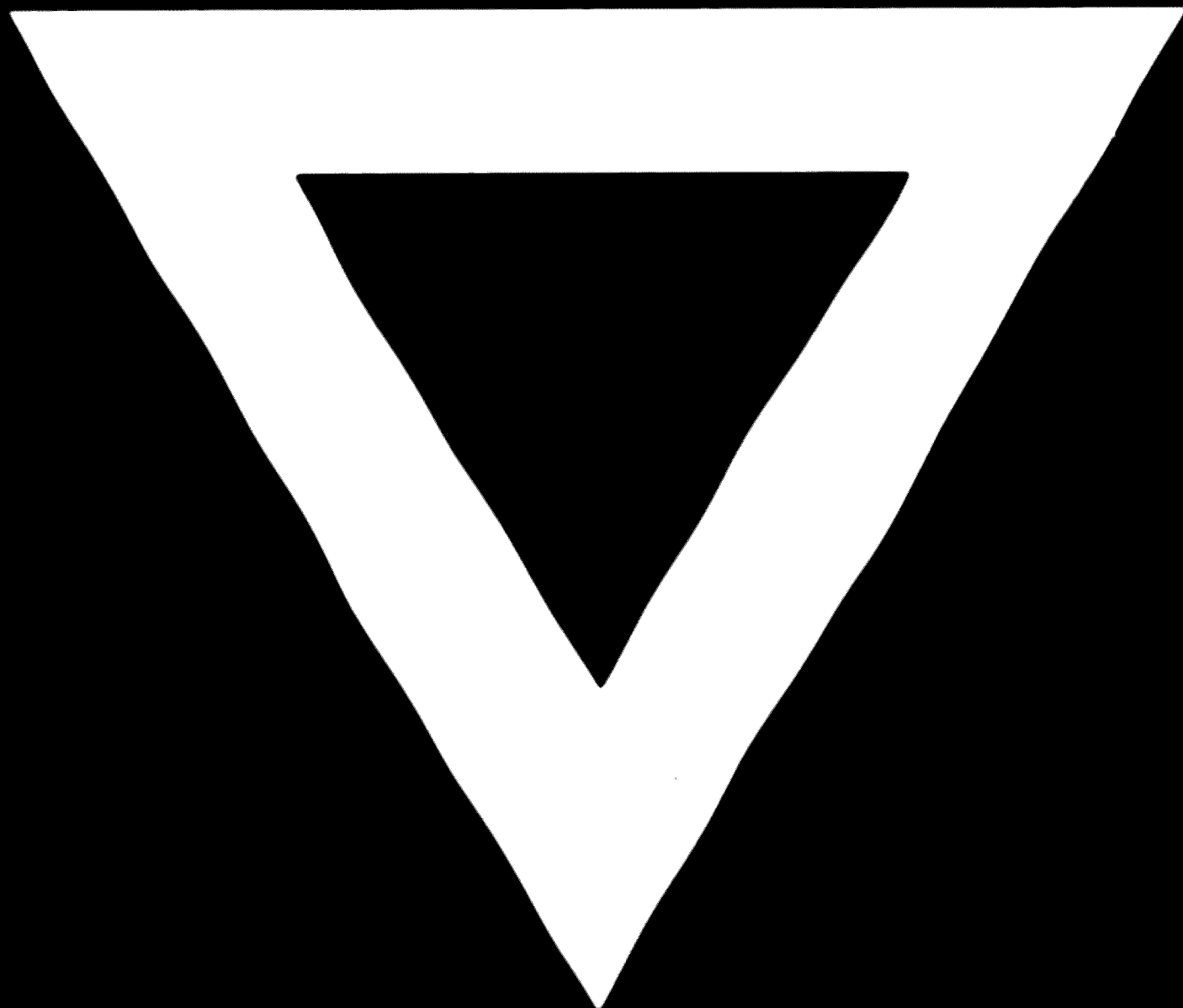
6. Other Experts. After branches and industries for domestic production and exports have been identified, engineering experts at the highest level will be required for the preparation of feasibility studies for individual projects or project complexes. In addition it is envisaged that short-term advice would be required with respect to the technical-economic analysis of the sector. (Short-term).

Partial list of prospective projects for
the Fifth Five-Year Plan.

Preliminary indications exist that combined local market demand and export possibilities would justify the establishment of industrial units manufacturing following products:

Bright nuts, bolts and washers
Cutting tools, measuring instruments and gauges
Industrial valves
Small Motors and Generators
Starters and Contractors
Medium size Electrical Machines
Power rectifiers, Germanium Silicon Mercury
Industrial motor applications
Switchgears
Instrument transformers
Power transformers above 20 kv
Instruments, Meters and Relays
Electrical Furnaces
Insulated cables and wires
Cable terminals and Junction Boxes
Overhead and Bare Cables
Transmission Line Hardware
Transmission Line Supports
Crankshafts
Camshafts
Intake and exhaust valves
Oil filters
Fuel filters
Carburetors
Air compressors
Fuel pumps
Oil pumps
Hydraulic pumps
Tire valves for cars, lorries and motorcycles
Tire pumps
Jacks of different kinds.

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