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ID/WG.113/13
20 July 1972

ORIGINAL: ENGLISH

Regional Seminar on Machine Tools
for Countries in Latin America

Buenos Aires, Argentina
16 - 25 October 1972

Sao Paulo, Brazil
26 - 27 October 1972

MACHINE TOOLS
IN THE COUNTRIES OF LATIN AMERICA ✓

prepared by

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ID/WG.113/13/Corr.1
1 September 1972

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Regional Seminar on Machine Tools
for Countries in Latin America

Buenos Aires, Argentina
16 - 25 October 1972

Sao Paulo, Brasil
26 - 27 October 1972

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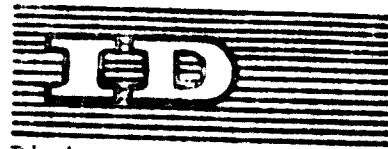
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Mr. N.N. Krainov, Industrial Development Officer, Engineering Industries Section, UNIDO, would be pleased to elaborate or clarify any substantive and technical aspects that the readers may wish to secure on this paper.



DC3805

Distr.
LIMITED

ID/WG.113/13/Corr.2
2 November 1972

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

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Sao Paulo, Brazil
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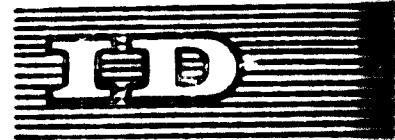
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id.72-6515





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ID/WG.113/13/Corr.2
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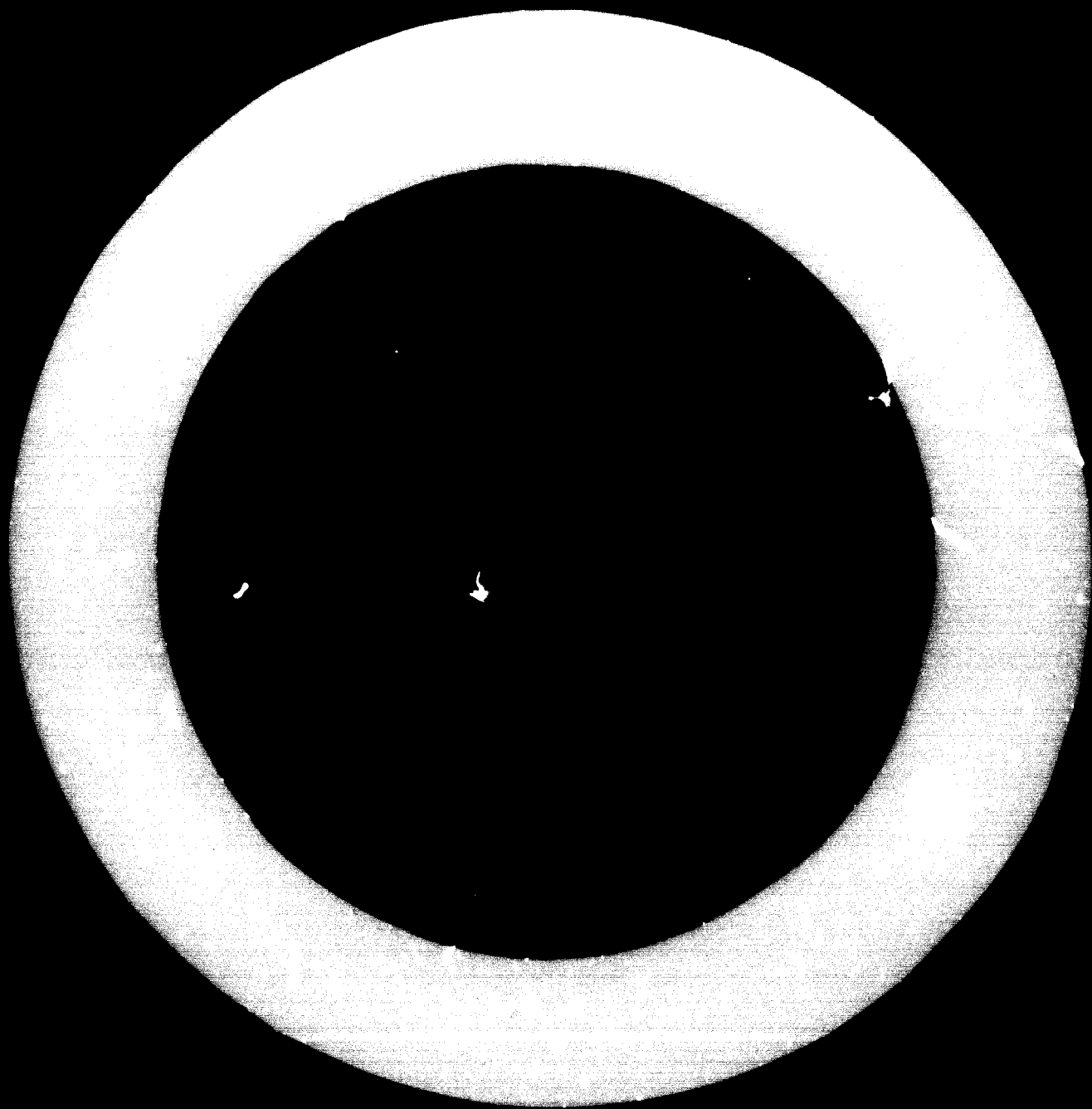


TABLE OF CONTENTS

	Page
<u>INTRODUCTION</u>	4
<u>PART I</u>	
<u>Review of Metalworking Industries in the Region</u>	5
1. Role of Metalworking Industries	5
2. World Machine Tool Production	6
3. Share of the Region in Machine Tool Production	8
4. Import of Machine Tools	9
5. Export of Machine Tools	11
6. Metalworking Industries in the Countries of the Region	11
7. Selection and Utilisation of Machine Tools	20
8. Maintenance and Repair of Machine Tools	21
9. Machine Tool Rebuilding	22
10. Machine Tool Production	22
11. Transfer of Technology	23
<u>PART II</u>	
<u>Outline of UNIDO's Activities</u>	29
1. UNIDO Technical Assistance	29
2. Typical Field Projects in Metalworking	29
3. UNIDO and the ANDean Group of Countries	32
4. UNIDO Assistance to the Countries of the Region	33
<u>Annex 1</u>	
<u>Groups of Engineering Products and Scope of Functions of UNIDO Assistance</u>	1
1. Division of Engineering Industries in Accordance with the Group of Products to be Manufactured	2
2. Metal Products	3
3. Metalworking Machinery and Equipment	4
4. Transport Equipment	5
5. Agricultural Machinery and Implements	6
6. Scope of UNIDO Assistance	7

	Page
<u>Annex 2</u> <u>Tables of Imports of Engineering Products</u> <u>by Countries of Latin America</u>	1
1. Imports of Engineering Products	2
2. Imports of Non-electrical Machinery	3, 4
3. Imports of Transport Equipment	5
4. Imports of Electrical Machinery	6
<u>Annex 3</u> <u>Samples of Job Descriptions for UNIDO Experts</u> <u>for the Countries of the Region</u>	1
1. General Survey of Metalworking Industries	2
2. General Survey of Machine Tools	3
3. Selection and Utilization of Machine Tools	4
4. Maintenance and Repair of Machine Tools	5
5. Development of Tools, Dies, Jigs and Fixtures	6
6. Introduction of Welding Techniques	7
7. Introduction of NC Machine Tools	8

INTRODUCTION

The United Nations Industrial Development Organization (UNIDO) was established in 1967, as an autonomous organization within the Secretariat of the United Nations. The main purpose of the Organization is to promote and accelerate the process of industrialization in the developing countries.

The principal legislative body of UNIDO is the Industrial Development Board which meets once a year. The executive organ is the UNIDO Secretariat with its headquarters in Vienna, Austria.

UNIDO's operations cover a very wide field of activity connected with technical assistance to developing countries in the planning and programming of their industrial development including, *inter alia*, the formulation and implementation of industrial policies; the development of certain branches of industry; the establishment of research institutes and centres of industrial development; the training of local personnel; and the creation of pilot industrial plants.

The main sources of finance for the provision of technical assistance to developing countries are the United Nations Development Programme Indicative Planning Figure, bycountry and intercountry (IPF), and the Special Industrial Services Programme (SIS), in addition to the United Nations Regular Programme and the General Trust Fund (GTF) of UNIDO.

One of the activities of UNIDO is to promote the proper selection and utilisation, design and development, maintenance and repair of machine tools and their accessories, in developing countries.

The Regional Seminar on Machine Tools for the Countries of Europe and the Middle East, held in Bulgaria in 1971, drafted recommendations for each particular country of the region and for the appropriate UNIDO action, taking into account the differing levels of development of the metalworking industries in the various countries. Areas for possible UNIDO technical assistance were identified for eleven developing countries. The Seminar was useful for both developing and developed countries, as many direct contacts were established that will lead to mutually beneficial commercial and technical arrangements.

The work of the Seminar on Machine Tools for the Countries of Latin America in October will provide an analysis of the present status of machine tools and identify demand in accordance with the future development of metalworking industries in the countries of the region. It is expected that the Seminar will also determine a means of co-operation between countries of the region, industrialized countries and UNIDO regarding the development of metalworking industries, including the selection, development, marketing and utilization of machine tools. Local sponsors of specific projects in Latin American countries will have an opportunity of discussing proposals from the investment promotion point of view with industrialists and businessmen from Europe, North America and other parts of the world.

It is envisaged that UNIDO will undertake a similar seminar for the developing countries in Asia and the Far East to be held in co-operation with the Economic Commission for Asia and the Far East (ECAFE), in the USSR at the end of 1973.

PART I REVIEW OF METALWORKING INDUSTRIES IN COUNTRIES OF THE REGION

1. Role of metalworking industries

Latin American countries, in common with other developing countries, encounter difficulties in their economic development which depends mainly on their industrial development.

The task of selecting the particular branch of the economy that should be given first priority has to be studied in the light of the capacities and resources of the individual country.

The industrial structure of developing countries is contingent upon their natural resources and inherent characteristics. Some of them promote industries aimed at the production of electricity by the creation of electric power stations, others develop their metallurgical and mining industries or cement and petrochemical industries, while some countries concentrate on automotive and engineering industries. As agriculture is the predominant feature of the economies of many developing countries they try to promote such industries as food processing and textiles.

As industries of any description require machinery and equipment for normal operation, the first consideration is the provision of machine tools and accessories needed for the production of this equipment.

During the initial period of industrial development these requirements can be met by imports. With the growth of industry, however, it becomes unprofitable for developing countries to import machinery owing to the considerable disparity in the cost of imported machinery and the price of the agricultural products and raw materials that are exported. Hence, many developing countries are now paying much attention to the development of the metalworking industry where machine tools are a vital factor.

The metalworking industry, probably more than any other industry, requires the constant application of the latest developments of science and technology in order to solve a number of problems connected with the utilisation of new types of metalcutting and metalforming machines essential for modern technological production.

The industrial progress of most developing countries, especially in the engineering industry, is seriously hampered by the lack of indigenous production of such tools as jigs and fixtures, dies for press-work, dies and moulds for forgings, dies and moulds for diecasting, dies and moulds for plastic moulding.

Many of the developing countries have to buy the jigs, fixtures, dies and moulds needed for production from abroad. Others have to import the appropriate grades of steel for the manufacture of these tools. Such purchases require foreign currency which is usually in short supply in developing countries. Apart from the financial disadvantages accruing from the purchasing abroad of these items, serious delays may result which cause further expenditure owing to the disruption of manufacturing programmes. In addition to such tangible disadvantages, there are many intangible problems that are difficult to define. They may occur owing to a lack of understanding of the design of the tooling with a consequent failure to use the most suitable methods of manufacture, this, in turn, results in an insufficient utilization of extremely expensive presses and forging machines and the subsequent expenditure on secondary operations which otherwise would be unnecessary or could be undertaken more economically.

The manufacture of jigs, fixtures, dies and moulds is a labour intensive operation which makes it particularly desirable that this activity should be undertaken locally, rather than importing these items from a industrialized country where the labour rates are much higher.

The production of jigs, fixtures, dies and moulds is a specialized operation requiring a highly skilled team of management and labour. The enterprises producing such items can benefit considerably from a proximity to the principal customers for these goods, who in turn can improve efficiency by an understanding of the design problems and manufacturing techniques involved.

2. World Machine Tool Production

There is a continuously growing demand everywhere for metal-cutting and metal-forming machine tools that are indispensable for the production and repair of the various machines that are rapidly being introduced into all branches of industry. The machine tool is the only product that is capable of reproducing itself. For this reason machine tools play a key role in the expansion of industrial production since nearly all products are manufactured by metalworking machines. The machine tool is never an end product per se, but it is a means of manufacturing the end product.

The world machine tool production in 1970 representing US \$7,811,5 million, according to prices prevailing in 1970. Table 1 below shows nearly all the countries that manufacture machine tools, and their percentage of world production with figures of their own production.

Table 1

World Machine Tool Production

No.	Country	1970			Percentage of world production	1971 (estimated)			Percentage of world production
		in millions of US Dollars				in millions of US Dollars			
		Total	Metal-cutting	Metal-forming		Total	Metal-cutting	Metal-forming	
1.	FRG	1479.0	1018.4	460.6	18.9	1820.0	1230.0	590.0	23.4
2.	United States	1443.1	992.9	450.2	18.5	980.0	662.0	318.0	12.6
3.	Japan	1109.4	867.4	242.0	14.2	912.0	722.0	190.0	11.7
4.	USSR	1073.0	803.0	270.0	13.7	1160.0	865.0	295.0	14.9
5.	UK	476.9	378.5	98.4	6.2	465.0	367.0	98.0	6.0
6.	Italy	433.6	346.9	86.7	5.6	423.0	338.0	85.0	5.4
7.	France	316.5	240.5	76.0	4.1	397.0	273.0	114.0	5.0
8.	GDR	252.3	185.7	66.6	3.3	260.0	193.0	67.0	3.3
9.	CSSR	250.0	210.0	40.0	3.2	275.0	230.0	45.0	3.5
10.	Switzerland	242.0	206.0	36.0	3.1	266.0	226.0	40.0	3.4
11.	Poland	123.0	112.0	11.0	1.6	145.0	132.0	13.0	1.9
12.	Spain	88.6	77.5	11.1	1.0	98.0	83.0	15.0	1.2
13.	Sweden	66.0	43.0	23.0	0.8	79.0	51.0	28.0	1.0
14.	China	52.0	31.0 ^{1/2}	22.0 ^{1/2}	0.6	58.0	43.0	15.0	0.7
15.	Hungary	44.8	41.6 ^{1/2}	3.1 ^{1/2}	0.5	47.3	44.3	3.0	0.6
16.	Canada	34.9	21.1	13.8	0.4	37.0	22.0	15.0	0.5
17.	Belgium	33.9	16.3	17.6	0.4	37.4	17.7	19.7	0.5
18.	Brazil	33.8	19.6	14.2	0.4	34.4	20.0	14.4	0.4
19.	Argentina	32.4	19.0	14.4	0.4	34.3	19.1	15.2	0.4
20.	India	31.2	29.3	1.9	0.4	45.0	42.5	2.5	0.6
21.	Holland	29.7	18.5	11.2	0.4	33.7	21.1	12.6	0.4
22.	Yugoslavia	26.0	22.5	3.5	0.3	36.3	29.0	7.3	0.5
23.	Austria	25.4	11.6	13.8	0.3	28.1	12.9	15.2	0.4
24.	Bulgaria	23.0	21.0	2.0	0.3	26.9	24.6	2.3	0.3
25.	Australia	22.5 ²	6.2 ²	16.3 ²	0.3	23.9	6.8	17.1	0.3
26.	Romania	17.0	15.5	1.5	0.2	22.8	20.8	2.0	0.2
27.	Denmark	14.7	9.1	5.6	0.2	19.3	10.1	5.2	0.2
28.	Taiwan	14.2	7.9 ²	6.3 ²	0.2	16.0	9.5	6.5	0.2
29.	South Africa	7.2	3.3 ²	3.9 ²	-	7.0	3.0	4.0	0.1
30.	Mexico	5.0	2.0 ²	3.0 ²	-	5.0	3.0 ²	2.0 ²	0.1
31.	Turkey	4.9	2.9 ²	2.0 ²	-	-	-	-	-
32.	Portugal	2.8	1.5	1.3	0.5	3.1	1.7	1.4	-
33.	Egypt	1.7	0.7 ²	1.0 ²	-	-	-	-	0.3
34.	Israel	1.3	1.0 ²	0.3 ²	-	-	-	-	-
35.	Chile	0.9	0.5 ²	0.4 ²	-	-	-	-	-
	Other Countries	1.0	0.6 ²	0.4 ²	-	-	-	-	-
	TOTAL	7,813.6	5,782.6	2,031.0	100	7,781.5	5,723.1	2,058.4	100

Metalworking Production, London, March 1972

Role of UNIDO in the Promotion of Machine Tools in Developing Countries of Europe and the Middle East, ID/WG.87/29; ID/WG.87/29/Corr.1., by N.N. Krainov

1/ Rough estimate from fragmentary data.

2/ Year ended 30 June

It can be seen from Table 1 above that five countries, namely, the Federal Republic of Germany (FRG), the United States (US), Japan, USSR and the United Kingdom (UK) produced 71.5 per cent of the world machine tool production.

The twelve nations of Western Europe that are members of the Committee for European Co-operation of the Machine Tool Industries (CECIMO), represent 1,500 manufacturers who were responsible for about 41 per cent of the world machine tool production in 1970.

The share of the countries with centrally planned economies in the world machine tool production in 1970 was about 24 per cent, while that of the developing countries was only about 2 per cent.

In the eighth annual survey of world machine tool production carried out by the American Machinist, it is estimated that in 1971 the five leading countries will be first, FRG with an estimated US \$1,820 million, second, the USSR with \$1,160 million, third, the US with \$980 million, fourth Japan with \$912 million and fifth the UK with US \$465 million.

3. The Share of the Region in the Machine Tool Production

In spite of the fact that more and more developing countries have started to produce machine tools, their share in the world machine tool production is still very low, for instance in 1970 it was about 2 per cent. The share of the Latin American countries is only 0.9 per cent of the world production. In other words the countries of Latin America are producing about 50 per cent of the total machine tool production of all developing countries.

The largest producer of machine tools in Latin America is Brazil, with 46.3 per cent of the regional machine tool production, Argentina comes second with 44.4 per cent and Mexico third with 6.9 per cent.

The volume of the production of machine tools in the countries of the region is shown in Table 2 below.

As can be seen, in 1970 the value of the machine tools manufactured in Brazil was US \$33.8 million, in Argentina US \$32.4 million, in Mexico US \$5.0 million, in Chile US \$0.9 million and in Colombia US \$0.6 million.

The total production of machine tools in the countries of Latin America in 1970 represented US\$73 million.

Table 2

PRODUCTION OF MACHINE TOOLS IN LATIN AMERICA IN 1970

Country	Machine tool production in millions of US Dollars	Percentage the regional machine tool production	Percentage world machine tool production
1. Brazil	33.8	46.3	0.43
2. Argentina	32.4	44.4	0.42
3. Mexico	5.0	6.9	0.064
4. Chile	0.9	1.2	0.011
5. Colombia	0.6	0.8	0.006
Other Latin America	0.3	0.4	0.003
TOTAL	73.0	100.0	0.934

It was estimated that in 1971 the value of machine tools produced in Brazil and Argentina could increase to US \$34.4 million and US \$34.3 million respectively while in Mexico it would remain the same as in 1970 (US \$5 million).

In addition to the five countries mentioned in Table 2, there are several manufacturers in other countries of the region that are manufacturing machine tools for their own internal use. Their production, however, is very limited.

4. Import of Machine Tools

Machine tools have often to be imported during the early stages of the industrial development of a country. It is obvious that countries wishing to manufacture more engineering products must buy a certain amount of machine tools. Generally, machine tools are purchased for one of the following three reasons:

- (a) For manufacture where no capacity exists;
- (b) To replace an obsolete or inadequate unit by a more efficient machine;
- (c) Where a machine tools has broken down beyond repair and need to be replaced.

Table 1
 WORLD MACHINERY TRADE

No.	Country	1970				1971 (estimated)			
		Exports		Imports		Exports		Imports	
		in millions of US dollars	percentage of world export	in millions of US dollars	percentage of world import	in millions of US dollars	percentage of world export	in millions of US dollars	percentage of world import
1.	Fed. Rep. Germany	200.4	30.6	212.5	9.9	220.0	32.7	210.0	9.5
2.	United States	305.1	11.6	131.8	6.1	264.0	9.7	96.0	4.3
3.	United Kingdom	206.2	7.9	134.2	6.2	220.0	7.8	122.0	5.5
4.	Switzerland	198.0	7.6	51.5	2.4	218.0	7.7	40.0	1.8
5.	German Dem. Rep. (DDR)	196.2	7.5	58.5	2.7	202.0	7.2	60.0	2.7
6.	Italy	190.8	7.3	123.8	5.7	170.0	6.3	169.0	7.6
7.	Czechoslovakia	122.0	4.6	66.0	3.1	136.0	4.8	68.0	3.1
8.	France	116.5	4.4	193.3	8.9	133.0	4.7	224.0	10.1
9.	Japan	90.9	3.5	160.6	7.5	100.0	3.5	132.0	6.0
10.	USSR	86.7	3.3	145.5	6.8	96.0 ³	3.4	196.0 ³	8.9
11.	Poland	46.0	1.7	97.0	4.5	57.0	2.0	90.0	4.0
12.	Sweden	44.8	1.7	61.0	2.8	54.0	1.9	78.0	3.5
13.	Belgium	30.5	1.2	36.5	1.7	33.1	1.2	40.3	1.8
14.	Spain	29.5	1.1	56.2	2.6	33.0	1.2	49.0	2.2
15.	Hungary	29.2	1.1	27.0	1.2	28.0	1.0	28.0	1.3
16.	Netherlands	24.1	0.9	44.8	2.1	27.2	1.0	51.1	2.3
17.	Austria	21.5	0.8	28.5	1.3	20.7	0.7	52.7	2.4
18.	Canada	20.4	0.8	143.5	6.7	24.0	0.8	90.0	4.1
19.	Bulgaria	16.0	0.6	31.0	1.4	18.9	0.7	36.3	1.6
20.	Denmark	11.4	0.4	12.7	0.6	12.5	0.4	13.0	0.6
21.	Yugoslavia	5.5	0.2	16.5	0.8	12.0	0.4	25.5 ³	1.1
22.	Romania	5.5	0.2	29.0	1.3	6.5 ³	0.2	34.2 ³	1.5
23.	Brazil	4.6	0.2	34.6	1.6	3.0	0.1	37.7	1.7
24.	India	3.7	0.1	24.0	1.1	4.1	0.1	24.0	1.1
25.	Taiwan	3.1	0.1	9.8	0.4	4.0	0.1	10.0	0.4
26.	China	3.0	0.1	40.0	1.9	3.0	0.1	32.0 ¹	1.4
27.	Australia	2.7 ¹	0.1	27.9	1.3	2.9 ¹	0.1	39.4 ¹	1.8
28.	Argentina	2.0	-	36.9	1.7	2.1	-	32.0	1.4
29.	Portugal	1.4	-	7.6 ²	0.3	1.5	-	8.5 ²	0.4
30.	South Africa	0.6	-	43.2 ²	2.0	0.3	-	53.6 ²	2.4
31.	Mexico	0.1 ³	-	65.0	3.0	0.1 ³	-	67.0	3.0
32.	Turkey	-	-	n/a	-	-	-	n/a	-
33.	Egypt	-	-	n/a	-	-	-	n/a	-
34.	Israel	-	-	n/a	-	-	-	n/a	-
35.	Chile	-	-	n/a	-	-	-	n/a	-
	Other Countries	-	-	n/a	0.0	-	-	n/a	-
	TOTAL	2,619.1	100	2,150.1	100	2,815.0	100	2,209.3	100

* Total Machine Production London, March 1970

^{1/} Year ended 30 June

^{2/} Imports to South Africa include machine tools re-exported

^{3/} Rough estimate from fragmentary data

The largest importer of machine tools in 1970 was the Federal Republic of Germany (FRG). It imported machine tools to the value of US\$212.5 million, or 9.9 per cent of the world import. Japan comes second with US\$160.6 million or 7.5 percent of the world import and France third with US\$193.3 million or 8.9 per cent.

From Table 3 it can be seen that the share of Mexico was 3 per cent of the world import, while that of Argentina and of Brazil was 1.7 per cent and 1.6 per cent respectively.

It was estimated that in 1971 Brazil would import machine tools to the value of US\$37.7 million while the value of imports for Mexico and Argentina would be US\$67.0 million and US\$32.0 million respectively.

Engineering products imported to Latin American countries including machine tools, are shown in Annex 2.

5. Export of Machine Tools

The main exporter of machine tools in 1970 was the FRG with exports representing US\$800.4 million, that is 30.6 per cent of the world export while the value of US and UK exports was US\$305.1 million and US\$206.2 million respectively.

Brazil exported machine tools to the value of US\$4.6 million, while Argentinian and Mexican exports represented US\$2.0 million and US\$0.1 million respectively.

6. Metalworking Industries in the Countries of the Region

According to the degree of development of metalworking industries and particularly of the machine tool industries, developing countries of the region can be classified into the three following groups:

- (a) Countries with developed metalworking industries and established machine tool industries, such as Argentina, Brazil and Mexico;
- (b) Countries with developed metalworking industries that are considering setting up machine tool manufacturing, such as Chile and Colombia; and
- (c) Countries with limited metalworking industries and machine tool manufacturing, such as Ecuador, Paraguay, Peru, Uruguay and Venezuela.

Countries under group (A):

Brazil

Brazil ranks among the most industrialized countries in Latin America and is the largest industrial producer in the region. In 1970 its industrial production represented US \$9,300 million.

The Brazilian metalworking industry began to develop in 1955 through the promotion of the automotive and shipbuilding industries and the assembly of machine tools. The share of the metalworking industry in the gross national product (GNP) in 1968 was 16.2 per cent.

The value of production, imports, exports and consumption of machine tools in Brazil from 1966 to 1970 is shown below in millions of US dollars.

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Production	32.0	47.5	28.3	21.6	22.4
Imports	20.7	23.8	50.0	46.8	48.0
Exports	2.5	2.4	2.3	2.5	3.0
Consumption	50.2	68.9	76.0	65.9	67.4

In 1971, 71 per cent of machine tools were imported and 29 per cent were produced locally.

Brazil has been exporting machine tools since 1966 and the value of exports has remained constant at a figure of from US \$2.5 million to US \$3.0 million a year, the Latin American market accounting for 85 per cent. In recent years the export of lathes to the US has achieved considerable success and it now accounts for 6 per cent of the total exports.

The number of machine tool building enterprises is about 85, employing approximately 5,700 people. They can be divided into the following three main groups:

1. Medium to large enterprises, well equipped and financially sound with modern production facilities. All of these firms, of which there are fifteen, work with foreign know-how and are either Brazilian owned with licensing or similar agreements, or subsidiaries of foreign firms. They do not require assistance, either technically or commercially and account for 90 per cent of the machine tool export of Brazil.

2. Small to medium-scale manufacturers subsist behind high customs barriers and supply the local market with less sophisticated machinery which is not competitive in the world market. Technical and economic assistance for this group of manufacturers is required in order to change production techniques and improve the quality of production. There are 50 enterprises in this group.
3. Twenty small companies producing machine tools of out-dated design, using old-fashioned models with obsolete machinery and production techniques. They need outside assistance in order to improve their activities, as they have a very limited chance of survival their own.

It should be pointed out that only the first two groups possess the engineering and design capabilities of a standard sufficiently high to meet the demand for machine tools and for the expansion of the metal-working industries. Out of a total of 85 enterprises in this group 73 are situated in the area of São Paulo. They are located as follows:

43 in the city of São Paulo

13 on the periphery of the city and

17 in the State of São Paulo

The majority of the plants are using only up to 50 per cent or less of production capacity. The range of manufactures covers metalcutting machines, such as lathes, milling, boring, shaping, thread milling, gear cutting, sawing, grinding and metal forming machines including presses, forging and bending machines. However, lathes are the largest single product group to be produced successfully in Brazil and they account for approximately one third of the total annual production of the machine tool industry. In 1971, 306,200 machine tools were involved in the production of metal products, both electrical and non-electrical and transport machinery and equipment. The majority of the machine tools (90,900 units) were used in the automotive industry.

The Government, realizing the importance of the further expansion of the machine tool industry to the Brazilian economy (resolution 3/71 of 30 April 1971; Council of Industrial Development), is encouraging the national collection know-how, not only through licensing agreements, but also through foreign investments, in order to ensure the supply of machine tools of the latest design to meet increasing requirements of the industry.

At present, Brazilian machine tool manufacturers have ten licensing agreements with the Federal Republic of Germany, two with the United States, one with the United Kingdom, one with France and one with Switzerland.

The Instituto de Pesquisas Tecnológicas de São Paulo (Research Institute of Technology of the University of São Paulo) is established on a scientific basis capable of dealing with all aspects of the development of machine tools in Brazil.

Argentina

Argentina is one of the industrialized countries of Latin America. The value of its industrial production in 1970 was US \$7,200 million. The value of the production, exports, imports and consumption of machine tools for Argentina is shown below in millions of US dollars:

	1966	1967	1968	1969	1970
Production	18.1	19.1	22.7	29.2	32.4
Imports	11.2	8.9	10.4	16.0	28.5
Exports	1.6	1.1	1.6	1.4	1.8
Consumption	28.2	26.9	31.5	43.8	59.8

In 1970, 95 per cent of machine tools were manufactured locally and 45 per cent were imported.

The structure of the machine tool building industry is characterized by many small and medium sized enterprises.

About 90 per cent of the machine tools manufactured today in Argentina are universal machines, and only very few enterprises have started to manufacture specialized production machines. This is caused on the one hand, by the lack of technology available, and on the other by the difficulty of procuring sufficiently large investments for such an undertaking.

Of the total stock of machine tools available in the country 85 per cent are locally produced, representing 45 per cent of the total value, while the remaining fifteen per cent are imported.

The value figure is constantly increasing and the local industry produces at present a number of machines of a high degree of sophistication.

Nevertheless, the value of machine tools imported is still large in terms of local consumption. The lack of modern management and organization, technology, production and the non-competitive status of production, are the main shortcomings of most of the enterprises of small and medium-sized companies.

In order to improve the machine tool building industry in Argentina and in particular productivity and the quality of machine tools, it would be desirable to introduce a protection policy, encouraging users to buy locally produced equipment. It is also important to strengthen the activities of the Instituto de Tecnologia Industrial (INTI), and the newly created Centro Estudios Maquinas Herramienta Argentinas (CEMHA).

Mexico

Mexico has more or less the same consumption of machine tools as Argentina. However, the share of local manufacture of machine tools is more than 50 per cent in Argentina, while it is only about 10 per cent in Mexico.

The first plants were installed in 1932, 1934 and 1944, but were unable to survive mainly because of outdated technology, poorly trained labour, deficient raw materials and strong competition.

Activity was initiated again in 1959 with one die-sinking plant. Today there are seventeen such companies located in the main industrial centres, seven of them in the Federal District; two each in the Mexican states Coahuila and Jalisco; three in the state of Nuevo León and one in the state of Querétaro. However, only four of these plants manufacture exclusively machine tools. There are also about fifteen general metalworking shops manufacturing simple machine tools to order in small quantities.

The average investment per plant amounts to US \$568,000 with an average annual production turnover of US \$528,000. These enterprises produce metal-cutting and metalforming machines such as lathes, drills, grinders, saws, die-sinking machines, presses and folding machines, as well as woodworking machines such as planers, saws, edge-planers, lathes, taps and drills.

Lathes are made under licence from Czechoslovakia, Spain and France.

Only 48 per cent of the capacity of the plants producing lathes and drills is utilized. Moreover the equipment used in this sector is generally obsolete.

The value of production, exports, imports and local consumption in Mexico from 1967 to 1970 is shown below in millions of US dollars:

	1967	1968	1969	1970
Production	4.2	4.5	5.0	5.0
Exports	-	-	0.1	0.1
Imports	35.3	54.0	55.0	56.0
Local Consumption	39.5	58.5	60.0	61.5

Machine tools are being used in different branches of the metalworking industry, but the largest consumer is the automotive industry, which uses mainly highly sophisticated imported machine tools. In 1965 the automotive industry took more than 50 per cent of all imported machine tools in Mexico the cost of which was US \$34 million. During recent years the consumption of machine tools by the automotive industry has been about 20 per cent, a figure that is likely to be maintained.

Manufacturing capacities are considered to be adequate to meet local demand for drilling machines, (bench and column type), mechanical presser, bending machines and shears (pedal and motor driven). Other types of machine tool production are insufficient to satisfy local demand.

The condition of Mexico's machine tool industry is a result in part of the fact that the capacity of the factories bears little relation to market demand. The following factors impede its development: obsolete technology and a deficient supply of raw materials, which affect the quality of production; insufficiently trained and poorly paid labour, leading to a high turnover; strong competition from abroad; deficient plant organization; low plant utilization and low productivity; and high production costs.

The situation in countries falling under group (b) is as follows:

Chile

The share of the metalworking industry in Chile, a country of the Andean Group, in the total industrial production in 1970 was 22.5 per cent. Local production of machine tools was started soon after World War II in the form of small enterprises some, having ceased production owing to competition, others having merged with other plants. In 1971, twelve enterprises produced 800 machine tools of an estimated value of US \$925,000, including lathes, presses, shearing and sawing machines, drillings, grinding and other machine tools.

The total number of machine tools used in 1966 in the metalworking industry was 20,375 units. The electrical industry as the most recent industry to be started, is the best equipped with modern machine tool parts, while the basic metal industry is the most conservative and is equipped with older machine tools.

At the present time the Government of Chile is planning the establishment of new enterprises in order to increase the production of machine tools and to start producing new models, including universal milling machine tools.

It is expected that during the first phase in 1972, the new enterprises will produce 200 lathes of a better quality and precision and 100 milling machines both for the local market and for export.

From Table 4 below it can be seen that in 1971 the consumption of metal-forming machines was mainly covered by machines produced locally.

Table 4

LOCAL CONSUMPTION OF MACHINE TOOLS IN 1971

Types of Machine Tools	Imported	Local Production	Consumption
Lathes	350	200	550
Milling Machines	100	-	100
Presses	20	100	120
Forming Machines	50	50	100
Sawing	20	100	120
Drilling	50	300	350
TOTAL	590	750	1,340

Colombia

Colombia is one of the ANDRAN Group countries. The share of the metalworking industry in the total industrial production of the country in 1968 was 11.2 per cent. The output of the metalworking industry represented US \$274.2 million.

The production of machine tools in Colombia started in 1966. At present there are seven manufacturing enterprises producing machine tools in the country, two of which are the most important.

One firm developed from a repair shop of a major textile group and today employs about 200 people engaged in the production of such machine tools as lathes up to 2,000 mm, drilling machines (bench, column and radial) up to 60 mm; planing machines (650 mm), and other machines. The enterprise does not have know-how agreements with foreign sources.

A second enterprise, much the same size, but set up originally as a machine tool factory operating with foreign know-how, has its own foundry.

Five small firms are manufacturing lathes and planing machines.

The seven enterprises are also involved in the manufacture of presses, bending and shearing equipment.

It is estimated that the total number of machine tools in Colombia in 1970 consisted of 22,500 units.

One of the main problems in the metalworking industries of the country is the under-utilization of installed industrial capacities. At the same time, 25 per cent of all parts and raw materials are imported. Many workers would like to move to Venezuela where wages are considerably higher.

In the last few years one third of the total imports came from the United States. The machine tools imported are mainly drilling machines, boring, grinding, turning, milling, planing and gear-cutting machines.

The following countries are classified under group (c):

Bolivia

Bolivia has no machine tool production at present. However, as one of the ANDEAN Group countries, Bolivia has been approached to suggest a plan for the establishment of a central machine tool manufacturing unit. The feasibility study for it will be completed by the end of 1972.

No clear definition exists yet on the capacity of the proposed manufacturing unit. But it has been decided that only machines that are not manufactured in the other ANDEAN Group countries will be manufactured by the central unit. The production of small machine tools such as drilling machines, small lathes and presses for the local market is also being planned for this unit.

Although high quality iron-ore deposits exist, up to now the country has only small foundries. The metal-working industry of Bolivia in 1968 consisted of 52 enterprises with a labour force of about 720 engaged in the repair of industrial machinery, rather than in its production.

Ecuador

The share of the metalworking industry in the total industrial production of Ecuador, a member of the Andean Group, is very small. In 1966 it was only 3.2 per cent, namely US \$7.8 million. The main industry is the manufacture of consumer goods. In 1969 about 45,000 people were employed in industry, 4,000 of them engaged in the metalworking sector.

The average number of employees working in each industrial enterprise is about 53 people. Metalworking units are generally small with an average of 13 people each.

There are no enterprises in Ecuador producing metalcutting machine tools and only one unit manufacturing simple mechanical presses in a limited quantity.

From 1957 to 1969 Ecuador imported 623 machine tools at a cost of US \$2.6 million.

In 1970, it is estimated that there were about 1,400 machine tools in operation in the country, including 1,100 metalcutting and 300 metal-forming machine tools.

Paraguay

Paraguay has recently started to develop its metalworking industry, and its share in 1970 of the gross national product (GNP) was 1.3 per cent, while its share for industry as a whole, including food processing, wood-working, chemical and leather processing, was 16 per cent.

The Centro de Industriales Metalurgicas, is an association of 17 enterprises employing about 2,000 people in the metalworking industry. There are no statistics on the stock of machine tools in Paraguay. Machine tools are mainly used for the production of consumer goods and for the repair of machinery and equipment.

Peru

Peru, a member of the Andean Group, has developed extensively its mining and non-ferrous industry. Repair workshops account for the greater part of the metal-working industry. The country's requirements in machine tools are met by imports.

Uruguay

In 1967 the share of the metalworking industry in the industrial output of Uruguay was only 4.3 per cent. It is expected that by 1974 it will have as a whole increased to 16.1 per cent. Emphasis is laid on the servicing and repair of industrial equipment.

There are 348 small sized metalworking enterprises in the country producing engineering products for the local market. One of the reasons for the slow development of the industry in Uruguay is the small amount of iron-ore available in the country.

As Uruguay has one of the highest rates of vehicles per head of population in Latin America, the metalworking industry produces a large quantity of parts for the automotive industry some of which are exported to neighbouring countries. Local enterprises are also producing motors, generators, transformers, lamps and batteries. Moreover, Fiat Concord SAIC of Argentina is investing US \$4 million in auto, truck and tractor assembly and simultaneously expanding the assembly operations of Fiat's Uruguayan licensee. Production will supply the local market and be integrated into an auto parts export-import compensation agreement between Argentina and Uruguay.

Venezuelan manufacturers produce their own machine tools, such as common lathes, mechanical presses and shears, for their own use copying designs of older machine tools in their shops and adapting them to specific requirements.

Most of the mechanical shops in Uruguay have a large number of obsolete machine tools. It is estimated that there are about 2,000 machine tool units in the country at present.

Venezuela

The share of the metalworking industry in the whole industrial output of Venezuela was 17.1 per cent in 1970, representing US \$640 million. Metalworking plants are now being built in Carabobo and Lara.

The metalworking industry produces metal products, electric batteries and transformers, agricultural machinery and implements (except tractors), mine and petrochemical equipment and diesel motors. It also assembles motor vehicles, radio and television sets.

In 1970, 48,500 people were employed in the metalworking sector.

It is worth noting that the growth rate of production in the metalworking industry is higher than in industry as a whole. Nevertheless, production in the metalworking industry depends on from 40 per cent to 50 per cent imports.

There is no single enterprise engaged in the manufacture of machine tools for commercial purposes. However, some small manufacturing non-electrical machinery are occasionally involved in the production of special machine tools for their own needs.

A feasibility study on the effectiveness of the local production of machine tools in Venezuela was carried out by the Corporación Venezolana de Guayana, with negative results.

7. Selection and Utilization of Machine Tools

The machine tool is a means of production that can be expected to sustain a long period of service, so that the selection of the most suitable machine is important to ensure efficiency over a period years. The machine tool should be selected carefully by those equipped with a knowledge of the methods used in the manufacture of the particular component. The selection of the cheapest machine may prove to be false economy if it has been designed for intermittent operations or for light breakdowns, which may become frequent owing to overloading if the machine is subject to normal workshop use.

The countries that wish to develop their industries have constantly to increase the total number of machine tools. However, the success of the industrial development in such countries depends not only on their stock of machine tools and other industrial equipment, but also on the way in which these are used, as some developing countries have a sufficient stock of equipment but is not fully or properly utilized.

Modern machine tools, including those with numerical controls, can only be used efficiently if the machines are kept in operation continuously. Their high purchase price may demand the operating of three shifts a day, seven days a week. Only then can the operation be profitable. Standard machine tools are often working only 10 per cent of the time.

The following steps have therefore been taken to increase output:

- (a) The group scheduling of machining operations to avoid loss of time, thus increasing production;
- (b) The preparation and pre-setting of tools and fixtures in the toolroom;
- (c) The selection of optimum feeds and speeds by the production planner for the particular workpiece, materials and tools required;
- (d) The regular scheduling of the maintenance of machine tools and the re-conditioning of worn tools, thereby eliminating break-downs.

8. Maintenance and Repair of Machine Tools

In creating a stock of machine tools, developing countries should always plan how to use them most efficiently and how to extend their lifetime as long as possible. This can be achieved only through the organisation of a special repair and maintenance system which is particularly important for modern and highly complicated machines that include precision devices, hydraulic and electronic systems, high-speed and power transmission systems, automatic and control devices.

The efficient functioning of a machine tool unit depends to a considerable extent on the methods used to operate, maintain and service it, otherwise such wastage can result, particularly, with regard to foreign exchange for imported material.

Two factors cause wastage when individual units are taken out of service prematurely.

First, there is an increase in the amount of and, consequently the cost of, repair work. Often the repairs entail importing spare parts. When the failure occurs in a complicated precision part, such as a precision lead screw, the bushing of a jig borer, a reading mechanism or the like, it is not always possible to repair and recondition it

locally. Such a breakdown can be avoided by proper methods of operation and servicing.

Second, wear and breakdowns increase the time lost in repair and reduce the usefulness of the machine tool in question. Consequently extra machine tools have to be acquired to do the same amount of work, and shop space has to be increased correspondingly.

Furthermore, improperly repaired and maintained machine tools may fail to meet their technical specifications, particularly with regard to accuracy.

In order to maintain machines permanently in working order with the minimum expenditure of time and resources, it is essential to set up a maintenance and repair system with a set of basic rules.

9. Machine Tool Rebuilding

The cost of rebuilding an old machine is usually under two thirds of the cost of a new one. If the rebuilding is carried out efficiently the accuracy and characteristics of the machine will be as good as those of a new one. An enterprise specialising in rebuilding machine tools has the advantage of knowing which parts will normally have to be replaced so that they can be built in stock. As machine tool rebuilding is a less complicated operation than the manufacture of machine tools, there is good reason to establish a rebuilding enterprise in a country before undertaking the manufacture of machine tools.

10. Machine Tool Production

The production of machine tools is one of the most attractive industries for any country to develop, because it occupies a central place in the interrelationships between different branches of production and it is of paramount importance for the development of engineering industries.

However, a country existing to start the production of machine tools should have certain pre-requisites such as metalworking industries with skilled labour, ancillary industries for castings, forgings, bearings, electrical equipment and components and tools.

After a study of the preliminary conditions has been carried out, it is necessary to determine the types and sizes of machine tools that should be produced and the quantity.

During the initial stages, it is advisable to produce universal machines, designed to perform a wide range of operations. The types and the sizes usually in the greatest demand in developing countries are the following:

- lathes for maximum workpiece diameters of 250 mm, 320 mm, 400 mm and 500 mm;
- steel drilling machines of maximum drilling diameters of 18 mm, 25 mm, 35 mm and 50 mm;
- boring machines with spindle diameters of 65 mm and 80 mm;
- shaping machines with ram strokes of 320 mm, 500 mm and 700 mm;
- knee-type milling machines with a table width of 200 mm, 250 mm and 320 mm;
- circular grinding machines for a maximum workpiece diameter 140 mm, 200 mm and 280 mm;
- surface grinding machines with a table width of 200 mm and 320 mm;
- universal tool-grinding machines, hack and circular saws.

It does not mean that these types and sizes of universal machines should all be produced at the same time. Manufacture should be carried out according to priority.

It may also be advisable to produce other types and sizes of universal machines, such as small bench-type lathes, milling, drilling and tool-grinding machines, to meet the needs of the handicraft industry.

The production of heavy-duty machines is necessary for such countries as, for instance, Argentina, Brazil and Mexico which have an adequately developed machine tool industry and enterprises for the heavy engineering industry.

Although general-purpose machines can perform a wide range of operations, it might be advisable to produce also single-purpose machines which are easy to handle and comparatively inexpensive.

The development of metalworking machine tool production should be integrated with the other industries being developed in a country, as ultimately it is the user industry that determines the type, size and quantity of the machine tools produced.

To achieve this aim it is desirable that a Metalworking Industry Development Centre should be established in a country to co-ordinate the activities of manufacturers and provide services to the metalworking industry, including machine tool manufacturing.

11. Transfer of Technology to the Countries of the Region

The development of industrial management techniques of the countries of the region can be accelerated by the transfer of technology from industrialized countries by the provision of patents, licences, know-how, trade marks, management and other technical services.

Successful industrial growth depends to a considerable extent upon the indigenous capacity to create and develop engineering and industrial design, as well as to the ability to adapt the designs of products to be manufactured under licensing agreements in accordance with domestic needs. The engineering and industrial design capabilities of nearly all developing countries are either absent or at early stages of development.

The UNIDO Expert Group Meeting on the Development of Engineering Design Capabilities in Developing Countries held in Vienna in 1970 stressed that to permit the optimal use of available technology, this capability should be increased in these countries, irrespective of level of development.

In many developed nations, the introduction of engineering design began at a late stage of industrialization because more attention was paid initially to problems of basic manufacture. Only later did the importance of design become apparent.

The developing countries can benefit from the experience of the industrialized nations by improving their local design facilities simultaneously with their manufacturing processes, thereby reducing the time lag in their growth to full industrial capacity.

The major potential contribution of UNIDO to developing countries in the field of design capability is assistance in the establishment of engineering design centres in these countries. With a UNIDO assistance such centres have been or are being established in Bulgaria, Ceylon, Egypt, India, Philippines and Tunisia.

In order to achieve a greater productivity of machine tools in developing countries, to improve their quality to reduce production costs, and to use the installed capacity fully, special care should be taken in the introduction and application of methods of progressive measuring and control.

Developing countries should make greater use of welding technology and equipment. Welding is a simple and cheap process and consists of joining and cutting various parts of machines. It could be most useful for the countries of the region in maintenance and repair, as well as in the production of various types of industrial, agricultural and transport equipment.

As it is possible to produce welds with the same mechanical properties as the base material, welding is used extensively throughout industry. This technique reduces the weight of equipment and increases production.

The process is not complicated, nor does it require specially skilled personnel and it can be undertaken in any country.

Developing countries have an opportunity for adopting more advanced forms of technology without having to pass through the long period of research, experiment and adaptation experienced by industrialized countries.

One of the most elementary forms of the transfer of technology is by the sale of drawings. This form is only satisfactory, however, where the recipient organization has had considerable experience in the manufacture of similar products. Once the drawings have been handed over, the supplier has no further obligation and the buyer must rely on his own resources for their utilization in manufacturing.

It is usually considered more satisfactory to enter into an agreement for a supply of the drawings of a product, in addition to the technical information necessary for its manufacture.

The know-how may be in the form of written instructions for the manufacture of each constituent part and may include sets of drawings for all the jigs and fixtures required for production. It is usually desirable for a team of technicians be present at the works in the developing country to assist in the initiation of production suitable for local conditions. The local staff could be sent to learn the manufacturing process and to familiarize themselves with the equipment at the plants of the company concerned.

Some developing countries have difficulties in adopting advanced technology because of a lack of knowledge of the processes suitable for their industrial environment. It is desirable for every country to establish a Metalworking Industry Development Centre (MIDC) to accumulate the know-how and experience to provide technical assistance to local manufacturers in the design and production of prototypes and in the proper selection and application of manufacturing processes and equipment. Such centres have been established in several countries with the assistance of UNIDO and they are providing a valuable service to local industries.

Realising the importance of the transfer of modern technology to industry, the countries of Latin America buy experience and know-how from industrialized countries.

Table 5 below shows that Mexico and Argentina spent much more during the last few years than other countries in the region.

Payments by some countries of Latin America for the transfer of technology and their relationship to GDP and exports.

Country	Year	Payments for transfer of technology			Total	Share domestic market	Export market	Payments for transfer of technology as a percentage of	
		Patents licenses know-how and trademarks	Management and other technical services					GDP	Exports
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Millions of dollars									
Argentina	1969	58.1	59.6	117.7	17.8	1.6	0.72	1.5	
Mexico	1965-68 ^{b/}	...	51.6	59.6	23.0	1.8	0.26	3.0	
Colombia	1966	...	26.7	26.7	5.8	0.5	0.10	5.0	
Venezuela	1969	...	200.0	200.0	25.7	1.3	0.74	15.0	
Chile	1969	(8.2)	5.8	1.1	(0.15)	(0.5)	
Venezuela	1969	...	6.1	(6.1)	9.2	2.9	(0.17)	(0.5)	
TOTAL		...	(428.1)	(428.1)	(27.1)	(0.1)	(0.49)	(0.5)	

Numerical Control (NC), potentially applicable to the majority of metalworking operations in both developed and developing nations is a technique for controlling machine tools (or other processes) by means of programmed instructions punched on a tape. The instructions are defined by a person called a post-programmer, after he has studied the engineering drawing and determined the actions to be taken by the machine tool in question. The instructions punched on the tape in code must be understandable to the machine control unit (MCU). This

Notes: Figures in brackets indicate that the information available is incomplete, or refers to different items or periods. Figures in bold have been included in the totals merely to provide order of magnitude.

Source: UNCTAD, World Investment 1971

- ^{a/} In last cases exports refer to the foreign exchange cost (in billions of dollars)
- ^{b/} Annual average
- ^{c/} 1969

tape can then be loaded into the MTC. At the initiation of the machine tool operator, the MTC will decipher the tape and cause the machine tool to follow its commands. This concept is effective in producing any number of parts requiring only one reading of the tape for the production of each part. As this method is designed primarily for repetitive work it can be used for the manufacture of replacements and spare parts.

The main advantages of NC for developing countries include the following: a reduction in the time required for setting up; the elimination of complex jigs and fixtures; the improvement of quality; greater accuracy, a substantial reduction in human error; the reduction of inspection and measuring instruments; the use of less skilled labour to operate the machine.

Although highly skilled machine operators are no longer needed, programmers are required for the preparation of the control tape. This raises the problem of training, in addition to the maintenance of a more complex machine with a sophisticated control system.

A machine tool building industry in any country must satisfy the needs of machines, shapers, planers and milling machines. The production of machine tools may differ in respect of types and quantity depending on the needs of the developing country. A plant should be designed to produce a range of machine tools, fixtures, accessories and pneumatic tools that are in the greatest demand. With planned production, it is possible to operate a plant profitably.

Assistance could be provided by the developed countries by means of bilateral agreements, or through UNIDO, for exploratory and design work, or in consultation with local specialists on certain aspects of design, production, testing, quality control, proper utilization, maintenance and repair of machine tools.

Consulting firms in developed countries are prepared to undertake the following steps in the creation of machine tool building plants:

- Determine the optimal production programme;
- Participate in working out the project report;
- Take part in selecting the site for the plant;
- Take part in the selection of the initial data required for the design and construction;
- Work out the project report and, upon approval by the Government, prepare the working drawings required for plant construction.

Apart from the design work, developed countries could undertake the delivery of complete sets of equipment, instruments, apparatus and materials, or part of them, for the construction of a plant in accordance with the

project plan. In addition to the conventional equipment of batch production, auxiliary non-standard equipment, for instance, interdepartment transport, special conveyers, hoisting mechanisms, test rigs, ventilating, and electrical equipment, painting, heat-treatment and other facilities could be furnished.

If the recipient country can produce such equipment, working drawings should be made and handed over to the recipient.

Consulting firms could also furnish the technological documents for the production of certain models of machine tools, namely:

- Technological charts, covering all operations of machine tool production;
- Working drawings for special fixtures required in accordance with adopted production technology;
- The organization of production, including the management structure of individual departments, the hiring of plant staff, their rights and obligations, the planning of office management and the supply of forms for interplant record keeping.

Developed countries could undertake to deliver special technological fixtures in the form of devices, attachments, dies, special cutting and measuring tools and instruments required for machine tool production, including parts and standard articles for machine tool assembly. In addition, technical assistance might be offered in the construction and setting-up of production, by sending specialists to supervise the construction, to initiate operations for the production of machine tools and to train technicians of the recipient country. Training courses could also be arranged for staff and specialists in industrialized countries.

Upon request, machine tool plants could be constructed in two or three stages, spreading the cost over a longer period. During the first stage the recipient country could organize the assembly of machine tools, producing simple parts, or purchasing them in the country, while importing the complicated parts.

During the next stages, the parts locally produced will gradually increase as the production technique is mastered, providing it is advantageous to manufacture them.

In more advanced developing countries where an effective engineering industry has been established, another type of co-operation may be adopted. In this age of rapid technical evolution it is not possible for a country to be self-sufficient and produce every type of machine tool required.

It would be desirable for the industry to concentrate on the design and development of a certain range of machine tools, a process that could be accelerated and expenditures reduced by co-operating with engineering firms in neighbouring countries. This would save foreign currency by the production of various types of machine tools in the region.

PART II

OUTLINE OF THE ACTIVITIES OF UNIDO

1. UNIDO Technical Assistance

UNIDO technical assistance to developing countries consists of the following three basic types of activity:

- (a) Operational activities, involving direct assistance to developing countries;
- (b) Supporting activities, including action-oriented studies and research; and
- (c) Promotional activities, through which UNIDO seeks to mobilise resources, far greater than its own, by encouraging direct contact between the business communities in industrialized and developing countries.

In the field of engineering industries, UNIDO is dealing with manufacturing industries that are engaged in the design and production of metal products such as machinery and industrial equipment, machine tools, agricultural machinery and implements, electrical, electronic and telecommunication equipment, metal cutting and measuring instruments, transport equipment, processing industry machinery and other equipment. It is also concerned with the problems of repair and maintenance of these machines.

A breakdown of the groups of engineering manufacturers including metal products, machinery and equipment functions connected with these operations are shown in Annex 1.

UNIDO undertakes feasibility studies, including project formulation, project evaluation, market research and techno-economic studies before recommending the local manufacture of selected engineering products.

2. Typical Field Projects in Metalworking

The following are typical UNIDO field projects in the metalworking industry:

- Manufacture of mining and mineral processing machinery (Chile)
- Development and manufacture of mining and processing equipment and spare parts (Peru)
- Production of mine-working equipment and spare parts (Tunisia)

- Study on the production of machine tools (Algeria)
- Materials handling equipment (Czechoslovakia)
- Assistance in the organization of a manufacturers' association (Indonesia)
- Study on the possibility of the establishment of Engineering Design and Development Centres in Ceylon, Kenya, Malaysia and Yugoslavia
- Feasibility study on cutting tool production (Iran)
- Assistance to Tams Industrial Holding Corporation
- Utilization of machine tools (Pakistan)
- Application of numerically controlled machine tools (Brazil, Bulgaria, Romania)
- Tool Makers Institute (Jamaica)
- Technical assistance in the manufacture of household appliances (Uganda)
- Establishment of mechanical workshop and foundry (Somalia, Sudan)
- Metalworking Industry Testing Centre (Chile)
- Assistance in the quality control of engineering products (Korea)
- Quality Control Centre for Engineering Industries (Egypt)
- Engineering and Industrial Design Development Centre (Syria)
- Adviser for the Metal Products Industry (Indonesia)
- Centre for the Development of Prototype Tools (Tunisia)
- Metal Industries Development Centre (Philippines)
- National Design and Consulting Centre (Chile)
- Technological Research Institute for Machine Tools (Argentina)

It may perhaps be of interest to examine more fully some of the more important of these projects, as follows: -

Centre for the Development of Prototypes in Tunisia

The main objectives of the Centre are the development, design and production of tools, dies, jigs, fixtures and gauges. International experts train local staff in the design and prototype production of tools and jigs. UNIDO is co-operating with the International Labour Organisation (ILO) in the implementation of this project.

Metal Industries Development Centre in Singapore

The aim of the Centre is to survey the problems and requirements of the metal industries; to train local personnel; to provide facilities for manufacturing prototype mechanical engineering products; and to improve production processes by the introduction of new methods.

The project is being implemented by ILO and UNIDEM. UNIDEM provides experts in machine tool repair and maintenance, controls and industrial cost accounting.

Tool Maker Institute in Mexico

At the request of the Government, UNIDO expert provides services to the metalworking industry over one year under the SIB programme. Taking into account the growth of the metalworking industry in the country, the expert recommended the establishment of a Tool Room for the training of local personnel in the design, manufacture, maintenance and repair of tools, dies, fixtures and moulds for the metalworking and plastic industries. As a result, the Tool Room has been set up according to his specifications in the Tool Maker Institute. It is expected that UNIDO assistance to this Institute will be continued to the end of 1974.

Metal Industries Development Centre in the Philippines

The task of this Centre is to solve problems in the metalworking industry by the provision of technical advisory services, quality control, management and technical training. IIC is co-operating in the field of training.

Metalworking Industry Testing Centre in Chile

The purpose of the Centre is to test raw materials and finished products (refrigerators, motors, washing machines and heaters); to control and calibrate dies, gauges and measuring instruments and to improve the technical standards of products. The first phase of the project will be completed by the end of 1974 and the Government is providing UNIDO assistance for a second phase to provide quality control and testing services to local manufacturing industries.

National Research and Development Centre in Ceylon

The Government of Ceylon has expressed interest in the establishment of a National Research and Development Centre for metalworking industries engaged in the selection, utilization and development of machine tools, tools, dies, jigs and fixtures. A UNIDO expert and a UNIDO staff member visited Ceylon to consult with the metalworking industries and to assist in the preparation of a draft request for the establishment of the Centre. It is expected that the Centre will be concerned with the research, design and prototype manufacture of units for machine tools and other industrial equipment.

The Centre will identify the product lines to be developed or adapted by industry. UNIDO will supply equipment, provide international experts and grant fellowships, while the Government will provide the facilities, sample equipment and counterpart staff for training.

Metals Industries Development Centre in Malaysia

The Government of Malaysia is requesting UNIDO technical assistance in the establishment of a Metals Industries Development Centre in Kuala Lumpur. It is expected that the Centre will be responsible for the development of foundries in the country and for the design and production of dies and moulds for the metalworking and plastic industries in order to substitute local manufactures for imports.

3. UNIDO and the Andean Group of Countries

The five countries of the region, namely, Bolivia, Chile, Colombia, Ecuador and Peru have signed the Agreement of Cartagena (Acuerdo de Cartagena) within the framework of the Montevideo Treaty which created the Latin American Free Trade Association. This agreement foresees a process of economic and international integration which is to be implemented in 1980. It has the following main aims: the liberalization of trade, regional industrial development and the co-ordination of economic and social policies.

The process of integration started on 1 January 1970 when the Junta, the executive body, was formed. Other bodies of an advisory nature were subsequently set up such as the Economic and Social Advisory Committee, the Consultative Committee and a system for the co-ordination of economic policies, constituted by specialized councils on different aspects of economic and social problems.

The main decision making body is the Comisión which is composed of the plenipotentiary delegates from the member countries.

Among the decisions taken by the Comisión for the liberalization of trade were: the establishment of a common tariff for outer zone products which are reserved for the industrial sectorial programming, and the approval of regulations and trade marks.

In the work programme for 1971, the Junta had foreseen the preparation of the first programme for sectorial industrial development. The programme relating to the petrochemical sector has been finished.

At the request of the Governments of the Andean Group, UNIDO will shortly send a team of experts to recommend the steps to be taken by the countries of the sub-region to develop their metalworking industries. It is expected that comprehensive studies will be carried out in several branches of the metalworking industry, including the manufacture of heavy electric machinery, textile machinery and office equipment, as well as shipbuilding and repair.

An extensive study on the machine tool industry for the Andean sub-region was completed by the Junta del Acuerdo de Cartagena with the assistance of a UNIDO expert in 1971. The recommendations made took into account the economic integration as laid down in the Cartagena Agreement.

At the request of the Government of the Republic of Venezuela, member of the Andean Development Corporation (CAD), UNIDO is providing the services of a metalworking industry expert for a period of two years to advise CAD on metalworking industry projects which have been identified in the six member countries and to assist in the evaluation of studies and project proposals submitted to CAD.

4. UNIDO Assistance to the Countries of the Region

The following outlines by country indicate where UNIDO technical assistance has been given and/or could be given to the countries of Latin America in this field:

Argentina

In 1968 two UNIDO experts in the design and production of machine tools (Messrs. A. O. Schmidt and H. Schunacher) visited Argentina and made recommendations for improvements in the machine tool building industry. It was noted that the quality of the machine tools produced in Argentina was rather low and the experts recommended the establishment of a centre for the research, design and testing of machine tools.

Later, a UNIDO expert in machine tool export promotion (Mr. Svoz) visited 27 enterprises producing machine tools, seven factories manufacturing tools and five commercial firms and institutions. It was recognized that the main difficulties in increasing the export of machine tools were poor quality, high price and the lack of specialization and standardization in production. Furthermore, small and medium-size manufacturers are deficient in personnel experienced in export questions. The establishment of a centre was, therefore, recommended, to be responsible for the design, production, quality control, standardisation, testing, utilization, maintenance and repair of machine tools. Following these recommendations, the Government of Argentina decided to create a Technological Research Centre for Machine Tools and requested UNIDO assistance in its establishment.

The UNIDO expert appointed will work in close co-operation with the National Institute for Industrial Technology (INTI) and the Chamber of Machine Tool Manufacturers in planning the Centre, which will provide technical services to local manufacturers. The possibility of an extension of the services of the proposed Centre to other Latin American countries will also be studied.

Another team of UNIDO experts is assisting small and medium industry in the Industrial Estate of San Francisco, with regard to the design and production of machine tools and their accessories, the improvement of foundry technology and in settling production problems.

Bolivia

Recent UNIDO assistance to Bolivia has been directed at the construction and building materials industries. Assistance has also been provided in industrial programming, vegetable oil production and processing and the manufacture of agricultural machinery.

Future assistance might be provided by UNIDO in the promotion of export oriented industries by the establishment of quality control and product development programmes.

It is expected that Bolivia will develop a small metalworking industry within the Andean Group and that assistance could be rendered by UNIDO in this field.

A number of metal products have been listed for production... in Bolivia, under decision number 28 of the Junta del Acuerdo de Cartagena. Such products include transmission chains, pneumatic tools, "christmas trees" for oil wells, theodolites, plummet and ball bearings.

It is envisaged that consultants will be required to undertake techno-economic feasibility studies to develop the local metalworking industry.

In the field of shipbuilding and repair the introduction of ferro-cement boat building has been suggested.

During a fact finding mission on agricultural machinery to the Andean Group in 1972, a UNIDO consultant visited Bolivia and recommended that UNIDO assistance should be given in the design and adaptation of agricultural machinery for crop protection and erosion control in tropical soils under intensive cultivation for crops such as cotton, maize, rice, sugar cane. The expert also recommended UNIDO assistance in the design, adaptation and small-scale manufacture of agricultural hand tools and animal powered implements.

A Maintenance Week will be organized in Bolivia in early 1973. The Government is in the process of designating the counterpart authority to collaborate with UNIDO in implementing this programme. It is expected that, as a result of the Maintenance Week, specific projects will be identified for UNIDO assistance in this field.

Brazil

At the request of the Government of Brazil, UNIDO is providing the services of experts to assist the Technological Research Institute of São Paulo (Instituto de Pesquisas Tecnológicas) in the organization of a research laboratory for servo-mechanisms and NC systems and elements in the Machine Tool Division of the Institute. This Division has a well-equipped machine shop including two-axis NC drilling and milling machines. The Division has a staff of 80, 30 of whom with the advice of the expert will work out the machining data for production and will organize a suitable group technology.

UNIDO has also been requested to provide the services of an expert in the design and manufacture of tools, dies, jigs and moulds for the metalworking and plastic industries. It is expected that this assistance will lead to a recommendation for the establishment of a Die and Mould-Making Centre to be attached to the National Service of Industrial Apprentice Training (SENAI), which is under the direction of the Confederação Nacional da Indústria. SENAI is a large, well equipped organisation with establishments in São Paulo and in other parts of Brazil.

Chile

In accordance with the request of the Government, a Metalworking Industry Testing Centre (Centro de Servicios Metalúrgicos) (CESMEL) was established in Santiago, with the assistance of the United Nations Development Programme.

UNIDO as the executive agency of the project, has provided the Centre with experts, equipment and fellowships to improve technical and scientific standards. By the establishment of laboratories and workshops for testing raw materials and finished products, the Centre services the metalworking industry of the country. It also provides small and medium-size industries with the specialized equipment needed for the control and calibration of measuring instruments. The first phase of the project, which started in 1969, will be completed in 1972, and the Government has requested UNIDO assistance for the second phase (1973 - 1976) to proceed with the development of the Centre.

It is expected that in co-operation with the Chilean Industrial Corporation (CORFO), UNIDO will examine the possibility of setting up quality control services for an electronics industry in the region. The market will be the whole Andean Group of countries.

A similar mission will be undertaken by UNIDO in order to develop the local manufacture of mining equipment and spare parts, using the existing production facilities to the best advantage and with a view to establishing new metalworking lines to satisfy the local demand.

In co-operation with CORFO, UNIDO will study the possibility of establishing a National Design Centre for industrial plants and selected machinery and equipment. The expert is already selected and approved by the Government and he will take up his assignment in the second half of 1972.

Colombia

The Government of Colombia has requested UNIDO technical assistance to evaluate the metalworking industry, particularly the stock of machine tools with a view to their better utilization and the selection of new lines of metal products. It is planned that two experts, one in machine tools and one in the production of metal products will study the metalworking industry in Colombia, taking into account the stock of machine tools and additional metal working machines to be imported and/or produced locally with the aim of meeting the national demand, increasing exports and improving the industry with respect to other members of the Andean Group.

The Colombian Federation of Metalworking Industries (FEDMETAL) has also requested UNIDO assistance in the establishment of a Metalworking Industry Development Centre. The Centre will provide technical assistance to enterprises in the design, production and application of engineering products and in the proper utilization, maintenance and repair of equipment.

The Centre will also collect technical information needed by industries in this field in order to support the metalworking sector in Colombia.

The two experts will assist the authorities in the formulation of the plan of operations in the form of a Project Document for the Centre.

Ecuador

UNIDO has assisted several industrial sectors in Ecuador, including textiles, ceramics, the foundry industry and the chemical industry. In addition, general assistance has been provided to small industry development, industrial management and industrial planning and programming. An industrial survey was made by a UNIDO team in mid-1969.

Future assistance will be provided by the establishment of a system of industrial extension services, improving quality control and developing industrial financing facilities.

The development of the metalworking industries in the country will provide local manufacturers as a substitute for imported machinery and metal products. It is expected that the Government will request UNIDO assistance to examine the metalworking industries on the spot and to make recommendations for their development.

UNIDO is organizing, in co-operation with the Centro de Desarrollo (CENDES), a Government counterpart, a Maintenance Week that will be held in the first quarter of 1973. The purpose is to bring to the attention of the responsible authorities the urgent problems facing the country in the field of maintenance and repair. After making an analysis of the problems of the industry, UNIDO will determine the fields in which it could offer a comprehensive programme of assistance to Ecuador.

Mexico

The Mexican "Secretaria de Industria y Comercio" is at present engaged in evaluating the industrialization of the country. It has been noted that the lack of planning in the shipbuilding and repair industry of the country has hampered its development.

The Government of Mexico has requested UNIDO to provide a team of experts for a short period to assess the shipbuilding and repair industry in Mexico and to recommend a plan for its development during the next five years.

UNIDO has also provided assistance to the Nacional Mirandiera S.A. in programming the capital goods industry.

In 1970, the representative of the Departamento de Investigaciones Industriales, Banco de Mexico, discussed with officials at UNIDO Headquarters in Vienna the possibility of the establishment of a machine tool development centre and asked for UNIDO assistance in this endeavour. To date no official request has been received by UNIDO.

As a result of the UNIDO study on construction machinery, the Secretaria de Industria y Comercio has expressed an interest in providing UNIDO assistance in this field.

Paraguay

The considerable contribution of the metalworking industry to the development of Paraguayan economy in recent years has drawn particular attention to this branch of industry.

With UNIDO technical assistance, the Government has established the Technical Standards National Institute (INTN) to propose methods and standards for the verification and control of the quality of raw materials and manufactured products in the country.

Its purpose is to carry out research and studies intended to improve techniques for the processing of raw materials; to reduce production costs; to reduce and eliminate risks; to promote the use of local raw materials, or the most economical materials; to utilize all by-products; to carry out soil analyses to improve agricultural production; to stimulate industrialists to undertake studies to increase production and to promote the formation of research centres. The activities of the Institute are concerned with the following industries: food-stuffs, beverages, hides and skins, textiles, wood, building materials and tobacco.

It is planned to expand the activities of the Institute to include the metalworking industry by creating a metalworking department within the Institute, which will provide technical services to local manufacturers in the selection of the equipment, the design, manufacturing, quality control, maintenance and repair and the testing of equipment and metal products.

UNEP

The Ministry of Industry and Commerce, in accordance with the objectives of the National Development Plan, is beginning to develop the metal and electrical industries. It is felt that UNEP technical co-operation in the following fields would have an important impact: machinery and mechanical equipment; electronics, automotive parts, electrical goods, shipbuilding and repair.

To aid the development of the machinery and mechanical equipment industries, the services of experts in project formulation, investment proposal evaluation, production planning and quality control have been requested. This collaboration should begin in 1972 and continue for six years.

For the electronics industry the assistance of two experts has been requested in the establishment of basic manufacturing designs for consumer electrical products and in the formulation of projects. This assistance should begin in 1972 and last for two years and for six months respectively.

The automotive industry project requires assessment principally in the development of projects to produce parts. In addition, assistance in conducting feasibility studies has been requested. The services of the experts should be provided from 1972 to 1975 for a total of three man/years.

For the development of the shipbuilding and repair industry experts have been requested in the fields of design and the modification of shipyards, the formulation of projects for the manufacture of parts of ships and to undertake an export market study for these products. The services of the experts are estimated for three man/years.

The technical co-operation requested from UNDP for these five industrial development projects is valued at US \$570,000 from 1972 to 1976. The contribution of the Government will be US \$1.5 million. The Sectorial Planning Office of the Ministry of Industry and Commerce is responsible for these projects.

Uruguay

It is expected that the Government of Uruguay will request UNIDO to undertake a general survey of the metal-working industries of the country, including the possibility of the local manufacture of agricultural machinery and implements, transport equipment, electrical and electronic products. UNIDO has made proposals concerning this matter in the Country Programme, which are under consideration by the Government.

Early in 1973, a Maintenance Week will be held in Uruguay. The Government has already appointed the counterpart authority, the Productivity Centre and a liaison officer. It is expected that, as a result, more comprehensive aid would be provided to Uruguay by UNIDO in this field.

Venezuela

The services of a UNIDO expert in the maintenance and repair of industrial equipment were provided from 1967 to 1971.

At the present the installed capacity utilized is only about 48 per-cent and it is expected that UNIDO will advise local manufacturers on the better utilization of plant capacities.

Taking into account that the Venezuelan Development Corporation and the Venezuelan Corporation of Guyana promote the establishment of new enterprises for the manufacture of machine tools, industrial motors, material handling equipment and other products, UNIDO could provide assistance in the establishment of new enterprises.

The Expert Group Meeting on Agricultural Machinery Industry in Developing Countries, held in 1967 in Vienna advised UNIDO to assist Venezuela in the design and adaptation of production techniques, quality control, testing and technical services for tractors and other agricultural machinery and implements.

An expert engaged under the SIS programme advised the Government on the quality control and standardization of automotive parts.

In order to provide inexpensive fishing boats to the small-scale fishermen on the Venezuelan coast, the use of ferro-concrete boats was suggested. These boats are easy to maintain, withstand tropical conditions and are immune to fungus and borer insect damage. They are easily built with semi-skilled labour and local materials such as cement, fine sand, additive, rod, pipe and chicken wire mesh.

A pilot shipyard for the building of ferro-concrete fishing boats has been suggested for Venezuela. This shipyard could be established with a regional centre, where fellows from neighbouring countries could undertake training courses in ferro-concrete boat building.

In connexion with the planned expansion of the telecommunication network of Venezuela, UNIDO will provide SIS assistance to investigate the possibility of the domestic manufacture of telecommunication equipment.

Annex 1

This Annex covers engineering industries in accordance with the groups of metal products including metalworking machinery; transport equipments; and agricultural machinery and implements. It also indicates the functions arising from the development of engineering products.

ENGINEERING INDUSTRIES

MECHANICAL

Metal Products
1.

Metalworking Machinery and Equipment
2.

Transportation Equipment
3.

Agricultural Machinery and Implements
4.

Other Machinery

ELECTRICAL

Power

Electronics

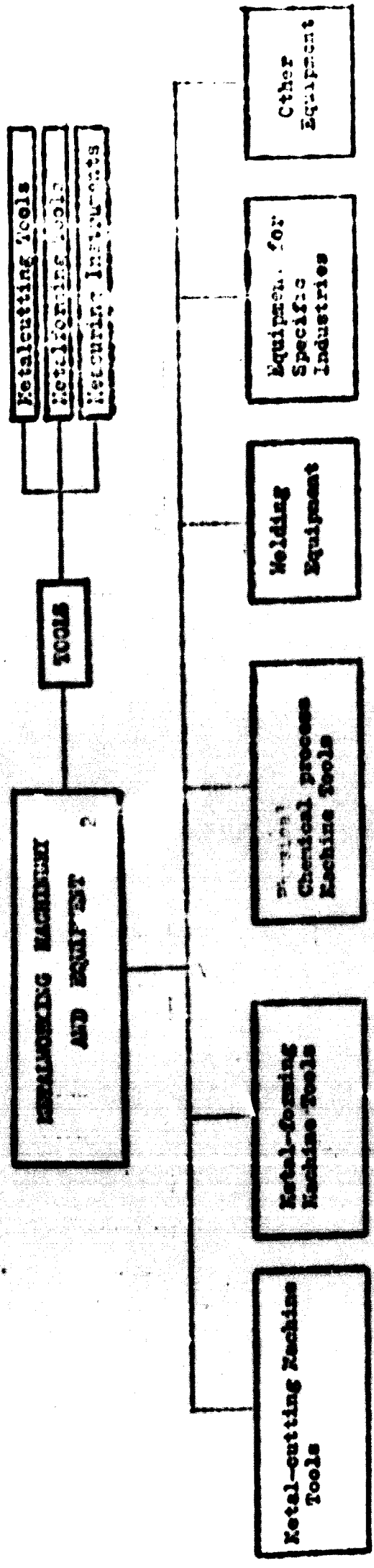
Final Products

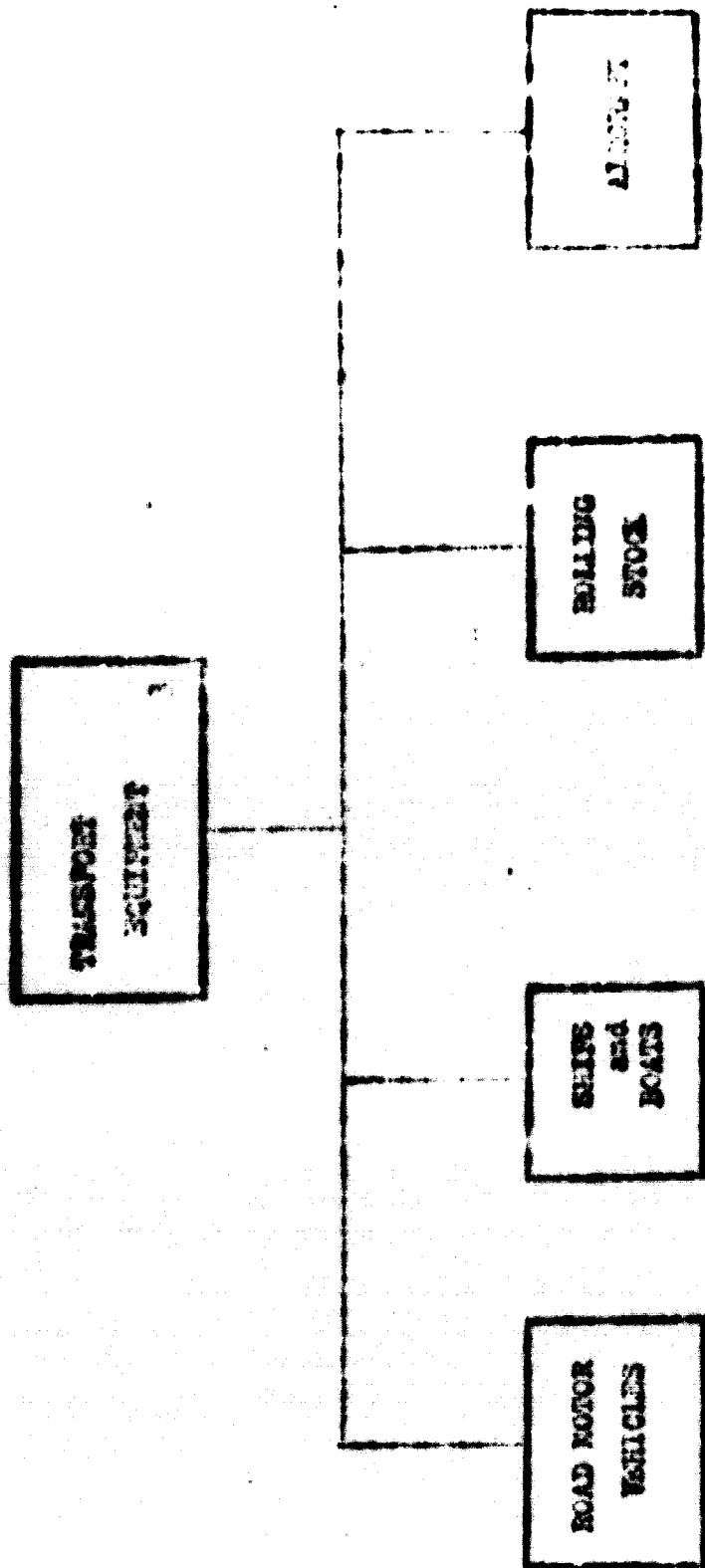
For Industry

- Plated structural parts
- Structures
- Local containers for storage and transport
- Auto products (excluding electric and fencing gates)
- Nuts, screws, nuts, bolts, rivets, etc.
- Forgings
- Other

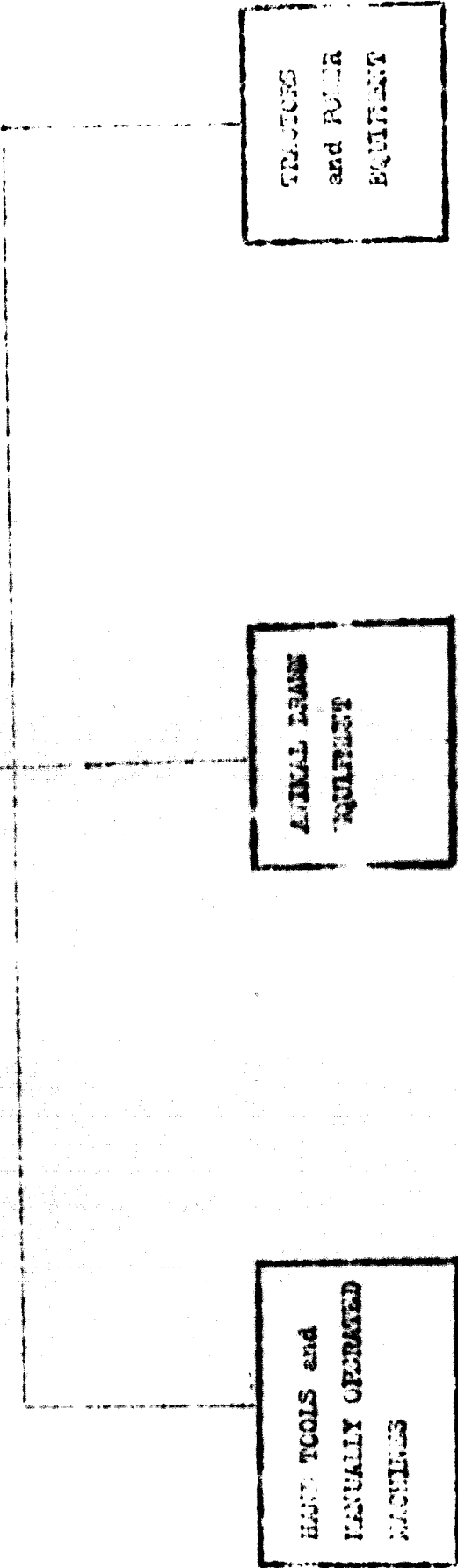
For the Consumer

- Cutlery
- Household equipment of base metal
- Door locks
- Hardware
- Aluminum items
- Motor operators
- Other





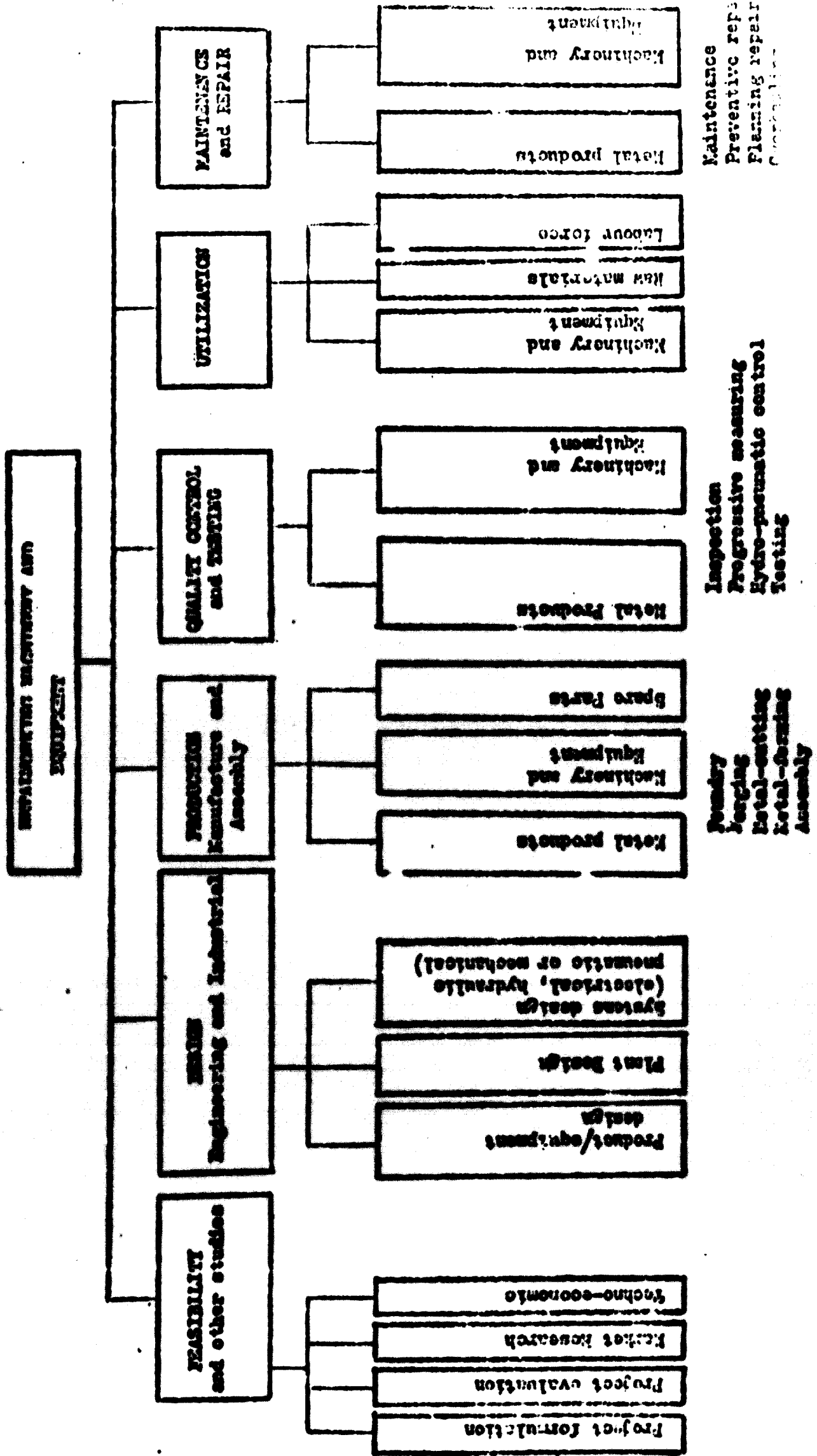
**AGRICULTURAL MACHINERY
and IMPLEMENTS** 4

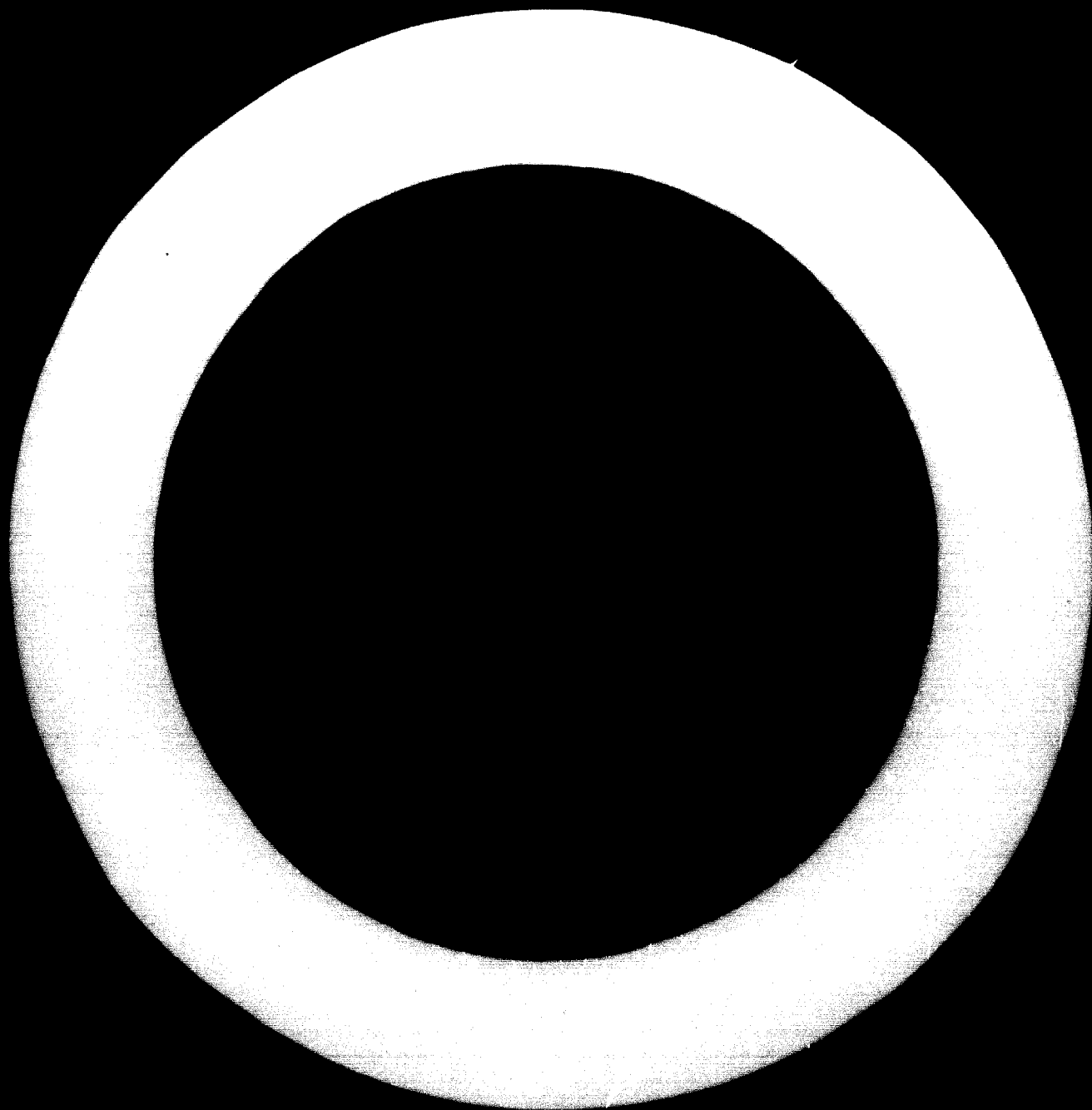


**HAND TOOLS and
MANUALLY OPERATED
MACHINES**

**ANIMAL DRAG
EQUIPMENT**

**TRACTORS
and POWER
EQUIPMENT**





ANNEX 2

This Annex contains tables of imports of engineering products
by the countries of Latin America.

TABLE 1
 TRADE IN ENGINEERING PRODUCTS BY
 COUNTRY OF LATIN AMERICA ✓

Country	Total Engineering Products		Non-Electrical Machinery		Electrical Machinery		Transport Equipment	
	1967	1969	1967	1969	1967	1969	1967	1969
Argentina	326.3	517.1	175.3	305.4	42.8	88.1	109.1	154.6
Bolivia	59.2	64.0	25.0	32.7	9.6	11.5	17.6	20.2
Brazil	498.4	833.8	292.7	474.4	95.7	167.1	105.1	192.2
Chile	315.2	355.0	165.5	193.0	46.1	66.0	103.4	94.6
Colombia	204.6	287.3	98.5	128.2	24.7	49.9	71.4	109.1
Costa Rica, El Salvador, Nicaragua	132.3	138.5	55.3	64.6	28.1	26.8	48.9	47.2
Cuba	288.6	458.9	132.5	216.8	30.5	36.7	95.2	116.4
Dominican Republic	48.0	70.6	24.7	32.4	8.7	12.4	14.6	25.1
Ecuador	78.3	82.3	41.9	39.7	16.1	15.3	20.2	27.1
Guatemala	56.5	60.7	24.0	28.2	9.4	10.7	23.1	21.4
Haiti	5.3	8.9	1.8	3.4	0.9	1.9	2.5	4.1
Honduras	40.2	47.4	18.6	21.0	6.1	6.2	15.4	20.1
Mexico	978.8	1140.8	497.9	580.5	183.8	242.4	297.1	317.2
Panama + Canal Zone	160.3	287.6	28.2	32.5	29.0	34.8	103.1	220.1
Paraguay	23.5	24.9	7.4	10.6	6.2	3.5	9.3	10.1
Peru	290.9	257.2	140.1	111.6	47.3	46.2	103.6	99.1
Surinam	30.2	26.4	14.6	11.9	7.0	5.7	3.6	8.1
Uruguay	14.9	58.8	18.8	34.6	5.1	10.3	11.1	13.1
Venezuela	500.8	648.5	232.3	328.5	99.0	116.8	169.1	201.1
West Indies 2/	148.6	206.3	69.3	85.9	31.8	46.3	47.5	74.1
Other Countries 3/	253.5	307.3	89.0	105.9	49.1	65.4	115.4	136.1
Imports by countries of Latin America	4467.4	5918.0	2158.7	2845.5	787.2	1067.4	1485.5	1916.1
TOTAL WORLD IMPORT	55521.8	76378.0	24826.9	32077.5	10223.4	14135.0	19508.5	28842.1

1/ The Bulletin of Statistics on World Trade in Engineering Products - 1967 and The Bulletin of Statistics on World Trade in Engineering Products - 1969. The countries of Central America and the West Indies are included in the table.

2/ Antigua, Barbados, Dominica, Granada, Jamaica, Montserrat, Nevis and Aguilla, St. Christopher, St. Lucia, St. Vincent, Trinidad and Tobago.

3/ Bahama Islands, Bermuda, Guyana, British Honduras, Falkland Islands (Malvinas), French Guiana, Guadeloupe, Martinique, Puerto Rico, Netherlands Antilles, St. Pierre and Miquelon and Virgin Islands.

IMPORTS OF NON-ELECTRICAL MACHINERY BY
COUNTRIES OF LATIN AMERICA ^{1/}

Millions of US Dollars, C.o.b.

Country	Metalworking Machinery		Machinery Tools		Power Generating Machinery		Agricultural Machinery	
	1967	1969	1967	1969	1967	1969	1967	1969
Argentina	21.3	24.2	12.6	19.2	23.8	43.8	6.5	13.7
Bolivia	0.5	0.4	0.4	0.4	2.9	3.5	3.4	3.6
Brazil	33.8	36.6	27.5	31.7	41.4	66.4	25.0	41.7
Chile	8.8	10.4	6.4	6.8	14.4	23.3	18.1	16.4
Colombia	3.6	4.4	2.0	3.6	16.0	20.0	8.1	17.3
Costa Rica, El Salvador, Nicaragua	1.6	2.2	1.4	1.8	4.6	6.6	7.9	5.1
Cuba	1.9	2.0	1.4	1.4	8.9	18.6	36.6	73.5
Dominican Rep.	1.1	0.7	0.6	0.6	2.8	5.0	4.4	4.8
Ecuador	1.0	1.0	0.9	0.8	5.8	4.8	2.3	6.4
Guatemala	1.0	0.7	0.9	0.4	3.4	2.9	2.3	4.0
Haiti	-	0.1	-	-	0.5	0.6	0.1	0.2
Honduras	0.4	0.3	0.3	0.3	1.9	2.0	2.1	3.3
Mexico	40.0	59.3	33.1	39.1	70.3	80.0	36.2	45.3
Panama + Canal Zone	1.3	0.5	1.3	0.4	3.2	3.6	1.2	4.4
Paraguay	0.2	0.3	0.2	0.3	1.1	1.5	0.7	3.3
Peru	6.1	6.6	3.6	3.0	19.3	19.0	7.5	4.1
Surinam	0.1	0.1	0.1	0.1	1.6	1.1	1.1	2.3
Uruguay	0.3	0.3	0.2	0.3	2.0	5.5	4.7	5.1
Venezuela	9.5	15.1	6.9	9.8	30.6	34.4	19.1	27.0
West Indies ^{2/}	1.5	2.2	1.2	1.3	9.7	10.9	4.6	6.6
Other Latin America ^{3/}	1.5	1.3	1.2	0.7	11.0	17.1	6.4	8.6
Imports by countries of Latin America	136.1	170.4	104.0	123.5	274.7	371.2	148.5	296.7
WORLD TOTAL	2153.3	2668.5	1714.7	2,334	3339.9	4212.4	2257.7	2650.6

^{1/} The Bulletin of Statistics on World Trade in Engineering Products - 1967 and
The Bulletin of Statistics on World Trade in Engineering Products - 1969.

^{2/} Antigua, Barbados, Dominica, Granada, Jamaica, Montserrat, Nevis and Anguilla,
St. Christopher, St. Lucia, St. Vincent, Trinidad and Tobago

^{3/} Panama Islands, Bermuda, Guyana, British Honduras, Falkland Islands (Malvinas),
French Guiana, Guadeloupe, Martinique, Puerto Rico, Netherlands Antilles,
St. Pierre and Miquelon and Virgin Islands



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IMPORTS OF MECHANICAL MACHINERY BY
COUNTRIES OF LATIN AMERICA ✓

Millions of US Dollars, C.I.F.

Country	Office Machinery		Textile and Leather Machinery		Special Industrial Machinery		Other Special Machinery	
	1967	1969	1967	1969	1967	1969	1967	1969
Argentina	19.5	25.1	16.3	29.7	24.8	64.0	63.3	103.9
Bolivia	1.2	1.7	1.7	3.5	7.6	10.6	7.3	0.7
Brazil	32.5	38.4	30.0	60.5	48.7	69.4	46.4	170.4
Chile	9.4	6.6	25.8	14.3	34.3	44.7	55.7	77.4
Colombia	4.5	5.2	13.0	17.9	18.3	20.2	34.0	41.8
Costa Rica, El Salvador, Nicaragua	3.5	3.3	7.3	8.5	8.5	10.3	21.2	28.0
Cuba	0.2	2.0	5.3	3.7	43.0	60.1	16.5	46.9
Dominican Rep.	1.0	1.1	1.2	1.2	5.0	6.2	0.2	13.5
Ecuador	1.6	1.4	5.4	3.7	10.3	8.9	15.6	13.7
Guatemala	1.5	1.7	3.2	3.5	3.9	5.8	8.6	9.6
Haiti	-	0.1	0.3	0.6	0.3	0.6	0.6	1.2
Honduras	0.9	0.8	0.8	0.9	3.4	5.8	9.0	7.9
Mexico	31.0	45.3	61.9	75.5	72.4	78.5	186.0	194.6
Panama - Canal Zone	2.3	1.9	1.2	2.4	6.8	6.3	12.0	13.4
Paraguay	0.4	0.4	0.8	0.8	1.1	1.2	2.9	3.3
Peru	7.5	3.6	16.5	13.7	11.8	18.5	51.5	47.2
Suriname	0.3	0.3	0.2	0.2	5.3	2.7	5.8	5.3
Uruguay	1.2	0.7	3.4	2.5	2.5	13.9	4.6	6.4
Venezuela	16.0	16.0	13.8	17.7	38.9	46.6	105.0	171.6
West Indies ✓	2.8	5.0	1.6	3.7	13.5	17.2	34.8	40.4
Other Latin America ✓	4.1	5.9	1.8	2.1	18.8	14.2	45.4	56.7
Imports by countries of Latin America	140.6	166.0	212.4	257.4	399.6	509.3	798.4	1074.2
WORLD TOTAL	2299.6	3093.4	2100.5	2787.9	3381.8	4445.0	9303.4	12285.2

✓ The Bulletin of Statistics on World Trade in Engineering Products - 1967 and
 ✓ The Bulletin of Statistics on World Trade in Engineering Products - 1969.

✓ Antigua, Barbados, Dominica, Granada, Jamaica, Montserrat, Nevis and Anguilla,
 St. Christopher, St. Lucia, St. Vincent, Trinidad and Tobago

✓ Bahama Islands, Bermuda, Guyana, British Honduras, Falkland Island (Malvinas),
 French Guiana, Guadeloupe, Martinique, Puerto Rico, Netherlands Antilles,
 St. Pierre and Miquelon and Virgin Islands

TABLE 3

IMPORT OF TRANSPORT EQUIPMENT BY
COUNTRIES OF LATIN AMERICA ^{1/}

Millions of US Dollars, f.o.b.

Country	Railway Vehicles		Road Motor		Road Vehicles other than motor cycles		Aircrafts		ships boats	
	1967	1969	1967	1969	1967	1969	1967	1969	1967	1969
Argentina	8.4	19.2	58.5	76.1	0.2	1.3	28.3	47.1	12.7	9.3
Bolivia	0.7	0.4	15.7	14.9	0.6	0.7	0.5	4.6	-	0.1
Brazil	35.8	9.2	27.7	42.1	0.7	0.8	32.1	92.6	8.8	47.7
Chile	7.4	6.3	72.5	66.9	1.5	1.5	15.4	12.8	6.6	6.2
Colombia	0.7	15.4	50.5	74.8	0.6	0.8	16.6	15.2	3.2	2.2
Costa Rica, El Salvador Nicaragua	0.9	1.0	33.8	37.7	1.2	1.2	12.4	6.1	0.8	1.0
Cuba	2.3	2.5	62.5	52.9	5.3	10.3	14.3	6.6	11.1	41.9
Dominican Republic	0.3	0.4	12.4	19.4	1.0	1.1	0.9	4.7	0.1	-
Honduras	0.1	0.6	17.6	21.1	0.4	0.7	1.4	2.8	0.8	-
Paraguay	0.1	0.3	19.1	19.5	1.5	0.7	2.0	1.2	0.5	0.2
Puerto Rico	-	0.1	2.4	3.4	0.1	0.1	-	-	-	-
Venezuela	2.3	0.5	11.0	15.7	0.8	0.6	0.9	2.2	0.4	1.1
Mexico	23.0	36.5	199.5	240.9	1.9	2.6	35.6	23.2	37.1	5.7
Guatemala + Canal Zone	0.6	0.4	17.0	22.2	0.7	2.0	1.2	2.7	81.5	193.1
Uruguay	-	-	5.6	6.9	0.1	0.1	0.5	3.4	1.6	0.3
Peru	3.2	1.9	82.7	52.6	2.0	0.6	10.0	12.7	5.7	11.6
Trinidad	0.1	0.1	7.5	7.6	0.5	0.4	0.1	0.1	0.4	0.6
Paraguay	0.1	0.1	7.2	12.2	0.2	0.4	1.3	0.8	2.2	0.5
Venezuela	3.3	1.2	141.0	17.4	3.0	2.8	18.8	22.1	3.1	4.6
West Indies ^{2/}	1.7	1.2	38.5	50.7	1.1	1.3	2.2	18.8	4.0	2.1
Other Countries ^{3/}	1.1	0.8	54.2	73.4	2.7	3.2	7.5	13.5	49.9	45.2
Exports by countries of Latin America	92.1	94.4	938.1	1095.0	26.2	33.3	202.0	211.4	234.9	195.5
TOTAL WORLD IMPORT	249.2	1013.5	12577.1	19304.1	388.7	46.7	2631.9	3244.7	2961.5	3020.1

The Bulletin of Statistics on World Trade in Engineering Products - 1967 and
The Bulletin of Statistics on World Trade in Engineering Products - 1969.
The countries of Central America and West Indies are included in the table.

Antigua, Barbados, Dominica, Granada, Jamaica, Montserrat, Nevis and Anguilla,
St. Christopher, St. Lucia, St. Vincent, Trinidad and Tobago.

Bahama Islands, Bermuda, Guyana, British Honduras, Falkland Islands (Malvinas),
French Guiana, Guadeloupe, Martinique, Puerto Rico, Netherlands Antilles,
St. Pierre and Miquelon and Virgin Islands.

IMPORTS OF ELECTRICAL MACHINERY
BY COUNTRIES OF LATIN AMERICA ¹

Millions of US Dollars, f.o.b.

Country	Electrical Power Machinery		Equipment for Distribution of Electricity		Telecommunication Apparatus		Domestic Electrical Equipment		Medical Apparatus		Other Electrical Machinery	
	1967	1969	1967	1969	1967	1969	1967	1969	1967	1969	1967	1969
Argentina	9,6	23,1	0,9	2,3	9,3	20,8	0,6	1,0	1,7	3,9	20,3	22,0
Bolivia	1,8	3,7	1,3	1,1	3,0	2,1	1,0	0,9	0,1	0,1	2,3	2,0
Brazil	37,0	47,4	1,0	2,2	23,9	33,0	0,5	1,2	2,9	6,2	29,3	31,0
Chile	14,2	24,4	2,0	5,0	13,0	18,8	1,0	1,1	0,6	1,5	13,6	17,0
Colombia	11,5	15,4	1,9	1,0	11,4	10,2	0,8	0,7	0,5	0,5	8,0	11,0
Costa Rica, El Salvador, Nicaragua	6,6	6,7	1,8	3,2	8,6	6,8	4,4	4,1	0,5	0,5	5,5	6,0
Cuba	14,6	11,2	3,6	4,0	3,5	3,8	2,1	2,1	1,0	1,0	6,0	6,0
Dominican Republic	3,3	1,7	0,6	0,7	1,6	2,1	1,0	1,3	0,2	0,2	1,9	2,0
Ecuador	4,9	3,0	0,9	1,0	3,9	4,0	1,5	1,5	0,7	0,5	3,8	2,0
Guatemala	2,6	3,4	0,4	0,5	2,7	3,0	1,2	1,1	0,1	0,1	2,1	2,0
Haiti	0,2	0,4	0,1	0,1	0,1	0,2	0,1	0,2	-	-	0,3	0,0
Honduras	1,8	1,7	0,4	0,3	1,8	1,4	0,9	0,8	0,1	0,2	1,0	1,0
Mexico	44,4	53,7	6,9	10,5	73,6	74,8	4,6	5,7	2,5	3,0	51,1	50,0
Panama - Canal Zone	2,3	3,3	0,2	1,4	19,9	21,3	2,5	4,8	0,2	0,2	2,8	2,0
Paraguay	2,8	1,4	0,8	0,2	0,8	0,4	0,5	0,3	0,1	0,1	1,0	0,0
Peru	15,0	14,4	3,1	1,9	2,1	15,4	4,5	3,1	1,0	0,5	11,8	10,0
Surinam	1,8	1,2	0,4	0,4	1,9	1,5	0,7	0,2	-	-	1,0	1,0
Uruguay	1,4	2,9	0,4	1,2	1,4	1,1	0,2	0,1	0,2	0,2	1,3	1,0
Venezuela	26,1	33,1	2,5	2,1	27,1	30,1	16,5	20,2	0,9	1,5	23,2	20,0
West Indies ^{2/}	9,9	9,1	4,1	2,5	6,8	16,0	4,3	5,0	0,2	0,2	6,0	9,0
Other Countries	12,9	14,3	6,3	7,4	11,7	13,4	6,7	8,1	0,4	0,6	9,3	10,0
Imports by countries of Latin America	277,7	293,1	40,5	52,3	235,8	240,8	57,5	64,0	12,0	11,4	100,1	102,0
TOTAL WORLD IMPORT	640,0	705,0	122,4	129,0	517,6	576,0	138,0	136,8	20,0	19,0	100,0	100,0

¹ The Bulletin of Statistics on World Trade in Engineering Products - 1967 and The Bulletin of Statistics on World Trade in Engineering Products - 1969.
^{2/} The countries of Central America and West Indies are included in the table.

Antigua, Barbados, Dominica, Granada, Jamaica, Montserrat, Nevis and Anguilla, St. Christopher, St. Lucia, St. Vincent, Trinidad and Tobago.

Bahama Islands, Bermuda, Guyana, British Honduras, Falkland Islands (Malvinas), French Guiana, Guadeloupe, Martinique, Puerto Rico, Netherlands Antilles, St. Pierre and Miquelon and Virgin Islands.

ANNEX 3

This Annex contains samples of typical job descriptions for UNIDO experts. These job descriptions might form a basis of a request for assistance in any of the following fields:

1. General survey of metalworking industries
2. General survey of machine tools
3. Selection and utilization of machine tools
4. Maintenance and repair of machine tools
5. Development of tools, dies, jigs and fixtures
6. Introduction of welding techniques
7. Introduction of NC machine tools

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of
for Special Industrial Services 1/

Job Description

PGT TITLE: Expert to carry out a general survey of the metalworking industry

DURATION: Six months with possible extension

DATE REQUIRED: As soon as possible

DUTY STATION: *

PURPOSE OF PROJECT: To assist the Government in making general surveys of metalworking industries in the country and to study the possibility of the establishment of a Metalworking Industrial Design Centre (MIDC).

DUTIES: The expert, in collaboration with local officials, is expected to:

- a) study the existing situation in the field of the design and production of dies, jigs, tools and other related industrial equipment in the metalworking industry;
- b) formulate and recommend a long-term program for the development of the metalworking industry;
- c) study the possibility of the establishment of a Metalworking Industry Development Centre which will serve the local industry in improving of the quality of production.

QUALIFICATIONS: Mechanical engineer with experience in metalworking industry.

LANGUAGE: *

BACKGROUND INFORMATION: The UNIDO Regional Seminar on Machine Tools for the countries of the region held in 1972 stressed the importance of the development of metalworking industries in the countries of the region. The Government is requesting UNIDO technical assistance in the establishment of a Metalworking Industry Development Centre. The purpose of the Centre is to identify product lines to be developed or to be adopted; design and prototype production, quality control, testing and cost analysis; the development of manufacturing techniques and processes; the selection, development, utilization, maintenance and repair of machine tools and instruments, to provide technical services to local industries in the design and development of specific products.

Note: It is desirable that the Government should supply additional information on the status and plans for the industry.

1/ Request to be submitted through the UNDP Resident Representative residing in the respective country.

* To be completed by the Government.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of

for Special Industrial Services 1/

Job Description

POST TITLE: Expert to carry out a general survey of machine tools

DURATION: Six months with possible extension

DATE REQUIRED: As soon as possible

DUTY STATION: *

PURPOSE OF PROJECT: To assist the Government of * in the assessment of the stock of machine tools in the country taking into consideration the development of metalworking and other industries.

DUTIES: The expert, in co-operation with the respective government body will be expected to:

- a) study the existing stock of machine tools and the plans for metalworking and other industries;
- b) investigate the demand, production, import and possible export of machine tools;
- c) select machine tools by types to be imported and/or produced;
- d) recommend future UNIDO long term assistance in this field.

QUALIFICATIONS: Industrial Engineer or Economist with experience in the machine tool industry

LANGUAGES: *

BACKGROUND INFORMATION: The UNIDO Regional Seminar on Machine Tools for Countries of Latin America held in 1972, stressed the importance of availability of machine tools for industrial development. The Government decided to study the existing stock of machine tools in the country to discuss the kind of equipment required for the successful development of local industries;

UNIDO technical assistance is requested in order to make general surveys of the machine tools available in the country.

Note: It is desirable for the Government to supply additional information on the status and plans for the industry

1/ Request to be submitted through the UNDP Resident Representative residing in the respective country.

* To be completed by the Government.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of

for Special Industrial Services ✓

Job Description

POST TITLE: Expert in the selection and utilization of machine tools

DURATION: Six months with possible extension

DATE REQUIRED: As soon as possible

DUTY STATION: *

PURPOSE OF PROJECT: To assist the Government of * in the selection and utilization of machine tools, through an evaluation of the production lines.

DUTIES: The expert is expected to assist local enterprises to:

- examine machine tools by size and type through an evaluation of the production lines;
- identify the causes of the underutilization of machine tools;
- make recommendations on the proper selection and use of machine tools in order to increase productivity and improve the quality of production;
- train local personnel in proper utilization of machine tools.

QUALIFICATIONS: Mechanical Engineer with experience in utilization of machine tools

LOCATION: *

BACKGROUND INFORMATION: The UNIDO Regional Seminar on Machine Tools for Countries of Latin America held in 1972, noted an approximate 50 percent utilization of the machine tools in the countries of the region. This underutilization causes unnecessary expenditure and an increase in the stock of machine tools requiring additional servicing, maintenance and repair.

The Government is requesting UNIDO technical assistance in order to improve the situation concerning underutilization.

Note: It is desirable for the Government to supply additional information on the status and plans for the industry.

✓ Request to be submitted through the UNDP Resident Representative residing in the respective country.

* To be completed by the Government.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of

for Special Industrial Services ✓

Job Description

POST TITLE: Expert in the maintenance and repair of machine tools

DURATION: Six months with possible extension

DATE REQUIRED: As soon as possible

DUTY STATION: *

PURPOSE OF PROJECT: To assist the Government of * in the organization of services for the maintenance and repair of machine tools.

DUTIES: The expert will be attached to the Government organization and is expected to:

- a) study the existing maintenance and repair services for machine tools;
- b) make recommendations on means of improving these services;
- c) study the possibility of the establishment of a machine tool re-building centre;
- d) train local personnel in the maintenance and repair of machine tools.

QUALIFICATIONS: Mechanical engineer with experience in the maintenance and repair of machine tools.

LANGUAGE: *

BACKGROUND INFORMATION:

The UNIDO Regional Seminar on Machine Tools for Countries of Latin America held in 1972, stressed the importance of establishing proper maintenance and repair services for machine tools. In order to keep equipment in permanent working order with the minimum expenditure of time and resources, it is necessary to institute a repair and maintenance system in the country. Realizing the importance of such a project, the Government is requesting UNIDO technical assistance in this field.

Note: It is desirable for the Government to supply additional information on the status and plans for the industry.

1/ Request to be submitted through the UNDP Resident Representative residing in the respective country.

* To be completed by the Government.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of *

for Special Industrial Services 2/

TECHNICAL SUMMARY

- POST TITLE:** Expert in tools, dies, jigs and fixtures
- DURATION:** six months with possible extension
- DATE REQUIRED:** as soon as possible
- DUTY STATION:** *
- PURPOSE OF PROJECT:** To assist the Government of * in the development of the local production of tools, dies, jigs and fixtures.
- DUTIES:** The expert, in collaboration with the respective Government department, will be expected to:
- (a) study the requirements of the country in tools, dies, jigs and fixtures;
 - (b) assist in the design, adaptation and production of tools, dies, jigs and fixtures;
 - (c) make recommendations on the choice and use of the correct materials for tools and dies;
 - (d) study the possibility of the establishment of a centre for the design and prototype production of tools and dies;
 - (e) train local personnel in the use of modern technology for the production of the above mentioned tools.
- QUALIFICATIONS:** Mechanical engineer with extensive experience in the research, design and production of tools, dies, jigs and fixtures.
- LANGUAGES:** *
- BACKGROUND INFORMATION:** The Government has decided to develop its local tool producing industry, including the production of tools, dies, jigs and fixtures. Realizing the importance of establishing an independent centre with modern equipment for the manufacture of tools, dies, jigs and fixtures, their heat treatment and inspection, the Government is requesting UNIDO technical assistance for the project. It is expected that the Centre will train local personnel in the design and production of prototypes and in the use of dies and moulds, jigs and fixtures.
- Note:** It is desirable for the Government to supply additional information on the status and plans for the industry.

2/ Request to be submitted through the UNDP Resident Representative residing in the respective country

• To be completed by the Government

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of I.....

for Special Industrial Services

JOB DESCRIPTION

POST TITLE: Expert in Welding techniques
DURATION: six months with possible extension
DATE REQUIRED: as soon as possible
DUTY STATION: *
PURPOSE OF PROJECT: The Government wishes to develop the welding and brazing facilities in the country.
DUTIES: The expert is expected to:
(a) study the possibility of the development of welding by local enterprises;
(b) select welding equipment for local use;
(c) transfer the technological process to local enterprises;
(d) advise on the proper utilization of welding equipment;
(e) study the possibility of establishment of a welding centre;
(f) train local personnel.
QUALIFICATIONS: Mechanical engineering in welding
RELEVANT EXPERIENCE: Considerable experience in the field of the organization of welding works and the carrying out of feasibility studies.
LANGUAGE: *
BACKGROUND INFORMATION: Welding is a simple and cheap process of joining and cutting parts of machines. It can be of great use to developing countries in maintenance and repair as well as in the production of industrial, agricultural and transport equipment. As it is possible to produce welds with the same mechanical properties as the base material, welding is used extensively throughout industry. This technique reduces the weight of equipment and increases production. The process is simple, does not require highly qualified personnel and can be undertaken by any country.

Note: It is desirable for the Government to supply additional information on the status and plans for the industry.

Request to be submitted through the UNDP Resident Representative residing in the respective country.

to be completed by the Government.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
UNITED NATIONS DEVELOPMENT PROGRAMME

Request from the Government of
for Special Industrial Services

JOB DESCRIPTION

POST TITLE: Expert in numerical control machine tools
DURATION: six months with possible extension
DATE REQUIRED: as soon as possible
DUTY STATION: *
PURPOSE OF PROJECT: To assist the Government of * in the introduction of numerical control (NC) machine tools in the metal-working industries of the country, through an evaluation of the product lines.

DUTIES: The expert is expected to assist local manufacturers to:
(a) study the possibility of the introduction of NC machine tools;
(b) examine the possibility of the establishment of a NC Machine Tool Demonstration Centre;
(c) prepare a list of experts and equipment required for the activities of the Centre;
(d) identify the availability of local staff for employment by the Centre and participation in its training programme.

QUALIFICATIONS: Mechanical or Electrical Engineer with experience in NC machine tools.

LANGUAGES: *

BACKGROUND INFORMATION: Difficulties in metal-working could be settled to a certain extent, by the introduction of numerical control machine tools. The main advantages of NC which may be considered relevant in the country are:

- the improvement of quality;
- the elimination of jigs, fixtures and other expensive tooling, as well as the consequent reduction in setting-up time;
- the reduction of inspection and measuring instruments;
- greater accuracy and better reproduction;
- substantial reduction in human errors;
- the possibility of using less skilled operators.

In order to introduce modern techniques and to allow production engineers to see the practical application of numerical control under production conditions, to provide an advisory service on the selection of NC machine tools, the Government is requesting UNIDO technical assistance in studying the possibility of introducing machine tools into the country.

* Request to be submitted through the UNIDO Resident Representative residing in the respective country.

* to be completed by the Government.





16. 7. 74