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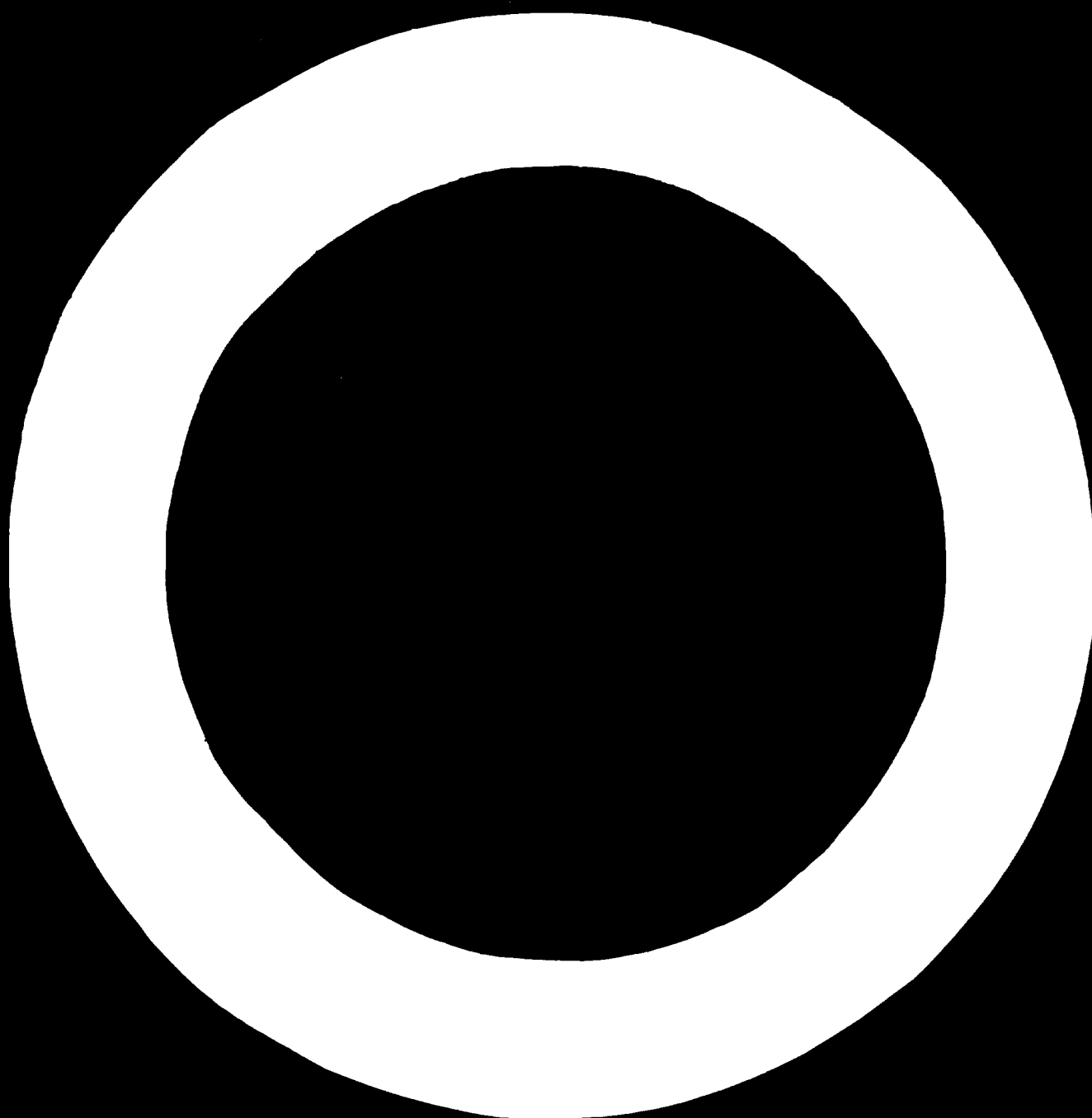
# Development of Metalworking Industries in Developing Countries

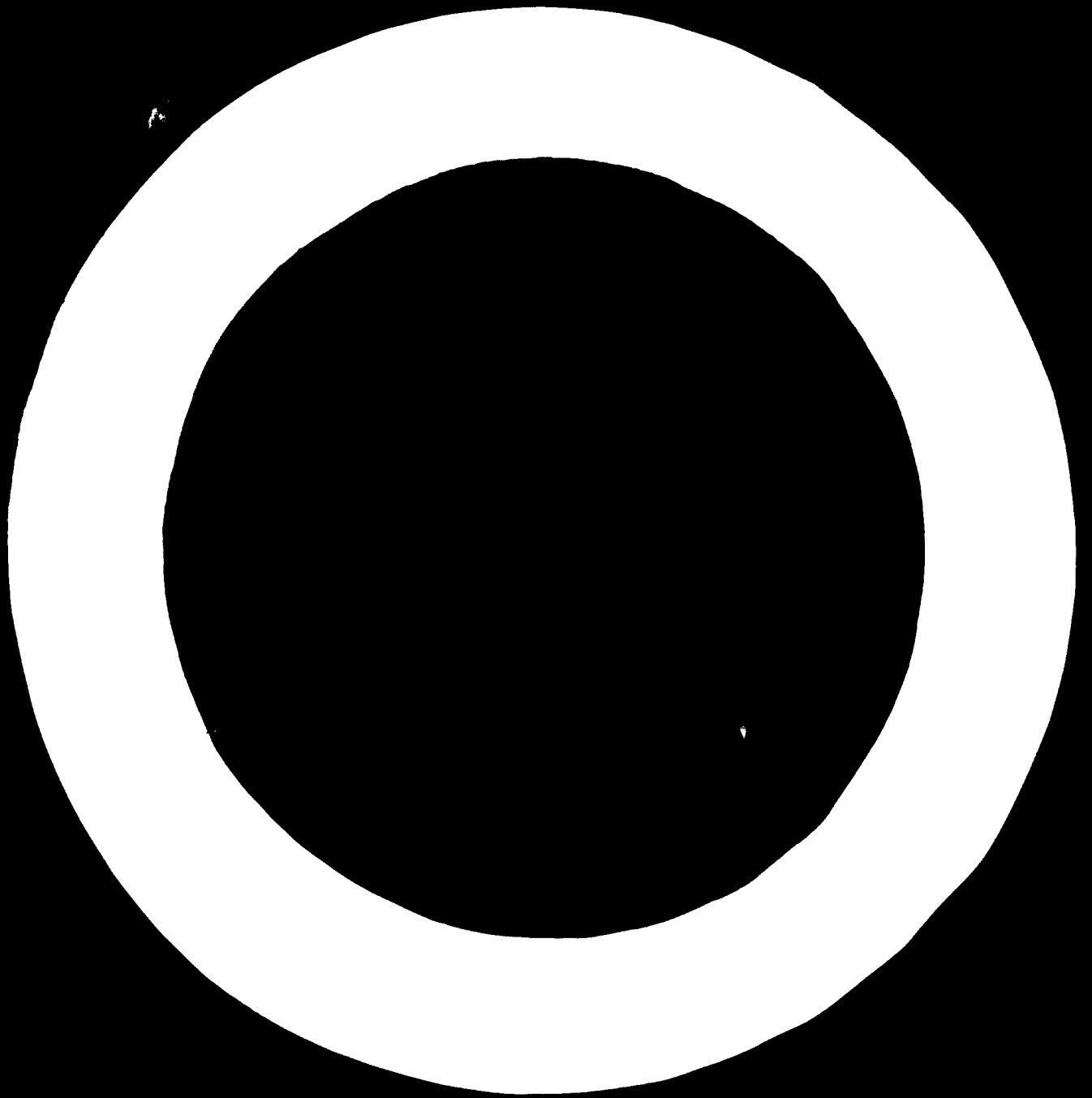
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## THE METALWORKING INDUSTRIES IN LATIN AMERICA

*Secretariat of the United Nations Economic Commission for Latin America*

The mechanical industries, including under this term the manufacturers of metal products, machinery and equipment, as well as electrical and transport material, represent almost 17 per cent of the total manufacturing industry in the region. With an aggregate value of some \$4,000 million, its contribution to the formation of the gross domestic product is slightly more than 4 per cent. In terms of employment, this activity maintains a labour force of nearly a million persons, or 15.6 per cent of the total occupied in the industrial sector of the area.

In view of the different levels of development in Latin American countries and the particular conditions of each of them, it is understandable that when taken individually they present great differences regarding these statistics as shown in table I. In this respect, it should be pointed out that although the figures are sufficiently illustrative, they do not provide further information on the situation among the countries. These statistics should therefore be taken with certain reserve; in many cases, particularly in

which together account for 90 per cent of the mechanical industries of the region. In these countries, import substitution of durable consumer goods has attained high levels and great progress has been made in the production of capital goods.

In the other countries, on the contrary, the limitation of national markets and other factors that will be mentioned later on have constituted serious obstacles for the expansion of this activity. In both groups of countries disequilibrium and maladjustment can be observed, in the evolution of the mechanical industries, which are an impediment to complementation and integration within the framework of a regional scheme.

In the larger countries, development has been rather spontaneous, leading in certain production lines towards an excessive concentration of manufacturers, with the consequent loss of the advantages of specialization or ill use of installed capacity; in others, this development has resulted in a shortage of supply of intermediate and

Table I

### MECHANICAL INDUSTRIES AND THEIR COMPOSITION IN SELECTED LATIN AMERICAN COUNTRIES, 1964

(Percentages)

	Participation of the mechanical industry		Composition of the mechanical industries			
	in the gross domestic product	in the manufacturing industry	ISIC 35 metal products	ISIC 36 machinery other than electrical	ISIC 37 electrical machinery and equipment	ISIC transport material
Argentina.....	8.5	26.3	25.1	24.3	12.8	37.8
Brazil.....	4.3	17.4	14.5	19.8	22.4	43.2
Colombia.....	1.7	9.4	38.1	9.3	25.8	26.8
Chile.....	2.4	12.5	37.3	19.3	19.3	24.1
Ecuador.....	0.9	5.8	37.5	12.5	12.5	37.5
Mexico.....	3.4	13.8	28.6	9.0	32.5	29.8
Peru.....	1.2	6.7	40.0	10.0	16.6	33.3
Uruguay.....	3.7	17.4	20.2	20.2	27.7	31.9
Venezuela.....	1.2	9.1	25.3	3.4	14.9	56.3
Others.....	0.6	3.6	31.1	12.6	8.4	47.9
Total Latin America.....	4.0	17.0	23.7	18.7	20.2	37.4

the medium and smaller countries, they represent services and mechanical maintenance rather than proper production. The scarcity and unreliability of available data is partly justified by the relatively short history of this activity in the region and the low degree of specialization existing in many mechanical plants.

The over-all evaluation of the mechanical industry, as shown in the table, evidently characterizes an activity which has reached a certain size and importance and is merely a reflection of the influence of the larger Latin American countries, Argentina, Brazil and Mexico,

semi-processed products. Furthermore, the rapidity with which this expansion process has been carried out has not permitted an accelerated adoption of the adequate institutional measures which should accompany the evolution of this activity. Among these are the training of labour and technological research.

On the other hand, medium and smaller countries present, in a greater or lesser degree, sharp deficiencies in their productive structure, a markedly backward technology and an almost complete lack of adequate mechanical infrastructure. In addition to this, in almost all

of these countries no plans or specific programmes exist for the development of this sector. Aside from economic and cost considerations, the possibility of starting the production of mechanical products, especially those which are particularly suitable for integration, is basically linked to prior knowledge of a series of procedures and manufacturing techniques which in turn require a significant supply of qualified manpower for practical and efficient application. Both conditions, technology and personnel training, are not easily or quickly acquired and demand a minimum training period, especially in the case of export products which must fulfil more exacting technical and qualitative specifications.

Domestic production provides nearly 60 per cent of the consumption of mechanical products in the area. This appraisal of the average situation in Latin America is certainly influenced by the strong participation of the larger countries of the region, which have been able to satisfy a great part of the consumption of both durable consumer goods as well as capital goods. In the medium and smaller countries, national production supplies consumer needs in varying proportions, which are in any case inferior to those for the larger countries, with the aggravation of a productive lag in relation to the latter vastly exceeding the one which would derive from the direct comparison of the sizes of the respective markets or other economic indicators.

The degree of expansion generally has been lower than the possibilities offered by their own markets, notwithstanding their limited size; the course followed by the mechanical industries has been disconnected, lacking orientation and a definite economic policy to foster development. As a reflection of all this, a series of weaknesses may be observed starting from the infrastructure to the very organization of firms.

On the evidence, it follows that these countries are seriously handicapped in their desire to enjoy, over a short period, the benefits of a regional integration of this activity and that they meet internal difficulties in resisting competition from the more advanced countries of the area.

This situation must be corrected in order to avoid a further accentuation of the existing differences which, besides separating these countries from the advantages of a common market, might even hamper their own process of internal economic development. The manufacture of exportable products could have more far-reaching importance for the future of the smaller countries than for the larger ones since, apart from reasons deriving from a trade balance deficit, the maintenance of strong and sustained industrial growth rates requires the concurrence of external markets to complement those national ones which, by themselves, do not have the capacity for it.

The development of the mechanical sector has been sustained to a great extent as a result of the increased activities of services and industrial maintenance and the starting of assembly activities for durable consumer goods and, to a lesser degree, the manufacture of certain mechanical products of simple construction for a ready market.

The future prospects of these countries are therefore closely connected to their formulation of adequate plans for the growth of the industries mentioned, the correction of their structural deficiencies and the elimination of their technological gaps. This should be done in such a way as to equip the industries with the necessary means of production to enable them, in addition to supplying the domestic market satisfactorily with the products that should be manufactured locally, to place themselves on a technical level which allows them to reach complementation or integration agreements with the other countries for the manufacture of more complex mechanical products. Such products will undoubtedly constitute a substantial part of future regional trade and some countries are already engaged in the formulation of national plans for the development of the mechanical sector with this orientation in view.

The studies carried out by ECLA in Uruguay and Venezuela,<sup>1</sup> as well as those in Colombia and Ecuador, reveal that the countries, in order to reach the goals envisaged, should follow different orientations in accordance with the stage and course their mechanical industries have attained up to now. Thus, for example, in Ecuador, Colombia and Venezuela where imports are fundamental for the supply of mechanical products (in Ecuador more than 80 per cent and in Colombia more than 70 per cent), import substitution would seem the most convenient attitude for the creation of this infrastructure and raising of the proposed technical level. In the case of Uruguay, with a more advanced process of import substitution which it would not be advisable to continue because of the size of its market, it has been estimated that the elevation of its technological level should be obtained on the basis of what already exists. Furthermore, in view of its geographic location and peculiar manpower characteristics, consideration should be given to the specialized manufacture of certain light mechanical precision products whose production in the area is just beginning or incomplete. This would mean launching a movement of effective national specialization to satisfy the Latin American market.

The programme outlined for Venezuela involves only import substitution for internal consumption with the sole aim of raising its technological level. At a later stage, once new manufacturing techniques have been incorporated, trained personnel is available and the country has familiarized itself with the processes of mechanical production, other activities oriented towards the Latin American market can be considered. In this respect, Venezuelan national organizations are undertaking a study for the creation of a specialized centre for longer-term manufacture of heavy machinery to supply the region.

It is only natural that in the field of construction of basic industrial equipment and machine tools as well as of capital goods in general, the major advances in the region should be apparent in countries with greater

<sup>1</sup> La industria mecánica del Uruguay: un programa para su recuperación y desarrollo (E/CN.12/743); La industria mecánica de Venezuela: un programa de sustitución de importaciones para su desarrollo (E/CN.12/737).

domestic markets. The studies in Argentina and Brazil<sup>2</sup> regarding the manufacture of equipment for basic industries have established that in these countries such manufacture has reached significant proportions in supplying present consumption of these goods and that a certain manufacturing capacity, sufficiently ample to cover a substantial part of the demand forecasts, is available for 1970 as shown in table 2.

Table 2

PROPORTION OF BASIC EQUIPMENT DEMAND WHICH SHOULD BE SUPPLIED BY NATIONAL PRODUCTION BETWEEN 1961 AND 1970

(Percentages of value)

	Argentina	Brazil
Petroleum refining and petrochemicals . . .		
Petroleum and gas exploitation and distribution . . . . .	89 <sup>a</sup>	65
Electrical energy generation . . . . .	22	86
Steel industry . . . . .	45	77
Paper and pulp . . . . .	84	89
Naval construction . . . . .	75	. . <sup>b</sup>
Cement . . . . .	. . <sup>c</sup>	62

<sup>a</sup> The high percentage indicated results from the inclusion of pipe for the development and distribution of petroleum and gas that were not considered in the case of Brazil, and which during the period covered by the study should rise to nearly 68 per cent of the value of the required equipment.

<sup>b</sup> This sector was not included in the study, but it is known that the capacity of the Brazilian naval industry is sufficient to meet the needs of the country and that the national parts incorporated into ships actually built amount to 75 per cent of the value.

<sup>c</sup> This sector was not considered in Argentina because at the time of the study the cement industry was already undergoing an expansion of considerable size.

The problem of these countries in connexion with the supply of a high percentage of the greater future internal demands is an improved utilization of the existing manufacturing capacity, the investments for which should not be particularly significant. Nevertheless, a series of measures should be adopted to eliminate certain obstacles which limit their development at both the national and the regional market levels.

Almost all of them originate in the absence of a development programme, either at a general or sectoral level. Lack of goals, ignorance of the domestic market and its future evolution and, in general, absence of a definite economic policy to stimulate and help the development of this manufacture (for while it is strictly mechanical with regard to supply, on the side of demand it is intimately linked to the industrial and economic growth of the country) are the principal causes that explain the situation in which this industry has evolved.

As a consequence, the incorporation of new manufacturing techniques has been slow; the training of qualified personnel at all levels has been rather circumstantial and according to the needs, since the existing training programmes have not included a timely appraisal of the factors which would orientate them to quantities and specialities required in the future. Installed capacity is often badly distributed between intermediate and final products and, among the latter, excessively concentrated in a few lines of manufacture; its utilization has been generally deficient because of the irregularity of demand

which accumulates in certain periods, even surpassing the local manufacturing capacity, while in the other it is totally absent. Finally, the credit and financing systems have not been constructed organically to provide for the needs of this manufacture. Regarding this aspect, various measures have been taken towards finding a solution to the problem.

Thus, in Brazil for example, with the collaboration of international credit organizations and the complementation of domestic and foreign resources, a financial fund has been established for the acquisition of industrial machinery and equipment which covers up to 60 per cent of the value of the transaction for a period of two to five years. On the other hand, the Inter-American Development Bank has dictated a ruling on the financing of intraregional exports of capital goods designed to place the Latin American exporter in a position competitive with suppliers from other areas.

The manufacture of machinery and equipment for basic industries is a rather heterogeneous sector and includes a wide and varied range of products, which makes it difficult to enter into general considerations equally valid for all of them. However, these products can be separated in two major categories: those which, because of their more or less widespread use in many activities, are produced in large series and constitute standard or catalogued products such as pumps, valves, electric motors, etc., and those which are specific of a certain manufacture, generally "made to order".

Although many of the preceding considerations may be applied to both groups, the majority refer to the last category of products. These products constitute an important part in the supply of industrial installations and, at the same time, form an activity of a complex operational structure which requires for its efficient development and operation the co-ordinated action of a series of measures.

Machine tools, on the other hand, integrate another type of capital goods whose manufacture in Latin America has achieved considerable progress in meeting demand, particularly in Argentina and Brazil, though in smaller proportions than basic equipment.<sup>3</sup> The figures in table 3 show the levels of supply and their structure in both countries. It may be verified that, besides the fact that Brazilian production is slightly higher than in Argentina, no outstanding differences exist between the two countries in product composition, at least at this aggregate level, which reveal tendencies towards specialization in either of the countries.

In both cases, lathes and drills represent nearly 80 per cent of the units manufactured in the category of metal-cutting machines, and presses slightly more than 70 per cent of metal-forming machines. The evolution followed in these countries has been similar and presents many characteristics in common, it has been possible to establish from studies in those countries.

The development of this sector is limited by the same factors for basic industrial equipment, but here they present different shades and have repercussions that in

<sup>2</sup> Estudio sobre la fabricación de equipos industriales de base en la Argentina (E/CN.12/629); Fabricación de equipos básicos en el Brasil (E/CN.12/619).

<sup>3</sup> Las máquinas-herramientas en la Argentina (E/CN.12/747); Las máquinas-herramientas en el Brasil (E/CN.12/633).

many cases compromise more seriously its evolution. As indicators of the background against which this activity must develop, the following can be pointed out: the heterogeneous nature of demand, the highly competitive market, the technical and research requirements for its construction, the time and capital needed to launch new models and the difficult competition with international production centres.

In Argentina as well as in Brazil, both industries have developed under the same stimulus, that is, the demand for machine tools for factory maintenance activities. In this field, technological and manufacturing needs are not as rigorous as those of production machinery. These countries are facing the transition from this stage to the construction of more complex machines. This will require the joint action of the manufacturers as well as the national authorities in order that the necessary technical,

fifty persons) which do not count with the technical and economic means sufficient to face by themselves the construction of more complex machinery. There is an accentuated concentration of manufacturers on a similar type or model of machine, thus losing the benefits of specialization and of production on a larger scale, as well as a backward line of production, each time more distant from actual market requirements.

It is true that these general considerations on the sector are not entirely applicable to a small number of enterprises which are outstanding because of the technical level, the quality of their products and the effort displayed to satisfy demand requirements. Such enterprises can be classified as proper manufacturers with many of the characteristics and aptitudes for meeting demand requirements and participating in export markets.

Table 3  
MACHINE-TOOL PRODUCTION IN ARGENTINA AND BRAZIL  
(Weight in tons)

Machines	Argentina				Brazil			
	Number	Per cent	Weight	Per cent	Number	Per cent	Weight	Per cent
<b>A. Metal cutting</b> .....	10,256	100.0	6,601.0	100.0	12,693	100.0	8,222.9	100.0
Lathes.....	3,580	34.9	3,927.4	59.5	4,638	36.5	5,265.0	64.0
Milling machines.....	248	2.4	345.9	5.2	278	2.2	289.8	3.5
Drilling machines.....	4,558	44.4	763.7	11.6	5,311	41.8	794.9	9.7
Boring machines.....	116 <sup>a</sup>	1.1	77.2 <sup>a</sup>	1.2	—	—	—	—
Planers, shapers and slotting machines.....	729	7.1	997.0	15.1	937	7.4	1,369.4	16.7
Threading machines.....	42	0.4	24.6	0.4	53	0.4	35.0	0.4
Gear cutters.....	14	0.1	28.0	0.4	—	—	—	—
Saws.....	366	3.6	113.3	1.7	1,296	10.3	342.4	4.2
Grinding machines.....	457	4.5	278.9	4.2	79	0.6	57.1	0.7
Tool grinders.....	146	1.4	45.0	0.7	101	0.8	69.3	0.8
<b>B. Metal forming</b> .....	1,236	100.0	3,936.3	100.0	2,813	100.0	4,986.0	100.0
Presses.....	95	73.2	2,912.9	74.0	2,139	76.1	3,890.0	78.0
Forging hammers.....	2	0.2	15.9	0.4	7	0.2	24.8	0.5
Other metal-forming machines <sup>b</sup> ..	329	26.6	1,007.5	25.6	667	23.7	1,071.2	21.5
<b>Total</b>	<b>11,492</b>		<b>10,537.3</b>		<b>15,506</b>		<b>13,208.9</b>	

<sup>a</sup> Majority are machines for reconditioning internal combustion engines.  
<sup>b</sup> Bending and forming, punching and shearing machines.

economic and institutional measures be adopted. An action within the regional framework would be highly positive and necessary in order to consolidate this activity leading it towards greater specialization.

The degree of development achieved in Argentina and Brazil has been the result of the initiative and the isolated efforts of a greater number of manufacturers who possessed neither an adequate knowledge of the market as a whole and its evolutionary trends, nor a general orientation which would enable them to better their investments and efforts. Neither did they have the backing of a definite policy to stimulate and promote development. As a consequence of this, its present state is characterized by a weak structure with great preponderance of small and medium industries (in Argentina, almost 91 per cent of the establishments have less than

This group constitutes the nucleus that is entering into the construction of production machinery, i.e., specific machines for larger-scale manufacturing, in contrast to the more universal type produced today. Nevertheless, they have not been indifferent to the consequences resulting from the ignorance of the market and its future prospects, the lack of credit and the absence of a national policy for such development.

The outlook for future growth and the attainment of a larger share of the supply of domestic requirements, as well as a more favourable position in foreign markets will depend to a large extent upon the removal of these structural and technical obstacles.

Machine tools constitute a field of multiple possibilities for interchange and regional complementation. The great diversity of types and models together with their



respective variations, as well as the different quality levels these machines attain in their construction (according to destination and future utilization), enables the existence of specialized factories. This situation is confirmed by the steady trade in machine tools which is observed among countries in which this industry is highly developed. Latin America, with a market that can be estimated at some \$250 million to 1970, with a present production not exceeding \$50 million and lacking a great quantity of machine types, offers sufficiently attractive possibilities to justify a detailed analysis of the future of this production line.

Moreover, some Latin American countries have a textile machinery industry of importance while others are in the process of establishing one, with well-defined plans for the future. This branch of mechanical manufacture is under study, particularly by ECLA, and data collected until now point out that the present installed manufacturing capacity in four countries, Argentina, Brazil, Colombia and Mexico, should supply nearly 60 per cent of the region's total demand.

While regional manufacturers started production through improvisation of designs, it was not long before they gained sufficient technological knowledge to compete with popular brands. Once the necessary technical basis was laid and minimum standards of quality were achieved, they could obtain from traditional manufacturers licences for the construction of already well-known models.

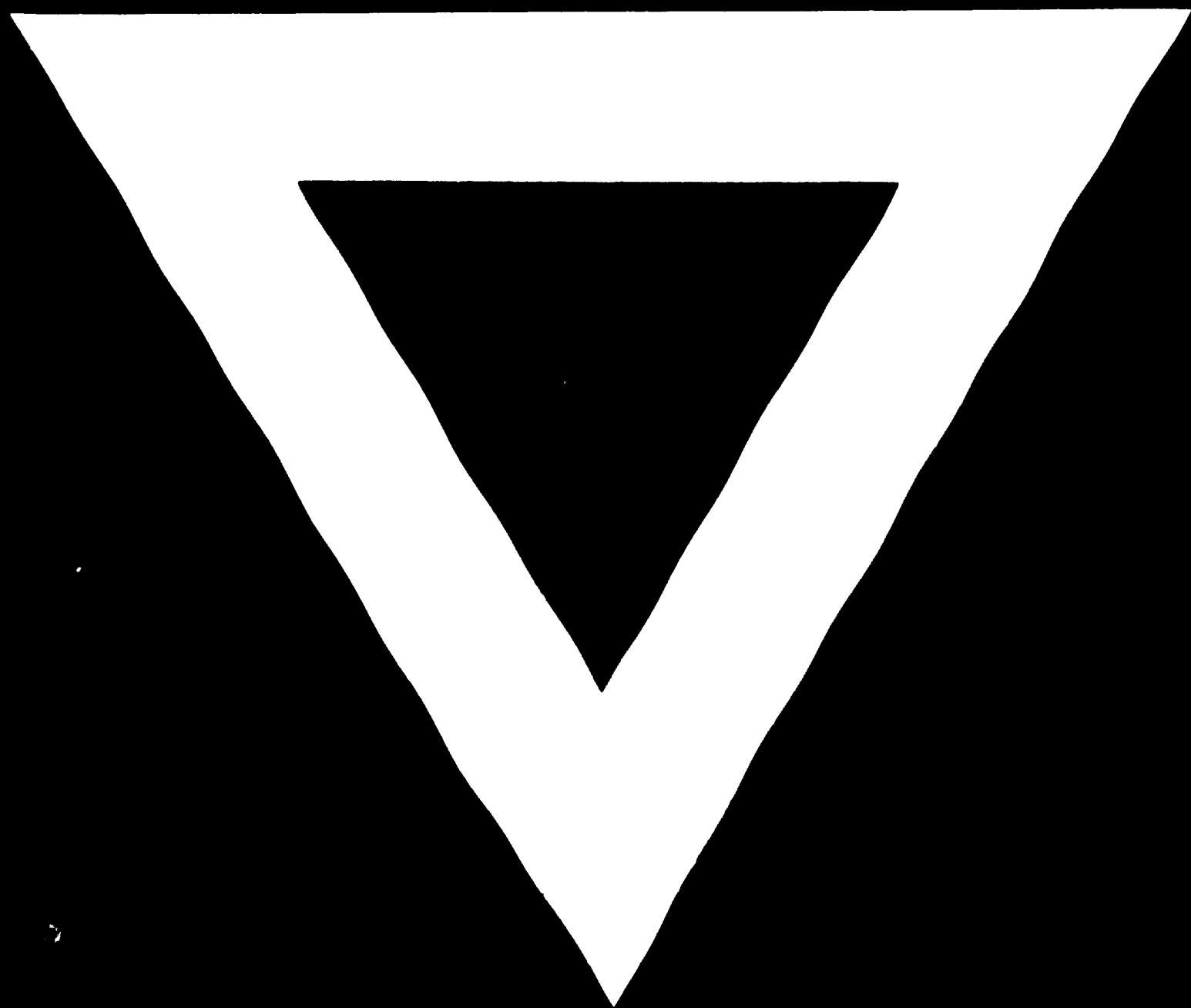
With the exceptions of Mexico and Colombia in which

industry is at an initial stage although with well-defined plans for the future, the other countries (Argentina and Brazil) which together make up almost 80 per cent of production have used in recent years only 20 per cent of their potential productive capacities. Under these conditions, they were able to keep going only because of the flexibility of production, characteristic of the mechanical industry, which allows factories to reorientate their work.

The need to modernize the textile industry as soon as possible is evident and the regional textile machinery industry could play an important role in this process. A preliminary estimate of global needs for renewal of Latin American textile equipment results in a figure close to \$480 million of which this industry could supply approximately two-thirds during the next five years, especially in such items as spindles, looms, and finishing machines.

However promising this situation may be for the textile equipment industry, certain difficulties emerge which, if not overcome, will force the sector to continue its functions without a work programme and consequently without any prospects for expansion. It should be pointed out that the textile and the textile machinery industries, while closely linked by common interests, have not apparently found a harmonic work formula. They lack the proper orientation and, above all, the necessary technical assistance in engineering and finances which would permit them to join those efforts which are scattered throughout both sectors.





**74.10.17**