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INDUSTRIAL DEVELOPMENT IN MEXICO

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CHAPTER XXV. MEXICO

In Mexico as in other countries, the industrialization process in its broader aspect implies an increase of real capital resources. No direct measurement of such a growth can be attempted, because of the unavailability of basic data. Nevertheless, an approximate measurement of the relative productivity of the broad categories of the goods-producing activities may be made first in its static aspect for international comparison.

For this purpose the net national product at factor cost accruing to agriculture ^{1/}, manufacturing ^{2/} and mining ^{3/}, respectively, has been considered as a percentage of the total, and related to the percentage of the economically active population engaged in the corresponding activities.

Considering the margins of error incurred in estimates of the net national product and of the distribution of the economically active population the results provide rough measurements only. Furthermore, such productivity data are distorted by changes in price relationships such as can occur, for instance, between manufactured goods, agricultural products and minerals. It should also be noted that the data do not reflect merely the various combinations of the factors of production but that they include other elements as, for instance, land rent in agriculture.

Despite the possible margins of error and the fact that the highly capitalized petroleum industry and smelters have been included in mining, there are remarkable differences in the relative productivity of the three main goods-producing activities of the nation. These differences are greater than in any other country for which comparative data have been assembled. (See Table 1).

It appears that in Mexico in 1940 the value added by an industrial

-
- ^{1/} Includes animal husbandry, forestry and fisheries.
^{2/} Includes construction, electricity and gas.
^{3/} Includes metallurgy and petroleum and petroleum products.

/worker was about

Table 1. Estimate of the relative productivity of various activities in Mexico and in six other countries

	Relative productivity of the three goods-producing activities in the net national product (All activities and services =100)			Productivity of manufacturing and mining as compared to agriculture (Agriculture = 100)	
	Manufacturing	Mining	Agriculture	Manufacturing	Mining
Mexico	222 ^{a/}	833 ^{b/}	22	1008 ^{a/}	3786 ^{b/}
Argentina	123	..	60	205	..
Chile	100 ^{c/}	182	47	212 ^{c/}	387 ^{d/}
France	89	468 ^{d/}	62	144	755
Netherlands	67	94	49	139	192
United States	117	110	46	254	239
India	191 ^{e/}	..	79	242 ^{e/}	..

Source: United Nations Economic Commission for Latin America.

^{a/} Includes construction.

^{b/} Includes metallurgy and petroleum refining.

^{c/} Excludes handicrafts.

^{d/} Includes blast furnaces, gas, electricity, petroleum and derivatives.

^{e/} Includes "unorganized industry".

Note: Mexico: net national product data and data on the distribution of the economically active population are for 1940; Argentina: net national product for 1945 and occupational distribution for 1947 (estimated); Chile: both series for 1940; France: net national product for 1938 and occupational distribution for 1936 (part of employment in industrial public services has been included in manufacturing); The Netherlands: net national product for 1938 and occupational distribution for 1930; United States: both series for 1940; India: both series for 1931.
The data are not adjusted for changes in price relationships.

worker was about ten times greater, and that of a miner about thirty-eight times greater than that of an agricultural worker. In contrast, the relative differences in productivity among the goods-producing activities in the other countries considered are indicated by the following coefficients (productivity in agriculture being 100 in each case): Argentina 205 (considering manufacturing and agriculture only), Chile 387, United States 254, France 755 ^{1/} and the Netherlands 192. The low coefficient of 242 of manufacturing in relation to agriculture in India seems to be mainly due to the existence of a broad sector of handicraft industries in a low productivity.

In themselves these data provide no direct indication of productivity in the respective countries but they point to the fact that in the more developed nations differences of productivity, largely due to a more uniform utilization of real capital, generally remain within fairly narrow limits.

Table 1 suggest the existence of three widely separated sectors in Mexico's economy. Thus Mexico has a natural advantage as a mining country and, therefore, mining and the petroleum industry which have developed as part of the international market, show a high degree of productivity. This is appreciably lower in manufacturing in comparison to the more developed countries, and its products in peacetime conditions are not generally competitive in the international market. Finally, productivity of the greater part (over 60 per cent) of the economically active population which is engaged in agriculture is exceptionally low and to an appreciable extent excludes them from the monetary economy.

It seems that the unbalanced character of the Mexican economy, due to a very uneven technological progress in production, is basically due to the backward stage of its agriculture despite recent progress in some of its sectors. Mining, which forms part of the international economy, need not be considered here. There is, however, a close dependence of a negative character, between productivity in manufacturing and in

^{1/} The magnitude of this coefficient is due to the inclusion in mining of highly capitalised activities such as blast furnaces, gas, electricity and petroleum and derivatives.

agriculture. The former, which for reasons that will be discussed later on, is limited essentially to the domestic market, encounters as the principal obstacle to its development the low purchasing power of the farming population. Since a substantial increase in the productivity of Mexican agriculture will necessarily be a long-term process, the question arises whether manufacturing can find a sufficiently broad basis while limited to the domestic market.

The development of manufacturing is broadening the domestic market for agricultural products. This expansion in recent years has been more rapid than in most Latin American countries for which data are available, the output of agriculture having increased 31 per cent between 1935-1939 and 1946-1947. Since the population engaged in agriculture rose by approximately 7.6 per cent during the same period of time it seems that an encouraging increase in productivity amounting to about 22 per cent has taken place. Considering the growth of the country's population, there occurred a 10 per cent increase in the per capita supply of domestically produced agricultural products. Nevertheless, the per capita caloric intake in Mexico, determined to a large extent by the low consumption of the farming population, is generally considered as being far from satisfactory. On the other hand, the expansion of the domestic demand for agricultural products, largely brought about by the progress of industrialization, does not seem to be sufficiently strong to lead to a substantial increase in real farm incomes. At their present rate of increase the non-farming activities cannot lead to a reduction of the farming population in absolute numbers and thereby relieve the existing pressure on the land. Their principal effect has been to diminish the rate of growth, since between 1937 and 1946 the agricultural population increased by 6 per cent and the non-agricultural population by 43 per cent.^{1/}

Considering the sharp differences in productivity of the goods-producing activities, the unbalanced character of the Mexican economy

^{1/} Economically active population only. In view of the higher reproduction rate of the farming population the difference, if dependents were included, would be smaller.

/still persists

still persists. Nevertheless, comparing the relative productivity of manufacturing and agriculture, two phases seem to emerge in 1929-1946. In the first, lasting until the outbreak of the war, productivity in agriculture was fairly stationary so that, in contrast, productivity in manufacturing presented an upward trend. Apparently, technological progress and the expansion of the area under cultivation were barely sufficient to absorb the increase of the farming population. Subsequently, however, the effect of industrialization and of the other non-farming activities became more apparent as a result of which, despite the considerable stimulus which manufacturing received during the war years, the gap in the productivity in manufacturing and agriculture began to narrow. During this second period, from the standpoint of productivity, the trend is toward the characteristics of a more developed and integrated economy. (See Chart 1 and Table 2).

Insofar as the relationship of agriculture and manufacturing illustrates the development of an economy, the share of manufacturing in Mexico's net national product became equal to that of agriculture in 1935-1937 when each represented about 17 per cent of the total. This is a position reached in the United States in the late 'eighties when the two activities became equivalent at nearly the same point as in Mexico. Nevertheless, it was not until about thirty years later that the pre-eminence of manufacturing in the United States was definitely established. Even though the conditions of economic development in Mexico are different to those obtaining in the United States, it cannot be concluded that the pre-eminence of manufacturing over agriculture has been definitely established in the former country. (See Graph 2).

The growing significance of manufacturing in Mexico's economy is more apparent than real, being essentially due to the low productivity of agriculture. In this way, if the proportion of the gainfully employed population that is engaged in agriculture is considered as a more accurate indicator of its development, Mexico's position would be similar to that of the United States in the middle of the 19th century when in 1850 63.7 per cent of the total occupied were engaged in agriculture and the industrialization process was only /in its initial

in its initial stage. The proportion of the economically active population employed in manufacturing seems to be less indicative of the degree of development attained. In the United States it represented 12.2 per cent already in 1820 while in Mexico employment in manufacturing amounted to 11.8 per cent of the total in 1946.^{1/}

Moreover, one outstanding fact seems to have characterized industrialization in the United States and probably all countries which have reached high levels of income, namely, a fairly rapid and uniform diffusion of technological progress in all activities. Thus the ratio of productivity in agriculture remained fairly high in the national economy from the beginning of the industrialization process, and considerably higher than in Mexico today. (See Table 3).

In the long run it appears that a substantial expansion of manufacturing in Mexico will find a seriously limiting factor in agriculture and that the effects of the non-agricultural activities in general upon an increased productivity of the latter, will be relatively slow. Agriculture, and primary activities in general, may require for several decades an additional impulse from the international market if the process is to be accelerated and if a broad basis for manufacturing is to be created.

A broad industrialization policy in Mexico, as anywhere else, must aim in the first place at narrowing the gap between productivity in agriculture and the other activities in an attempt to bring about a more uniform utilization of real capital in the nation. In addition to the measures that are directly intended to achieve this goal, they include improvement of communications, power facilities, education and health in the rural areas.

^{1/} Data for both countries include employment in construction.

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Table 2. Mexico : Relative productivity of agriculture,
manufacturing and mining, 1929 and 1937-1946.

Relative productivity of the three goods-producing activities in the net national product (All activities and services = 100)			Productivity of manufacturing and mining as compared to agriculture (agriculture = 100)		
Agriculture	Manufacturing	Mining	Manufacturing	Mining	
1946	29	219	525	755	1810
1945	29	217	556	748	1947
1944	28	219	600	782	2143
1943	26	216	674	831	2592
1942	23	219	753	952	3274
1941	24	225	753	938	3138
1940	22	222	833	1009	3786
1939	26	214	929	823	3573
1938	26	196	1038	754	3992
1937	26	165	1100	635	4231
1929	39	107	2650	274	6795

Source: United Nations Economic Commission for Latin America.

Table 3. Relative productivity of agriculture and non-agricultural activities in Mexico and in the United States
(All activities = 100)

<u>Mexico</u>		<u>United States</u>	
1929	39	1849	40
1937	26	1859	52
1938	26	1869	45
1939	26	1879	42
1940	22	1889	37
1941	24	1899	56
1942	23	1910	58
1943	26	1920	64
1944	28	1930	51
1945	29	1940	46
1946	29		

Sources: Banco de México; United States Bureau of the Census, Historical Statistics of the United States, 1789-1945, Washington, D.C., 1949, and Statistical Office of the United Nations, National Income Statistics, 1938-1947, Lake Success, New York, 1948.

Note: For Mexico net national product data; for the United States realized private production income by activities (1849-1930) and net national product for 1940. For the United States a small margin of error in the 1849-1899 ratios may have been incurred due to the fact that employment data are available only for years immediately following this considered.

SECTION 1. MANUFACTURING AND THE SUPPLY OF GOODS

I. Manufacturing and primary production.

The growth of manufacturing in Mexico and its role in the supply of goods in general and of manufactures in particular, can be traced only approximately, due to statistical deficiencies. These were particularly serious during the revolutionary wars when even foreign trade series were interrupted for several years.

The relative significance of manufacturing and primary production and particularly that of foreign trade have been explained in the Introduction to the Economic Development of Mexico. In the present section primary production is referred to only insofar as it illustrates the role of manufacturing in this process.

During the period under survey, since 1925, manufacturing production increased at a more rapid rate than the two main primary activities, namely, agriculture and mining. (See Table 1).

The development of the secondary and primary activities reflects in some measure their integration with world economy. Thus mining, which in its present form had been organized largely for the world market, shared the high level of economic activity of the industrial nations in the late 'twenties, the depression of the early 'thirties and the subsequent recovery. In view of the fact that during the war production of petroleum remained at low levels while domestic consumption increased very rapidly, the expansion of mineral production took place principally among base metals, so that the war-time stimulus was rather brief and little pronounced. The absolute decline in mining and petroleum production during the period under survey, and its effect upon Mexico's exports was compounded by the deterioration of the terms of trade. Considering also Mexico's rapid population growth, amounting to 57 per cent in 1925-1948, it was necessary to look toward other activities in order to maintain and even more to increase the per capita supply of goods.

/In regard

Table 1. Mexico: Relative changes in the output of the three
goods producing activities, 1925 - 1948
Quantum at 1937 prices
Index numbers; 1925 = 100

Years	Agriculture	Mining	Manufacturing	Total
1925	100	100	100	100
1926	116	116	113	115
1927	106	128	103	112
1928	112	134	108	118
1929	93	143	114	115
1930	86	125	120	109
1931	108	113	120	113
1932	93	78	104	91
1933	103	82	96	94
1934	96	97	143	110
1935	102	101	139	112
1936	114	106	160	125
1937	108	121	168	129
1938	109	121	165	129
1939	122	110	165	130
1940	114	107	175	129
1941	135	109	186	141
1942	152	124	205	158
1943	142	125	217	158
1944	154	112	237	164
1945	150	113	250	167
1946	155	86	274	166
1947	166	112	240	169
1948	..	102	249	..
Index numbers; base 1925 - 1929 = 100				
Averages				100
1925-1929	100	100	100	92
1930-1934	92	80	108	112
1935-1939	106	90	147	134
1940-1944	132	93	189	149
1945-1947	150	84	236	

Source: United Nations Economic Commission for Latin America. Basic data from official sources.

In regard to its dependence upon the world market agriculture stands in an intermediate position between mining and manufacturing. The bulk of its output is for domestic consumption, but whereas in 1925-1929 it was of minor significance in the composition of Mexico's exports, agricultural exports consisting mainly of cotton and henequén accounted for 26.3 per cent of the total in 1947-1948 (at current prices). While climatic conditions have an appreciable influence upon yearly harvests, Mexican agricultural production as a whole is not very sensitive to the fluctuations of the international markets, and its decline during the great depression was relatively moderate. On the other hand, changes in land tenure resulting from the agrarian reform have probably had a longer-term effect. In any case, a small but growing sector of agricultural production is assimilating modern technology and is mainly responsible for the steady increase in output since the late 'thirties. This was accelerated by the expansion of irrigation so that considering 1925-1948, production rose even more rapidly than population at the end of the period.

2. Role of manufacturing.

In contrast to the primary activities, manufacturing in Mexico is not directly related to the international market except insofar as the latter affects the level of economic activity in the country. It is upon domestic manufacturing that reliance was mainly placed to offset the effect upon the supply of goods of the unfavourable trend of exports of primary commodities, both as regards volume and the terms of trade. The cyclical upswing of the late 'twenties stimulated mining more than manufacturing, but the consequences of the depression upon the latter were milder and short-lived. Since then its rate of growth was uninterrupted with the exception of 1935 and 1947, and considerably more pronounced than that of primary production.

As a result of the growth of manufacturing the proportion of manufactures within total production of goods increased from 26 per cent in 1927-1928 to a peak of 47 per cent in 1946. Considering manufacturing
/production in

production in relation to the total supply of goods, the general increase in the percentage of the former is an indication of the industrialization of the country. The relative decline of primary production it implies is due above all to the slower development of agriculture and to the stagnation of mining. To a lesser extent it also reveals the fact that the exports of primary commodities, which constitute the bulk of the country's total exports, were being carried out in the face of deteriorating terms of trade. (See Table 2).

The changes in the relative significance of secondary and primary activities in the supply of goods can also be traced from the percentages given below. (See Table 3).

In 1925-1929 primary production accounted directly or indirectly, for 69 per cent of the domestic supply of goods, and manufacturing for only 31 per cent.

During the "great depression" the supply of goods was reduced by 12 per cent in 1930-1934 as compared to the preceding five years, and the share of primary production declined to 62 per cent. This was mainly due to the drastic decline of mineral exports which constituted the bulk of the country's total exports, and the consequent decline of mining production. The decrease of agricultural production was caused by a probable decline of real incomes and an accompanying smaller domestic demand. Under these circumstances, the main sustaining factor was manufacturing production which on the average increased in volume in 1930-1934, and the share of which in the total supply of goods rose more than proportionately to 38 per cent of the total.

During the recovery in 1935-1939 the supply of goods increased by nearly 23 per cent over the average of the five preceding years, but the relative contribution of primary production declined further to 58 per cent. Since mining production was still below the 1925-1929 level and agriculture had only slightly surpassed it, the increase in the supply of goods was mainly due to the expansion of manufacturing which had

/increased by

Table 2. Mexico: Role of domestic manufacturing in total production and total supply of goods, 1925 - 1947

Years	Manufactures as per cent of total production of goods	Domestic manufactures as per cent of total supply of goods
1925	29	30
1926	28	31
1927	26	31
1928	26	29
1929	28	31
1930	32	34
1931	30	37
1932	32	38
1933	29	34
1934	37	45
1935	35	43
1936	37	42
1937	37	41
1938	36	43
1939	36	40
1940	39	43
1941	38	39
1942	37	40
1943	39	42
1944	41	39
1945	43	40
1946	47	40
1947	41	35

Source: United Nations Economic Commission for Latin America;
basic data from official sources.

Table 3. Mexico: Role of manufacturing and of primary production in supply of goods, 1925-1947

(Quantum in millions of 1937 pesos and in percentages of total domestic supply)

Yearly averages	Manufacturing		Primary production						Domestic supply	
			for domestic use		indirect contribution; quantum of imports		total			
			quantum	per cent	quantum	per cent	quantum	per cent			quantum	index numbers
1925-1929	631	31	754	37	676	33	1,430	69	2,060	100
1930-1934	684	38	771	42	368	20	1,139	62	1,823	88
1935-1939	935	42	819	37	475	21	1,294	58	2,229	108
1940-1944	1,197	41	1,179	40	576	20	1,755	59	2,952	143
1945-1947	1,486	38	1,220	31	1,119	30	2,405	62	3,901	189

Note: Data based on quantum of domestic production of goods and commodity trade at 1937 prices. The percentages for manufacturing include exports of manufactures which at their peak were equivalent to 7.6 per cent of total imports. Primary production for domestic use has been calculated by subtracting exports (less exports of manufactures) from primary production. The indirect contribution of primary production to the domestic supply of goods is equivalent to imports less exports of manufactures. It should be noted that in contrast to production for domestic use imports include services, such as transport and others and therefore, the indirect contribution of primary activities is over-estimated. Furthermore, part of the imports is accounted for in varying proportions, by other receipts than on trade account.

Source: United Nations Economic Commission for Latin America; basic data from official sources.

increased by one-half over the 1925-1929 level.

In varying degrees, the war stimulated production in all fields so that the supply of goods in 1940-1945 was about one-third larger than in the preceding five-year period. The relative share of manufacturing did not increase even though its expansion was more rapid than that of primary production. The larger share of primary production retained in the country was mainly caused by increased consumption of foodstuffs and petroleum and by larger requirements of raw materials for the industry. On the other hand, increased exports were not matched by a proportionate increase in imports because of suppliers' shortages which led to an accumulation of international assets. These, together with pent-up demand, made possible an extraordinary increase of imports in 1945-1947 which lowered the relative share of domestic manufacturing despite its accelerated expansion in 1945-1946. On the other hand, in 1945-47 mining declined again, in contrast to agriculture which continued to expand. Though agricultural production data are not complete for 1948, it can be assumed that even had agricultural output increased at the rate of 1946-1947, the supply of goods decreased during that year in comparison to 1947 due mainly to the decline of imports and partly to the decline of mining production; this was not fully offset by the partial recovery of manufacturing from the sudden drop of the preceding year. However, since the 1947 imports were at an abnormally high level, having been financed to an appreciable extent from assets accumulated during the war, the decline in the total supply of goods in 1948 is apt to conceal the advance made in domestic production. Partial data for 1949 indicate that domestic production on the whole is still on the increase.

In addition to the data given so far, the progress of industrialization is also manifesting itself in the overall increase of the share of domestic production within the total supply of manufactures. (See Table 4).

The composition of imports according to the degree of their processing, where the general tendency toward increasing imports of raw
/materials and

Table 4. Mexico: Role of domestic manufacturing production in the supply of manufactures, 1925-1948

(quantum in millions of 1937 pesos, and percentages)

	Domestic production	Supply for domestic use	Domestic produc- tion as per cent of supply for domestic use
1925	587	1,113	52.4
1926	666	1,151	57.5
1927	603	987	60.6
1928	632	1,060	59.2
1929	669	1,110	60.0
Average	631	1,084	57.9
1930	705	1,069	65.7
1931	704	918	76.3
1932	608	756	80.0
1933	563	732	76.1
1934	840	1,063	78.7
Average	684	907	75.4
1935	817	1,085	74.8
1936	941	1,255	74.4
1937	986	1,379	70.9
1938	966	1,178	81.3
1939	966	1,235	77.6
Average	935	1,226	75.8
1940	1,025	1,278	79.4
1941	1,094	1,469	73.4
1942	1,203	1,440	81.0
1943	1,272	1,524	79.8
1944	1,390	1,794	74.8
Average	1,197	1,501	77.7
1945	1,469	2,022	68.8
1946	1,607	2,430	63.1
1947	1,410	2,299	58.9
1948	1,459	2,120	67.1
Average	1,486	2,218	64.5

Source: United Nations Economic Commission for Latin America; basic data from official sources.

materials and semi-manufactured goods is an indication of the industrialization process. In part, however, it also shows that the production of industrial raw materials which takes place in the country has not kept pace with the growth of manufacturing. (See Table 5).

It has been indicated in the Introduction that around 1936 the share of the net national product accruing to manufacturing had surpassed that of agriculture. However, considering primary production as a whole, as was done in Table 2 and more specifically in Table 3, it appears that even though manufacturing has grown more rapidly than primary production and that at present a distinctly larger share of the goods available is due to secondary production than in the late 'twenties, agriculture and mining still account for most of the aggregate domestic production and directly or indirectly, through the imports that their exports make possible, they also account for the major part of the total supply of goods available.

Exports of manufactures assumed certain importance during the war and immediate post-war years due to exceptional circumstances. Even though their share in total exports is now larger than in pre-war, the basic pattern characterized by the overwhelming role of primary commodities has reasserted itself. It is for this reason that even though the level of economic activity in Mexico is probably less dependent upon the fluctuations of the world market, the supply of goods and particularly the country's ability to ~~import~~ the capital goods and the raw materials that its progressing industrialization requires, depend to a very considerable extent upon Mexico's ability to maintain a high level of mineral, petroleum and agricultural exports.

Beginning with the more relevant aspects of the production and consumption of energy in Mexico, the sections that follow relative to the various groups of manufacturing industries illustrate at closer range the industrialization of the country. For some of them, namely

/the cotton

Table 5. Mexico: Composition of imports according to the degree of their processing, 1925-1948.

(Quantum in millions of 1937 pesos and percentages of imports)

Yearly averages	Quantum of imports	Raw materials and semi-processed goods		Manufactures		Source of energy		Foodstuffs for household consumption	
		Quantum	Per cent	Quantum	Per cent	Quantum	Per cent	Quantum	Per cent
1925-29	601	72	12	456	76	24	4	49	8
1930-34	333	68	21	217	65	17	5	31	9
1935-39	428	106	25	296	69	14	3	12	3
1940-44	541	132	24	333	62	19	3	57	11
1945-48	1,082	186	17	777	72	44	4	75	7

Source: United Nations Economic Commission for Latin America; basic data from Dirección General de Estadística.

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the cotton textile and iron and steel industries, basic data are available since the beginning of the century. For others, such as the cement industry, only since 1925. The development of other groups can be adequately traced not earlier than 1937 or 1939, while some of them had to be omitted altogether due to a lack of sufficient basic information. Despite the fact that they are not fully comparable, the first industrial census of 1930, those taken in 1935 and 1940, and the preliminary census survey of 1944, complete the periodical data from official sources.

The various industrial groups have been arrayed arbitrarily, not in the order of their significance of the present structure of Mexican manufacturing, but rather according to their rate of growth. In this way precedence has been given to the heavy industries upon which further progress of manufacturing chiefly depends.

SECTION 2. PRODUCTION AND CONSUMPTION OF ENERGY

I. General Aspects

In 1937 the consumption of inanimate energy per inhabitant in Mexico was estimated at 603 kilowatt-hours electricity equivalent.^{1/} The fact that it was well below the world average of 1,676 units indicates the magnitude of the progress to be achieved. (See Table 1).

The proportion of inanimate energy to total energy consumption was rather low in comparison to the economically developed countries. Nevertheless, this ratio overstates Mexico's position in comparison with Argentina, for instance, since the availability of animate energy is smaller. Per capita consumption of animate and inanimate sources of energy for productive purposes more truly represents differences in the relative intensity of real capital, which is one of the most important factors determining labour productivity. Among the four countries of Latin America where the use of energy is greatest in absolute terms, per capita consumption of energy for productive purposes was smaller in Mexico than in Argentina and Chile, and higher than in Brazil. However, consumption in these four countries was much lower than in the United States or Canada.

The development of fuel and power for use in Mexico in 1925-1945 is shown in Table 2. The data represent a trend rather than accurate measurements of year by year consumption of energy, mainly because of the predominance of oil and derivatives where changes of stocks are most likely to occur and data for which are not available. Data for oil used in thermo-electricity production have been segregated from the sub-total for oil derivatives and appear under electricity consumption together with hydro-electricity. No attempt has been made to estimate the quantity of fuel wood consumption, since no direct data are available and wide margins

^{1/} Department of State, Energy Resources of the World, Washington, D.C., 1949. International comparisons of the total supply of energy in most countries are possible only on the basis of 1937 data.

Table 1. Energy consumption in Mexico in 1937 as compared to five other countries in the Western Hemisphere.

	Mexico	Argentina	Brazil	Chile	United States	Canada
Ratio of inanimate sources to all sources (per cent)	70.9	67.0	56.6	85.0	97.6	97.7
Inanimate energy available for use (millions of Kw-hrs. electricity equivalent)	11,558	17,455	22,765	13,389	1,322,913	91,887
Fuels and power used in industry (millions of Kw-hrs. electricity equivalent)	6,685	6,288	3,338	2,786	545,804	34,546
Per capita consumption of inanimate energy (Kw-hrs. electricity equivalent)	603	1,368	526	2,913	10,236	8,263
Per capita consumption of animate and inanimate energy for productive purposes (Kw-hrs. electricity equivalent)	664	1,600	450	1,162	6,996	5,318

Source: Department of State, Washington, D.C., Energy Resources of the World, 1949.

Table 2. Mexico: Apparent consumption of fuel and power
in 1925-1948

(In millions of kilowatt-hours electricity
equivalent, and index numbers: 1937 = 100)

Years	Coal and coal gas	Oil deri- vatives	Imported natural gas	Electricity	Total		Per capita Consumption (kilowatt-hours)	
	Quantity	Quantity	Quantity	Quantity	Quantity	Indices	Quantity	Indices
1925	2,291	2,696	..	932	5,919	54	389	66
1926	2,125	3,479	..	764	6,568	59	425	72
1927	2,186	3,944	..	1,027	7,157	65	455	78
1928	1,678	4,361	..	1,118	7,157	65	447	76
1929	1,696	4,590	..	1,244	7,530	68	462	79
1930	1,991	3,504	119	1,214	6,828	62	412	70
1931	1,428	2,886	175	1,152	5,641	51	334	57
1932	1,057	2,790	150	1,118	5,115	47	298	51
1933	997	5,251	152	1,351	7,751	71	444	76
1934	1,210	6,789	423	1,609	10,031	91	564	96
1935	1,911	5,824	488	1,316	10,039	91	555	95
1936	2,003	5,268	493	1,381	9,745	89	529	90
1937	1,896	6,621	287	2,191	10,995	100	587	100
1938	1,674	6,464	123	2,218	10,479	95	549	94
1939	1,337	6,974	253	2,196	10,560	98	554	94
1940	1,258	7,045	381	2,295	10,959	99	555	95
1941	1,251	7,127	493	2,274	11,145	101	552	94
1942	1,368	8,124	594	2,354	12,440	113	602	103
1943	1,583	8,399	701	2,491	13,174	120	622	106
1944	1,365	9,383	836	2,569	14,153	129	653	113
1945	1,386	10,017	1,093	2,916	15,412	140	693	118
1946	1,483	10,890	1,003	3,109	16,490	150	724	123
1947	1,591	13,987	1,116	3,330	20,024	182	854	146
1948	1,655	11,745	1,154	3,670	18,224	166	763	130

Source: United Nations Economic Commission for Latin America.

Note: For sources and method used see Appendix A.

of error can be incurred in estimates. ^{1/} During the period under consideration the main source of natural gas as fuel has been imports by pipeline from Texas to Monterrey, while domestic gas has been used either for repressuring oil wells or has been wasted. ^{2/}

Since 1937 Mexico's consumption of energy has increased at a rate greater than that of the population so that in 1947-1948 the volume of energy available per capita was 38 per cent greater than in 1937, despite a 27 per cent population increase. During part of the time under survey, however, the increase of energy available was smaller than that of manufacturing production. ^{3/} Moreover, also due to the fact that the various sources of energy are not readily interchangeable, shortages of fuel and power for industrial and other uses were felt, particularly during the war. (See Chart 1).

The relative changes of the various sources of fuel and power are shown in Chart 2. The declining trend of coal consumption and the more rapid rate of consumption of oil and similar fuels as compared to electricity stand out as the main developments of the period under survey, as is shown below.

Mexico: Apparent Consumption of Fuel and Power, 1925-1948

(In million of kilowatt-hours electricity equivalent)

Yearly Average	Coal and coal gas	Oil and similar fuels	Electricity	Imported natural gas	Total
1925-1929	1,995	3,814	1,057	..	6,866
1930-1934	1,336	4,236	1,268	204	7,073
1935-1939	1,764	6,230	2,080	328	10,473
1940-1944	1,365	8,015	2,392	601	12,374
1945-1948	1,528	11,659	3,256	1,092	17,537

Source: United Nations Economic Commission for Latin America.

^{1/} In Energy Resources of the World, op. cit., the consumption of fuelwood in Mexico in 1937 has been estimated at 1,041 million kilowatt-hours electricity equivalents or 9.0 per cent of total inanimate energy consumption. Total inanimate energy consumption minus fuelwood is estimated at 10,519 million kilowatt-hours electricity equivalent, which is 4.35 per cent lower than the comparable total in Table 2.

^{2/} Armour Research Foundation of Illinois Institute of Technology, Report to the Banco de Mexico, Technological Audit of Selected Mexican Industries, Chicago, 1946.

^{3/} In 1937 industry (manufacturing, mining and construction) absorbed 57.9 per cent of the inanimate energy available for use. (Energy Resources of the World, op. cit.).

II. Changes in the consumption pattern

In contrast to the other three industrially significant countries of Latin America, Mexico is the most self-sufficient in energy resources, being able moreover to export an appreciable amount of petroleum.^{1/} The predominance of petroleum distinguishes Mexico's consumption pattern of energy from that in most countries in Latin America as well as from the United States and Canada. (See Table 3).

Considering the low level of energy consumption in Mexico, the predominance of petroleum seems to be due principally to its early development for export, for which a considerable volume of investment had become available, as compared with the slower growth of hydro-electricity and the decline of coal output.

The rapid expansion of energy consumption since the late thirties was largely achieved by devoting an increasing quantity of petroleum to domestic consumption rather than by an expansion of energy production. The predominance of petroleum in the energy consumption pattern was accentuated during the period under review, oil derivatives representing 59 per cent of total consumption of inanimate energy (excluding fuelwood) in 1936-1939 and 67 per cent in 1947-1948. (See Table 4).

It should also be noted that despite an increase in electricity output a progressively larger share of this source was obtained by burning petroleum. Thermo-electricity represented 17 per cent of total electricity production in 1933 and 36 per cent in 1946. Thus Mexico exceeded the world's rate of increase in petroleum consumption but lagged in production, as can be seen below.

Petroleum production and consumption indices for the world and for Mexico, 1947/48

(1937 = 100)

World production and consumption	<u>1947/48</u> 157
Mexico (production	123
(consumption	194

Sources: United Nations Department of Economic Affairs, World Economic Report 1948, Lake Success, New York, 1949, and United Nations Economic Commission for Latin America.

^{1/} In 1937 Mexico showed a net export of 6,545 million kilowatt-hours electricity equivalents, constituted almost exclusively by petroleum. These exports represented 1.9 per cent of the world interchange of fuel and power. The subsequent decline of these exports is indicated below.

Table 3. Nature of the fuel and power consumed in Mexico and in five other countries of the Western Hemisphere in 1937.

Percentages

	Coal and similar fuels	Fuel - wood and fuel peat	Oil and similar fuels	Natural and ma- nufactured gas	Electri- city
Mexico	9.1	10.5	65.4	3.4	11.6
Argentina	18.7	9.7	50.0	7.0	14.6
Brazil	16.4	62.7	11.6	0.4	8.9
Chile	18.3	56.5	13.8	0.6	10.8
United States	46.2	6.1	24.4	14.1	9.2
Canada	44.2	10.0	13.8	3.8	28.2

Source: Department of State, Energy Resources of the World, Washington, D.C., 1949

Table 4: Percentage of the various sources of energy within
total consumption of inanimate energy, 1925 - 1946

Year	Coal and coal gas	Oil and similar fuels	Imported natural gas	Electricity
1925	38.7	45.5	..	15.7
1926	32.4	53.1	..	14.7
1927	30.5	55.1	..	14.3
1928	23.4	61.0	..	15.6
1929	22.5	61.1	..	16.5
1930	29.2	51.3	1.7	17.6
1931	25.3	51.0	3.1	20.4
1932	21.1	54.5	3.0	21.9
1933	12.9	67.7	2.1	17.4
1934	12.1	67.7	4.2	16.0
1935	19.0	58.0	4.9	18.1
1936	20.6	54.1	5.1	20.3
1937	17.2	60.2	2.6	20.0
1938	16.1	61.7	1.2	21.2
1939	12.4	64.8	2.4	20.4
1940	11.5	64.2	3.5	20.7
1941	11.2	64.0	4.4	20.4
1942	11.1	65.3	4.8	19.0
1943	12.0	64.1	5.3	19.0
1944	9.6	66.3	6.0	18.2
1945	9.1	65.1	7.1	19.0
1946	9.1	66.0	6.1	18.9
1947	8.0	69.9	5.6	16.6
1948	9.1	64.4	6.3	20.1

Source: United Nations Economic Commission for Latin America;
basic data from official resources.

Note: Excluding fuelwood. Data for imported natural gas are
not available for 1925-1930, but their absence does not
affect appreciably the percentages for those years.

A number of factors have contributed to this pattern. Probably the most important was the scarcity of domestic savings which, together with the organizational and technological complexity of large-scale energy production resulted in a low level of domestic investment in the petroleum industry and electricity production. Investment in petroleum, limited to domestic resources, declined considerably, reducing drilling, so that considering the 1936-1939 average output of crude oil, there was a decline in 1942-1944 and a gradual recovery thereafter. In order to compensate for the loss of many of the foreign distributing facilities previously used by Mexican petroleum, due to the nationalization of the petroleum industry in 1938, the policy was adopted of stimulating domestic consumption on the part of Petróleos Mexicanos,^{1/} principally by supplying low-cost fuel to the railroads and to the industry.

It is generally believed that one of the consequences of this policy was the decline of coal consumption. In effect coal production declined from an average of 1,130 thousand metric tons in 1936-1939, without regaining that level in any of the subsequent years. Furthermore, the increase of hydro-electricity consumption was smaller than that of petroleum fuels, amounting to 44 per cent in 1947-1948 as compared to the 1936-1939 average, while consumption of petroleum fuels increase 103 per cent during the same time.

III. Effects upon Foreign Trade

The fact that petroleum production in Mexico failed to keep pace with consumption was accompanied by a reduction of petroleum exports. The increase in the production of other sources of energy was not rapid enough to offset this trend. Only in 1948 did exports regain their pre-war level, but considering the temporary decline of domestic petroleum consumption, this may be considered as an exception only. (See Table 5).

The decline of petroleum exports was accompanied by an increase of imports of petroleum fuels, particularly high-octane gasoline for the entire country. Some of this increase was due to increased consumption of partly refined products in the northern and northwest Pacific regions, part of which is met by imports from California owing to transport difficulties

^{1/} Petróleos Mexicanos or Pemex for short is the government-owned petroleum monopoly in Mexico.

Table 5. Mexico: Volume of output, foreign trade and consumption
of petroleum and derivatives, 1925 - 1948

(Thousand metric tons)

	Output of crude oil	Consumption of oil derivatives of domestic origin		Imports of oil and derivatives	Apparent consumption of oil derivatives	Exports of oil and derivatives	
	Volume	Volume	Per cent of output	Volume	Volume	Volume	Per cent of output
1925	17,784	990	5.6	165	1,155	14,261	80.2
1926	13,922	1,322	9.5	152	1,474	11,719	84.2
1927	9,871	1,479	15.1	186	1,665	6,848	69.3
1928	7,721	1,622	21.0	216	1,838	4,629	60.1
1929	6,880	1,612	23.4	324	1,936	3,588	52.1
1930	6,086	1,250	20.5	246	1,496	3,763	61.8
1931	5,087	1,039	20.4	208	1,247	3,062	60.2
1932	5,051	993	20.1	189	1,182	3,108	61.5
1933	5,235	2,075	39.6	144	2,219	3,029	57.9
1934	5,877	2,738	46.6	137	2,875	3,344	56.9
1935	6,196	2,424	39.1	128	2,555	2,854	46.1
1936	6,317	2,252	35.6	130	2,382	3,116	49.3
1937	7,221	2,679	37.1	237	2,916	3,000	41.5
1938	5,928	2,667	45.1	180	2,847	1,914	32.2
1939	6,604	3,040	46.0	48	3,088	2,770	42.0
1940	6,779	3,062	45.2	93	3,155	3,019	44.5
1941	6,628	3,120	47.1	84	3,204	2,299	35.1
1942	5,360	3,472	64.8	67	3,539	912	17.0
1943	5,413	3,645	67.3	68	3,713	1,018	18.0
1944	5,882	4,083	69.4	106	4,189	693	11.8
1945	6,704	4,308	64.2	124	4,432	1,137	17.1
1946	7,580	4,621	61.1	241	4,862	1,311	17.3
1947	8,665	5,836	67.3	312	6,148	1,016	11.7
1948	9,095	4,338	53.2	352	5,290	2,225	24.5

Source: United Nations Economic Commission for Latin America; basic data from Dirección General de Estadística and Dirección General de Industrias Extractivas.

of the domestic product. ^{1/} Aggregate petroleum imports, however, are relatively small compared with exports. Partly as a result of these changes and partly due to the expansion of other exports commodities, net exports of petroleum and similar fuels show a declining trend. (See Table 6).

When in the late thirties the industrialization of Mexico gained momentum, the country was in a fortunate position of being able to draw on domestic sources of energy without increased consumption implying a direct drain upon its foreign exchange availabilities and without being exposed to a curtailment of energy imports as was suffered by several Latin American countries during war. Nevertheless, the increase of energy consumption had an indirect effect of some magnitude upon Mexico's foreign exchange receipts on trade account. ^{2/}

It is not likely that considerations pertaining to the rate of production as related to reserves have influenced the relatively slow development of output in recent years. The general experience is that "proven reserves" that increased more rapidly than output in the measure that exploration progresses. In this way, in the United States, "proven reserves" have increased about 300 per cent in 1922-1942 ^{3/} while output increased 150 per cent. In 1937 petroleum production in relation to proven reserves in Mexico was higher than in the United States, the rate of output being 8.4 per cent for the former country and 6.1 per cent for the latter. The 1947-1948 average output in Mexico had increased to 10.2 per cent and in the United States

^{1/} The supply of this area with Mexican fuels will be facilitated when the Minatitlán-Salina Cruz pipeline that is being built across the Isthmus will be completed in 1950.

^{2/} Had exports been maintained in 1940-1948 at the average yearly volume of 1936-1939 the difference between the value such exports would have attained during those years, on the basis of unit prices of crude oil, fuel oil, gas oil, gasolene and Kerosene (assuming no change in the composition of such exports) and the export value actually obtained, plus the increase of imports of petroleum and in derivatives during those years amounts to 720.8 million pesos which is equivalent to 147.9 million dollars at the exchange rates corresponding to the years considered, and would have represented an average addition of 6.6 per cent to the value of commodity exports in 1940-1948.

^{3/} Energy Resources of the World, op. cit.

Table 6. Mexico: Net exports of petroleum and derivatives as per cent of total commodity exports, 1925-1948

	Value of net exports of oil and similar fuels	Value of total commodity exports	Per cent of total exports
(.....millions of pesos)			
1925	269.2	682.4	39.4
1926	212.5	691.8	30.7
1927	99.5	633.7	15.7
1928	74.0	592.4	12.4
1929	56.2	290.7	9.5
1930	56.7	458.8	12.3
1931	38.6	299.5	9.6
1932	44.7	304.0	14.7
1933	60.2	364.7	16.5
1934	112.9	643.7	17.5
1935	108.7	750.0	14.5
1936	117.9	775.0	15.2
1937	116.0	888.4	13.1
1938	62.6	833.0	7.5
1939	75.7	904.8	8.3
1940	79.7	960.1	8.3
1941	61.4	729.4	8.4
1942	23.4	944.1	2.4
1943	29.1	1,221.6	2.3
1944	20.7	1,045.1	2.0
1945	26.3	1,267.6	2.1
1946	25.9	1,894.7	1.3
1947	7.3	2,151.8	0.3
1948	185.4	2,653.4	7.0

Source: Dirección General de Estadística.

to 8.5 per cent in relation to the 1937 reserves.^{1/} However, in the United States extensive exploration work took place and in Mexico drilling on a larger scale is considered essential by Pemex and other responsible authorities to prevent net imports, in terms of value, of oil and similar fuels.^{2/}

IV. Prospects of the Supply of Energy

Actually, the aim of Pemex is not only to satisfy domestic consumption at future demand levels but also to provide substantial exports. For this reason the Director-General of Pemex submitted, in September 1948, to the Committee on Interstate and Foreign Commerce of the Congress of the United States, a five-year development programme; this covers 1949-1953 and involves exploration and development aimed at increasing Mexican petroleum production from the 167,000 barrels a day level of 1948 to 365,000 barrels per day in 1953, and to 463,000 barrels per day by 1955.^{3/} According to Pemex calculations the 1955 target would yield crude-oil and product exports of some 280,000 barrels daily, with a value of 170 million dollars a year, after estimated domestic needs are satisfied. Pemex estimated total capital outlays of 470 million dollars over the five-year period would be necessary to achieve such a programme. Despite the recommendations of the Committee no foreign credits have yet been obtained to permit large-scale petroleum exploration by Pemex and the arrangements concluded for this purpose by this agency with several small private companies are of a limited scope. However, negotiations related to the financing of the Pemex project are continuing.

Whatever the final outcome of the efforts for a larger petroleum

^{1/} By the end of 1949 reserves were estimated at 1,270 million barrels while production during that year amounted to 62.1 million, indicating a rate of output of 4.9 per cent. (Petróleos Mexicanos, Informe del Director General, 18 March 1950, Mexico, D.F.).

^{2/} Drilling of wells that were completed in 1949 totalled 204,375 linear metres which was the highest figure since 1930; drilling in 1948 amounted to 131,755 metres. (Ibid.).

^{3/} Fuel Investigation: Mexican Petroleum, Progress Report of the Committee on Interstate and Foreign Commerce, submitted by Mr. Wolverton, Chairman, December 31, 1948, Washington, D.C., 1949.

output may be, increased reliance is being placed upon the development of both hydro- and thermo-electricity. The fact that water power, in contrast to petroleum, is a recurring resource and that it represents the bulk of the visible reserves of fuel and power in Mexico, points to the need for a broader utilization of this source. ^{1/}

Only a small fraction of the potential yield of water power is being utilized in Mexico. Thus, in 1937 the actual yield amounted to only 1,470 million kilowatt-hours or 2.9 per cent of the potential yield, firm power, as compared with 21.9 per cent in the United States and 17.9 per cent in Canada. ^{2/} Even so, among the Latin American countries, Mexico was second only to Brazil in the actual yield of water power.

Following a trend that is rather widespread in Latin America, the expansion of electricity production in Mexico is expected to be carried out primarily by public authorities. For this purpose, the Comisión Federal de Electricidad (Federal Electricity Commission) was created in 1937 as an autonomous body. However, during the wartime shortages of equipment it could add only a fraction to the installed capacity in the country. The expansion of the Commission's construction activities took place only in subsequent years, partly with the aid of foreign credit. ^{3/} Its five-year plan, from 1948 to 1952 envisages a very large increase of installed power, totalling 1,071,000 kilowatts, including plants to be built by the Secretaría de Recursos Hidraulicos that are incidental to its irrigation projects. Private utility projects envisage an expansion

^{1/} Despite the tentative character of any estimates of energy reserves, particularly of coal and petroleum, the magnitude of the water power reserves of Mexico has been estimated as amounting to about 79 per cent of the probable reserves of inanimate energy in Mexico in 1937, according to Energy Resources of the World, op.cit.

^{2/} Energy Resources of the World, op. cit. These estimates are based on calculations of the horsepower available at mean low flow, assuming 8,000 hours of use annually without storage. "In view of the quantities additionally available through storage or during periods of excess flow it is believed to represent much less than the quantity theoretically available and considerably less than the quantity available in an engineering sense".

^{3/} As of mid-1948 this amounted to 28.2 million U.S. dollars, of which 20.0 million had been granted by the Export-Import Bank.

of 216,000 kilowatts during the same period of time.^{1/}

The planned expansion of electricity capacity represents an increase by the end of 1952, of about 114 per cent over 1947. Approximately three-fourths of the increase is to be made in hydro-electricity and one-fourth in thermo-electricity capacity. This would represent a reversal of the trend in the source of electricity which prevailed during the last decade. By the end of 1952 over 66 per cent of installed capacity would be utilizing water power as compared with 54 per cent in 1947.

If these projects are carried out as planned, total public power in Mexico will supply most of the electricity generated. The relative significance of public and privately owned utilities as well as the planned expansion of installed capacity are shown in Graph 3.

To a large extent these projects are expected to be financed from foreign sources. Those of the Comision Federal de Electricidad are to be thus financed to an extent of 60 per cent by means of a loan of 109.4 million U.S. dollars from the International Bank for Reconstruction and Development for which an application has been made by Nacional Financiera, a financial agency of the Mexican Government. Foreign credits for private utilities, to be guaranteed by the government, amount to 37.4 million U.S. dollars. In this way total present and proposed foreign credits for the development of electricity amount to 175 million dollars. ^{2/ 3/}

Only assuming that all sources of energy were interchangeable would it be possible to conclude that, there being no increases in petroleum and coal production, the carrying out of the projected expansion of

^{1/} Electric Power in Mexico, Horace H. Brauh, Embassy of the United States, Mexico, D.F., August 9, 1948. Data include the two largest private utilities systems and one of the smaller systems whose expansion is to be partly financed from foreign sources.

^{2/} Horace H. Barun, op. cit.

^{3/} In January 1949 the International Bank made two loans totalling 34.1 million U.S. dollars to agencies of the Mexican Government for electric power development. The first loan of 24.1 million was made to finance foreign currency expenditures of the Comision Federal de Electricidad and the second of the 10 million was for the Mexican Light and Power Company. The Bank is studying the plans for electric power development to determine, in agreement with the Government, which projects of the original loan application are most urgently needed.

generating capacity as planned could satisfy the country's consumption of energy by the end of 1952 should the latter progress at the average annual rate of 1937-1947, that is, 8.2 per cent. Thus, consumption of inanimate energy (except fuelwood) in Mexico in 1937-1947 increased at an annual rate of 903 million kilowatt-hours electricity equivalent while the projected expansion of generating capacity will make possible an increase in electricity output at an annual rate of 772 million kilowatt-hours in 1948-1952. ^{1/} Furthermore the carrying-out of the plan will require an increase of about 7.5 per cent of petroleum consumption over the 1947-1948 level for the envisaged expansion of thermo-electricity.^{2/}

Without the development of other sources of energy except electricity (including the estimated increase of oil consumption for thermo-electricity) the available fuel and power by the end of 1952 would amount to 23,883 million kilowatt-hours electricity equivalent, assuming that the output of the other sources for domestic consumption will remain at the 1947 level. Consumption of the 1937-1947 annual rate would require, however, a supply of 24,539 million kilowatt-hours in 1952, indicating the possibility of a small deficit of 651 million kilowatt-hours electricity equivalent. However, by the end of 1949 the pipe-line from Poza Rica, Veracruz, to Mexico City with a diameter of 51 centimetres (20 inches) was practically completed. It will supply over one million cubic metres of natural gas per day or the equivalent of 817 million kilowatt-hours of electricity per year, which might eliminate a theoretical deficit in its overall aspects.

Nevertheless, the rapid increase of internal combustion engines in Mexico, where registered motor vehicles (passenger cars and commercial vehicles) increased by 95 per cent in 1937-1947 and tractors about 350 per cent in 1940-47, is likely to continue, requiring an expansion of petroleum consumption. In general, only part of the increased demand of energy can be expected to be met by electricity. Furthermore, as in the past, any sudden increase in the demand of energy is likely to turn towards oil fuels. Also this is practically the only form of energy

^{1/} Annual output in kilowatt-hours calculated on the basis of capacity in kilowatts x 3,000.

^{2/} Assuming one metric ton of oil fuel for 2.47 thousand kilowatt-hours

which in Mexico's case can be imported should domestic production be insufficient.

Unless new petroleum pools are developed Pemex foresees a declining production which together with increased demand was estimated in 1948 as leading to increasing deficits beginning in 1949, as can be seen below. ^{1/}

Estimated (by Pemex) production and consumption of petroleum
in Mexico, 1949-1955

(In thousands of barrels of 42 gallons each)

	<u>Production</u>	<u>Domestic Demand</u>	<u>Deficit</u>
1949	51,300	55,000	3,700
1950	49,300	56,000	6,700
1951	47,600	62,000	14,400
1952	46,000	62,300	16,300
1953	44,800	64,800	20,000
1954	43,800	67,500	23,700
1955	42,800	70,200	27,400

Should there be no slackening in the growth of the Mexican economy, and even more should it be intensified, there is the danger that an increase of consumption of energy at the 1937-1947 rate will become a partial drain upon the country's balance of payments. The magnitude of foreign financing planned for the expansion of electricity production is considerable and will add to the liabilities of the balance. Only a large-scale expansion of petroleum exploration and production holds prospects that whatever drain on foreign exchange its financing may imply will be compensated by a net gain derived from petroleum exports. The alternative would be a contraction of imports.

V. Manufacturing industries and energy consumption

Energy consumption represents a relatively small percentage within total production costs of the manufacturing industries, amounting to 3.72 per cent in 1948. Of the total, fuels for direct use or for the

^{1/} Reproduced from Fuel Investigation: Mexican Petroleum, op. cit.

It is not known to what extent Pemex envisages a partial substitution of water power for oil consumption that may be feasible by the carrying out of the plans of the Federal Electricity Commission. It should also be noted that Pemex underestimated 1949 production which amounted to 62.1 million barrels.

production of electricity by the enterprises themselves represented 2.48 per cent and purchased electricity 1.24 per cent. However, fuel and electric power expenditures absorbed greatly varying shares of production costs within the various industrial groups, being relatively largest in cement plants, iron and steel foundries, glass and paper factories, and smallest in tobacco, shoe and soap production and in flour mills. (See table 7).

It seems that unit costs of fuel and electricity have increased more than other costs since their total rose from 2.52 per cent in 1943 to 3.72 per cent in 1948. Part of this increase may also be due to a greater degree of mechanization of the production processes. The shares of production costs that correspond to electricity and fuels varied in 1943-1948, as can be seen below.

	<u>Fuels</u>	<u>Electricity</u>	<u>Total</u>
1943	1.15	1.37	2.52
1944	1.28	1.86	3.14
1945	1.32	2.07	3.39
1946	1.21	1.90	3.11
1947	1.07	2.25	3.32
1948	2.48	1.24	3.72

Source: United Nations Economic Commission for Latin America;
basic data from Dirección General de Estadística.

The effect of this increase among the principal consuming groups of fuels and power is shown in Table 8.

Despite the relatively small share represented by fuel and electricity costs within total production costs, their availability is of decisive significance for the existence of industry and often plays a basic role in determining its location. This is particularly the case in the iron and steel industry, where the proximity of coal has been a basic factor. The location of the light industries, however, has been determined in most cases by the markets and was accompanied by an expansion of energy sources. It is in this way that the Mexico City area became the principal manufacturing centre of the country. It is likely that its pre-eminence will be accentuated still further since over 60 per cent of the generating capacity to be installed by the Federal Electricity Commission will be located there.

Table 7. Mexico: Electric power and fuel expenditures as per cent of total production costs of seventeen manufacturing groups, 1948

Arrayed according to the relative significance
of electric power and fuel costs

Group	Electric power	Fuel	Total produc- tion costs	Electri- city	Fuel	Power and fuel
	thousand pesos			per cent of total		
Cement	4,281	9,877	56,504	7.59	17.48	25.05
Iron and steel foundries	5,428	28,238	188,952	2.87	14.94	17.81
Glass	715	3,595	50,063	1.42	7.18	8.60
Paper	3,368	2,841	94,633	3.56	3.20	6.56
Rubber	1,803	726	112,802	1.60	0.64	2.24
Cotton yarns and fabrics	6,134	5,838	617,959	0.99	0.94	1.93
Woollen yarns and fabrics	640	865	89,512	0.71	0.96	1.67
Canned foodstuffs	163	490	41,790	0.39	1.17	1.56
Silk and rayon yarns and fabrics	623	490	75,800	0.82	0.64	1.46
Vegetable oils	1,394	675	145,231	0.95	0.46	1.41
Beer	1,246	1,194	181,814	0.68	0.65	1.33
Knit goods	338	176	38,851	0.87	0.45	1.32
Wheat mills	1,794	414	247,805	0.72	0.16	0.88
Soap	241	958	161,022	0.14	0.59	0.73
Matches	71	88	27,929	0.25	0.31	0.56
Shoes	19	166	40,903	0.04	0.40	0.44
Tabacco	261	262	126,477	0.23	0.20	0.43

Source: Basic data from Dirección General de Estadística

Table 7. Mexico: Production costs of the iron and steel industry, 1948

	<u>Thousands of pesos</u>	<u>Per cent of total</u>
1. <u>Raw materials</u>	57,522	30.4
Iron ore	6,533	3.4
Manganese ore	1,235	0.6
Pig iron scrap	12,231	6.5
Iron and steel scrap	22,976	12.2
Copper ingots	7,005	3.7
Ferro-alloys	1,836	1.0
Other materials	5,705	3.0
2. <u>Wages and salaries</u>	53,823	28.5
Salaries	10,780	5.7
Wages	43,043	22.8
3. <u>Other items</u>	77,607	41.1
Fluxes	1,851	1.0
Fuel	28,239	14.9
Electricity	5,428	2.9
Various costs	42,089	22.3
4. <u>Total production costs</u>	188,952	100.0

Source: Dirección General de Estadística

MEXICO : MANUFACTURING

SECTION 4. MECHANICAL INDUSTRIES

I. Agricultural equipment and machinery

As has been indicated in the Introduction, the productivity of Mexican agriculture is extremely low, amounting in 1946 to less than one-seventh of that in manufacturing and about one-eighteenth of that in mining. One of the basic causes of this difference resides in the fact that the real capital of Mexican agriculture is small and that, in addition, machinery and equipment constitute only a fraction of the total.

The small proportion of machinery and equipment within the real capital 1/ of agriculture reflects the low degree of capitalization of this activity. Machinery and equipment represented in 1940 less than 3.4 per cent of real capital of the ejidos 2/ and 4.3 per cent of farms of 5 hectares or more. For farms of less than 5 hectares no data are available but it is likely that the proportion was similar to that prevailing in the ejidos. The percentages given above compare unfavourably with the proportion of 7.4 per cent for the United States in 1940.

The rather small domestic production of agricultural machinery and equipment will be discussed later. The under-capitalization of Mexican agriculture is revealed also in the composition of total imports of machinery and equipment. This shows that agriculture, which during 1930-1948 accounted for over 60 per cent of the economically active population, absorbed an average of only 5.6 per cent 3/ of

1/ Includes value of land, its improvements, buildings, animals and machinery and equipment.

2/ Small holdings in individual or collective ownership of an inalienable character.

3/ It is likely that the percentage above is in reality somewhat higher. For instance, imports of lorries cannot be distinguished according to users and are included among machinery and equipment for transport and communications even though the 5,930 lorries employed in agriculture in 1940 represented 11.5 per cent of total commercial vehicles registration. Nor has it been possible to determine among imports of pumps how many are intended for domestic and other uses and how many for agriculture. On the other hand, it is likely that not all of the tractors imported were destined for agriculture.

total machinery and equipment imported during the period, its share fluctuating between 1.6 and 9.9 per cent of the total. (See Table 1).

It should be noted that as a result of the devaluation of the peso on 22 July 1943 the import values for 1943 are inflated in comparison to 1947. It is likely that imports of agricultural machinery and equipment increased both in absolute and relative terms in 1949 when an Export-Import Bank loan of five million dollars which had been granted in October 1943 became available for credit purchases of machinery by farmers.

The increase in the share of imports of agricultural machinery and equipment since the beginning of the war probably accounts in part for the fact that there was an increase in the relative productivity of agriculture as compared to the average of all activities as shown in Table 2 of the Introduction. It is also since that time that agricultural commodities have attained and maintained an important share in the country's exports.

Considering Mexico's foreign trade as a whole it appears that agricultural machinery in 1930-1948 averaged only 1.4 per cent of the value of all commodity imports, varying between a low of 0.3 and a high of 3.6 per cent. Although, as has been indicated above, the value of imports of agricultural machinery has been underestimated and that other imported goods are required by this activity, it appears that the net contribution that can be directly attributed to agriculture from the standpoint of Mexico's balance of trade is highly significant. (See Table 2). Taking into account, however, the small domestic production of agricultural machinery and equipment, part of this contribution merely reflects the deficiency of tools at the disposal of the farming population, being at the same time cause and effect of its low productivity.

Tractors, all of which come from foreign sources, chiefly the United States, are by far the most important item among imports of agricultural machinery and equipment. (See Table 3). However, the post-war increase in imports of parts is due to some extent to the opening of a factory in Saltillo by the subsidiary of a large United

/States farm

States farm machinery manufacturer which semi-assembles tractors as well as combines, disc ploughs and lorries, and assembles small machinery and implements 1/.

The rapid mechanization of at least a sector of Mexican agriculture is indicated by the fact that whereas only 4,604 tractors were in use on farms in 1940, imports of tractors in 1941-1948 totalled 20,761 units. In 1947 the tractors in use in Mexico were estimated at 17,035, representing the second largest number in Latin America, and closely following Argentina.

Despite the progress achieved in the mechanization of agriculture, tractors represent only a small part in the draught power used. With an average of 24 HP per tractor total motor power amounts to 408,840 HP as compared with the 1,368,429 oxen and work cows and the 927,419 horses and mules used in agricultural work 2/ 3/.

From a technical standpoint there is still considerable room for the utilization of tractors since the area thus cultivated is 1,109 thousand hectares while an additional 3,327 thousand are considered as being suitable for mechanization within a total of 7,394 thousand hectares of cultivated land 4/. Even now oxen constitute the main source of draught power of Mexican agriculture.

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- 1/ Report No.505, "Agricultural Machinery - Market in Mexico", Alan E.HOOL, Embassy of the United States, Mexico, D.F., 29 July 1949.
 - 2/ Report No.309, "Mexican Farm Wages and Farm Labour Productivity". John A. Hopkins, Embassy of the United States, Mexico, D.F., 13 May 1949.
 - 3/ These data indicate that motor power represents roughly 14 per cent of total draught power in agriculture. Considering, however, that it is generally utilized during fewer hours per year than draught animals the percentage is even smaller.
 - 4/ United Nations Economic Commissions for Latin America, Report of the Joint ECLA-FAO Working Party, Doc. E/CN.12/83 15 May 1949.

/At present

At present mechanization is most generally spread in the cultivation of wheat and cotton. It is on the increase in the case of rice, sesame and to a smaller extent, sugar. The cultivation of maize, Mexico's most important crop, is still largely carried out by primitive methods: most of the tilling is done with animal-drawn ploughs and the other operations are carried out by hand. There is also very little use of mechanized equipment in the cultivation of such major crops as beans, chile, bananas, pineapple and vanilla ^{1/}.

Even though, as indicated, the use of tractors is rapidly growing in Mexico, it seems that the country will depend for some time to come upon imports of either assembled or semi-assembled units. Except for some experiments in motor-construction no attempt is being made to create a tractor-building industry. The still relatively small size of the market, the high degree of technological development such an industry requires, the insufficient production of high-grade steel and other specialized products by the domestic steel industry, and the geographic proximity of the United States, which considerably reduces transport costs, constitute a handicap in this direction. It is reported, however, that when the new International Harvester plant at Saltillo reaches full development it will consider the production of Diesel motors and tractors ^{2/}.

The fact that tractors and spare parts represent the major part of imports of agricultural machinery and equipment, amounting to over 63 per cent of total value in 1930-1948, together with the fact that mobile motor power is beyond the reach of the great majority (over 88 per cent) of the individual holdings, suggest the co-existence of two very different sectors of Mexican agriculture. One is increasing its productivity and is largely responsible for the expansion of agricultural output achieved in recent years. The other, comprising the majority of

^{1/} Report No.505, op. cit.

^{2/} Ford, Bacon and Davis, Inc., Industrias Mecánicas de México, Monografías Industriales del Banco de México, S.A., Mexico, D.F., 1949.

the farming population, is still stagnant in its technology and productivity. It is for this reason that the joint ECLA-FAO Working Party pointed out in its analysis of agricultural machinery and equipment in Latin America: "That tractors should be imported in far greater numbers than before the war is doubtless to the benefit of agricultural production. But the Joint Working Party feels that the investments in modern farm implements are not enough. Much could be achieved in many areas by replacing archaic implements such as the chaqui-tacalla plough of Peru and Bolivia, the Egyptian plough and the hoe - used all over the region - the cuma of El Salvador and the machete of the Caribbean area, by simple but modern steel, animal-drawn, walking-type implements such as moldboard ploughs, planters, cultivators, mowers, etc.".

Excluding hand implements for which no data are available even though they are of greater significance in Mexico than in the agriculture of more developed countries, it appears that ploughs are the most important piece of machinery and equipment used. Ploughs and their spare parts constitute, after tractors, the most important item among imports of agricultural machinery and equipment, amounting to 13 per cent of total value in 1930-1948, and to 36 per cent if tractors are excluded. They represent approximately one-half of the domestic output of agricultural implements in terms of units, being estimated at about 10,000 units in 1943 ^{1/}. Assuming that 1947 production was of a similar magnitude, domestic production supplied about one-fourth of the demand ^{2/}.

Domestic production of ploughs takes place in ten small factories, seven of which are in Mexico City. The output is largely limited to animal-drawn, one-furrow ploughs. It seems that the increase in production has been slow since it amounted to 6,160 units according to the census of 1935 and, as indicated above, to an estimated 10,000 units

^{1/} Report No.505 op.cit.

^{2/} In contrast to 1937-1947 data, 1948 imports are stated in tons instead of in units.

in 1948. Data for the output of four producers available for 1935-1942 indicate an increase from 4,135 units in 1935 to a peak of 4,739 units, in 1940, and a decline to 4,333 in 1942 ^{1/}.

A comparison of 1948 with 1935 indicates that the volume of imports of ploughs almost trebled, having increased from 2,377 tons to 6,124 tons whereas domestic production increased only about 60 per cent. Nevertheless, imports of ploughs in 1948 were at an exceptional high level and do not permit a generalization. Assuming that in the intervening years imports of multiple-row ploughs for mechanical tractors have kept pace with the import of tractors, it is likely that the wartime imports of one-row ploughs were appreciably lower than in the pre-war period and that domestic production was able to fill a substantial part of the gap that occurred in the supply. In post-war years, however, domestic production lagged behind pent-up demand.

It is likely that the supply of ploughs will improve in the near future when the Compañía Constructora de Maquinaria in Mexico City reaches full production. The construction of the plant was reported near completion in 1946, and is intended to attain an output of 36,000 animal-drawn ploughs per year ^{2/}.

It seems that considerable progress was made between 1930 and 1940 in equipping Mexican farming with ploughs since census data indicate an average of one plough per eight hectares of cultivated land in 1930 and one for 513 hectares in 1940. Part of this progress may be apparent only, since the 1940 census was a more complete one. The deficiency which existed during that time can be roughly gauged

^{1/} Miguel Cleason Alvarez, Maquinaria Agrícola, Monografías Industriales del Banco de México, S.A., México, D.F., 1943.

^{2/} Ford, Bacon and Davis, Inc., op. cit.

by the fact that the average requirement is one plough per 4 hectares ^{1/}. This also suggests that an appreciable part of the acreage was cultivated by hand implements, particularly the hoe. The deficiency was even greater due to the high proportion of wooden ploughs in the total, amounting to 55.8 per cent.

Only a very rough estimate can be made of the progress achieved since 1940, it being likely that the number of steel ploughs increased by about one-third by the end of 1948 ^{2/}. This would indicate a considerably smaller rate of growth than that of tractors.

With the exception of tractors and threshers, other agricultural machinery and equipment is being produced in Mexico in considerable variety. In 1948 an estimated 4,000 cultivators, 4,000 shellers and about 2,000 units of miscellaneous machinery, such as rice separators, harrows and hand-operated corn planters were produced. However, domestic output is even less able to meet requirements than in the case of ploughs. Only the building of carts takes place almost entirely in the country.

The expansion of the irrigated area is requiring increasing quantities of water pumps and motors which are met mostly through imports. Even though only part of the pumps is used in agriculture, it may be noted that the quantities imported were rather stationary until the end of the war since considering the period of 1930-1944 they surpassed the 1,000-ton mark only in 1930, 1937 and 1944. Since then

^{1/} Approximately 250,000 ploughs were imported since mid-1940. Assuming that domestic production averaged 8,000 units per year and that depreciation is 8.3 per cent per year (as is assumed by Gleason, *op. cit.*, for moldboard ploughs) the increase would have amounted to 34 per cent. This may be an underestimate since, as indicated above, it is likely that imports of multiple-row ploughs have kept pace with the import of tractors. There being no information relative to wooden ploughs in 1930, when no distinction between wooden and steel ploughs was made, no trend regarding their supply can be assumed. For this reason and also due to the fact that changes in the area under cultivation are not known with sufficient accuracy, the change in the ratio of ploughs per cultivated area cannot be estimated.

^{2/} Report No.505, *op. cit.*

imports of pumps reached a peak of 5.5 thousand tons in 1947. In terms of value such imports amounted to 2.2 and 2.3 per cent of total imports of machinery and equipment in 1947 and 1948 respectively. Increasing demand is stimulating domestic production which is carried out on a commercial scale in the Federal District, San Luis Potosí and Monterrey, reportedly with satisfactory results.

The principal weakness of the domestic output of agricultural machinery and equipment lies in the fact that it is being carried out in small enterprises by rudimentary methods and that with one exception ^{1/} it is secondary to other lines of production of such establishments. Another difficulty lies in the unsatisfactory quality of some of the domestic steel products utilised by the industry; insofar as it relies upon imports of parts or of high grade steel, production was limited during the war by their shortage. It is likely that this shortcoming will be overcome in the measure in which the quality of the output of the iron and steel industry improves.

II. Transport equipment

The rugged topography and the production of petroleum in Mexico stimulate the use of motor vehicles over the other means of land transport to a greater extent than in most other countries. Thus, for instance it is likely that lorry freighting has reached in post-war years a volume almost equal to the freight transport of the railway ^{2/} while in the United States motor carriers are estimated to have accounted for only 11 per cent of the ton-miles of intercity commodity traffic in 1946 ^{3/}.

^{1/} The Mecánico Industrial, established in 1935, is a cooperative with government participation producing exclusively ploughs and other farm equipment. Its output has remained at rather low levels mainly because of personnel and technical difficulties. (Cf. Gleason, op. cit.)

^{2/} Dudley C. Singer, Truck Transportation in Mexico - 1947, Embassy of the United States, Mexico, D.F., 1948.

^{3/} Interstate Traffic Commission, 61st Annual Report, Washington, D.C., 1947

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Partly as a consequence of this development the present network of railroads in Mexico is practically the same in length as in 1913 when the railroad boom came to an end. Actually the track mileage in 1947 was slightly smaller than in 1913. However, since the end of the war additions have been made and other lines are in the process of building.

A. Railways

Fixed equipment.

The domestic steel industry, particularly since the start of operations of the Monclova steel mill appears to be in a position to produce a substantial amount of rails, as can be seen below:

Production and imports of rails and track accessories, 1943-1948 (metric tons)

	Production of rails	Production of track accessories	Import of rails and track accessories
1943	9,061	..	3,232
1944	22,179	..	9,755
1945	15,670	..	7,043
1946	16,743	..	36,452
1947	13,753	6,003	90,154
1948	5,757	4,446	43,923

Source: Dirección General de Estadística

Even though data are available only since 1943, it should be noted that the 1944 peak output of rails is higher than the average yearly import of rails and track accessories in 1913-1945. Average output of rails in 1943-1948 is also higher than import during all but five years in 1918 - 1945. It seems, therefore, that the Mexican steel industry is able to supply at least, the necessary replacements of rails. Any major expansion of tracks, however, depends substantially upon imports unless there is an increase in steel mill capacity.

It is also possible that domestic production might not be sufficient for a large-scale program of reconstruction of roadbeds and replacement of rails which would be necessary for a speed-up of traffic. The advantages of such modernization can be seen for instance in the case of the Mexico City - Laredo route where the old 75-pound rails were partly replaced by 112-pound rails, cutting freight running time

/by more

by more than 25 per cent. ^{1/}

Among other fixed equipment it should be noted that most of the essential materials and equipment for new track and track maintenance are produced in the country. These include in particular tie plates, rail plates, bolts clips, spikes, switch points and frogs.

Rolling stock

As yet no new rolling stock, except parts, and a few light duty mining and track maintenance cars are being produced in Mexico. In this respect the country is dependent upon imports, almost exclusively from the United States. (See Table 4).

Changes in locomotive numbers in 1928-1947 indicate an insufficient replacement rate so that the decrease in the number of locomotives ^{2/} and the small increase in passenger stock and wagons led to an overburdening of the transport system, particularly during the war years. This proved to be a drawback for most economic activities due to insufficient or irregular deliveries of raw materials resulting at times in the stoppage of production in manufacturing enterprises, delays in the supply of consumption centers, and spoilage of agricultural products. The overburdening of the railway system may be roughly appraised by considering the increase in passenger and ton-kilometers as compared to the increase in rolling stock ^{3/}. (See Table 5) Even at present the numbers and the maintenance of the rolling stock as well as the condition of the tracks are generally considered as not being satisfactory.

^{1/} Dudley C. Singer, The Railway System of Mexico, Embassy of the United States, Mexico, D. F., 1948

^{2/} The discarding of over-aged engines was partly compensated by the introduction of more efficient units, including Diesel locomotives. In 1948 the railways operated a fleet of 41 Diesel locomotives of which 13 had been acquired in 1947.

^{3/} It is likely, however, that the transportation bottleneck would have been less serious had the personnel and technical management of the railroads been more effective.

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Table 4. Mexico: Imports of locomotives, wagons and other rolling stock
1937 - 1948

	Locomotives (units)	Wagons (units)	Rolling Stock not specified (tons)
1937	38	1,172	7,671
1938	31	632	4,622
1939	6	306	4,764
1940	12	236	4,457
1941	20	176	4,730
1942	13	357	7,505
1943	21	653	5,347
1944	15	784	3,299
1945	41	1,609	6,102
1946	37	1,424	11,752
1947	29	956	9,892
1948	50	949	3,398

Source: Dirección General de Estadística.

Note: Data for years prior to 1937 are not comparable.

Table 5. Mexico: Railway rolling stock and traffic. 1928-1947

	Locomotives (Units)	Passenger stock (Units)	Passenger Kilometers (Millions)	Wagons (Units)	Ton- Kilometers ^{a/} (Millions)
1928	1,493	1,237	1,502	18,302	4,006
1929	1,527	1,401	1,629	18,792	4,035
1930	1,641	1,408	1,443	20,312	4,041
1931	1,473	1,303	1,123	20,096	3,378
1932	1,433	1,315	930	19,788	2,884
1933	1,389	1,342	1,005	19,621	3,245
1934	1,375	1,429	1,160	19,461	4,154
1935	1,375	1,430	1,332	20,540	4,596
1936	1,365	1,594	1,571	20,639	4,927
1937	1,300	1,642	1,719	21,046	5,331
1938	1,387	1,624	1,789	20,944	5,535
1939	1,359	1,607	1,841	20,630	5,728
1940	1,345	1,534	1,862	20,329	5,764
1941	1,305	1,521	1,976	19,846	6,076
1942	1,314	1,540	2,281	21,072	7,019
1943	1,324	1,448	3,022	21,473	8,092
1944	1,305	1,423	3,598	20,450	8,194
1945	1,367	1,516	3,405	20,525	8,024
1946	1,240	1,696	3,009	22,636	8,135
1947	..	..	2,860	..	8,661

Source: Statistical Office of the United Nations.

a/ Including service traffic.

Table 6. Mexico: Repairs of railway rolling stock and manufacturing of parts within group of foundries and manufactures of metal products, according to the 1950 census

	Total foundries and manufactures of metal products	Repairs of railway rolling stock		
		absolute figures	as % of total	as % of manufactures of metal products
Number of establishments	463	29	3.2	7.9
Value of investment (Millions of pesos)	139.4	59.9	43.0	58.0
Value of raw materials used (Millions of pesos)	96.0	16.0	16.7	20.4
Value of output (Millions of pesos)	203.2	61.9	30.5	40.0
Numbers employed	37,998	21,615	56.8	69.8

Source: Dirección General de Estadística.

Repairs of railway rolling stock constitute a major activity within the group of foundries and metal products group. (See Table 6). It is likely however, that their relative position has decreased since 1940 due to the rapid expansion of the foundries and particularly of the other metal products industries.

Equipment repair expenditures of the National Railways of México represent a substantial part of operating expenditures. The fairly constant percentage increased somewhat during the war years as a result of the unusual wear and tear of the equipment, as can be seen below:

Equipment repair expenditures as percentage of operating expenditures
of the National Railways of México: 1936 - 1947 ^{1/}

1936	27.5	1942	29.6
1937	27.1	1943	30.3
1938	25.7	1944	29.7
1939	27.4	1945	30.2
1940	27.9	1946	27.9
1941	28.4	1947	28.3

a/ Excludes the Inter-Oceanic Railway of Mexico

Source: National Railways of Mexico

Nearly all repairs of railway rolling stock are carried out by the National Railways of México which have 14 well equipped shops throughout the country and a large number of small shops for emergency repairs.^{1/} In addition to maintenance and repair of railroad equipment some of these shops produce replacement parts, particularly the largest one, located at Aguascalientes. The latter shop has a plate and sheet metal department for the building of locomotive boilers, combustion chambers, cabs and fuel tanks; a foundry for brass and gray iron castings; a rolling mill for producing rods, flat iron and angle iron; and a machine shop for machining foundry products and for maintenance and construction.

Among other products for railway use, the Aguascalientes shop, as well as an independent manufacturer, produces leaf springs for

^{1/}General Motor Overseas Corp., Industrial Survey of México, New York, 1943. Subsequent references to railway repair facilities are also from this source.

locomotives and freight cars; coil springs are also produced. No axles for railroad cars are manufactured in Mexico, but domestic production includes standard solid freight car wheels as well as locomotive wheels except steel tires. In addition, brake shoes and brake shoe retainers are also manufactured. Repairs and rebuilding of wagons also involve the manufacture of frames and bolsters, journal boxes, drawbacks, coupling bars, journal bearings and journal collars. Rebuilding of locomotives includes the manufacturing of boiler heads, cylinder jackets, driving arms, brass and bronze bearings and bushings, cabs and fuel tanks.

Despite the extensive repair facilities of the National Railways it is reported that because of unsatisfactory labor conditions they are not being utilized to best advantage and that an unduly large proportion of rolling stock is out of use awaiting repairs ^{1/}. Furthermore, it is reported that lack of coordination and utilization of freight car movement necessitates the rental of wagons from the United States at great cost, ^{2/}

Despite the considerable development of railway repair and production facilities for fixed equipment and parts of rolling stock, the obsolescence of the capital equipment is indicated by the fact that in 1948 the railway administration had completed plans to invest the equivalent of 114 million dollars over a period of five years in the purchase of new locomotives, rolling stock and other equipment and for the rehabilitation of roadbeds, bridges, signal systems, shops, stations and other installations ^{3/}. Since the 1948 imports of fixed equipment, locomotives and rolling stock were equivalent to approximately 5.1 million dollars ^{4/}, the contemplated investment program would undoubtedly call for a considerable increase of domestic output of railway equipment in order to reduce the foreign currency expenditures which might possibly be financed by means of a foreign loan.

B. Motor Vehicles

The number of passenger cars and commercial vehicles increased at a

^{1/}For instance in 1947 while 137 locomotives were undergoing repairs, 123 units were awaiting to be repaired (Source: Banco de México).

^{2/}Dudley G. Singer, op.cit.

^{3/}Ibid

^{4/}At the 3.65 pesos per dollar rate.

rapid rate particularly since the mid 'thirties, being accompanied by the development of highway construction. It may be noted that the increase of commercial vehicles was greater than that of passenger automobiles. In 1947 commercial vehicles consisted of 86,198 lorries (trucks) and 11,790 buses; passenger vehicles included 112,478 privately owned cars, 17,074 taxis and 4,527 official cars. (See Table 7).

Since no new motor vehicles, except locally assembled ones, are produced in Mexico, motor transport depends upon imports of motor vehicles; furthermore their maintenance requires additional imports of parts. Motor transport absorbs a substantial part of the country's commodity imports, its share in peacetime ranging from a low of 1.0 per cent in 1931 to a high of 15.7 per cent in 1941 (See Table 2).

There are ten establishments in Mexico assembling United States motor cars and lorries. ^{1/} Some of them are branches of the parent companies and others are Mexican-owned concerns importing parts and assembling them with the technical assistance of the suppliers. Since 1947 their output has been limited by quotas set up by the Government in order to save foreign exchange. These amounted to about 27,000 units in 1947/48, 15,900 in 1948/49 and 16,100 in 1949/50. The quotas are considerably below capacity so that it is reported that the largest assembly plant could produce more than the total quota for the industry in 1949/50; however, the quota for the two largest producers was only 5,000 units each. In addition to the ten assembly plants mentioned above a plant has been recently established which expects to begin producing motor cars on a commercial basis in mid-1950 using imported motors and a number of standard parts. ^{2/}

Transportation costs were of lesser significance for the establishment of United States assembly plants in Mexico than in other countries due to the shorter distance of rail, and subsequently also highway, transport from the production centers. ^{3/} Nevertheless, several

^{1/} The plants assemble vehicles of the following producers: General Motors, Ford, Chrysler, Nash-Studebaker, International, Packard, Hudson (including Renault), Willy's, Diamond-T, and Ree.

^{2/} The South American Journal, January 25, 1950.

^{3/} An illustration of savings in transportation costs is provided by the fact that an automobile that represents thirteen tons of shipping space when fully assembled is reduced to three or four tons in a "completely knocked down" shipment. /other factors

other factors which led to the establishment of assembly plants overseas were operative also in México. Principally among them were savings on tariff that could be obtained by exporting knocked down units instead of fully assembled automobiles ^{1/}, lower labor costs and the possibility of producing parts or purchasing them locally. In this way one of the largest assembly plants claims that already before the war approximately 40 per cent of production costs consisted of assembly labor and components purchased in Mexico or manufactured at the plant, and other factors.

A new impulse to the assembly of motor vehicles was given in July 1947 when imports of built-up passenger cars, lorries and buses was temporarily prohibited as one of the measures undertaken at that time to save foreign exchange.

The rise of an ancillary automotive industry in Mexico has led to a saving of dollar expenditures as well as to the expansion of technical knowledge and a larger number of industrial workers in the country. On the other hand, it has not contributed to a reduction of production costs. Also the loss of government revenue arising from lower tariffs on parts as compared to the rates applicable to built-up cars should be considered in this connection. On the contrary, there has been in recent years an increase in production costs mainly due to the fact that quotas have been introduced for the number of knocked down units that may be imported, and that these are below the expanded plant capacity, resulting in increased amortization, overhead and labor costs per unit assembled.

Operations of the assembly plants include riveting, spot and arc welding, soldering, painting, upholstering, assembly of body and chassis, and numerous other operations. The production of components either by assembly plants or by independent producers consists of a series of items, the main ones of which are indicated below.

About 63 shops are engaged in building bodies for buses and lorries

^{1/} Import duties on a knocked-down unit for assembly in Mexico amounted to approximately 138 pesos or less than 57 dollars prior to the devaluation of the Mexican currency. (Report No. 585, Don Vasque, Automobiles Market in México, Embassy of the United States, México, D. F., August 11, 1947).

with an output of an estimated 4,500 units in 1947. ^{1/} The tendency is toward a concentration of production, a greater use of metal as compared to wood, a greater standardization and an improvement in quality. Nevertheless, progress along these lines is slow in the small shops, but is more apparent among the four or five largest producers which have an average monthly output of 20 units. Bus bodies both for city and intercity service are produced; the principal types of lorry bodies are platform, stake and dropside as well as trailers. Most of the industry is concentrated in the Federal District. With the prohibition of imports of built-up vehicles, the expansion of motor transports will depend to a very large extent upon the efficiency of the industry.

The following recapitulation of the annual sales volume of the production and imports of bus and lorry bodies most commonly sold indicates the significance of the industry ^{2/} It should be noted, however, that imports are likely to have increased considerably in postwar until July 1947.

<u>Type</u>	<u>Total</u>	<u>Local</u>	<u>Imported</u>
Ambulance	40	-	40
Bus	1,000	1,050	50
Dropsides	1,000	1,000	-
Dump	800	80	720
Panel	500	-	500
Station wagons	300	150	150
Platform and stake	2,500	1,750	750
Tank	175	150	25
Vans	30	30	-
Pick-up	1,000	-	1,000
	<u>7,445</u>	<u>4,210</u>	<u>3,235</u>

The bulk of the apparent consumption of tires is domestically produced and the proportion of locally produced tires is even larger for standard sizes. Despite the expansion of the domestic tire production it was not sufficient to keep pace with demand so that

^{1/} Banco de México, Industria de fabricación de carrocerías, México, D. F. 1943.

^{2/} Industrial Survey of Mexico, op. cit. Production data refer to 1943.

/imports of tires

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Table 7. Mexico: Motor vehicles registered, 1928-1947

	<u>Passenger automobiles</u>	<u>Commercial vehicles</u>
	<u>Units</u>	<u>Units</u>
1928	49,059	18,075
1929	62,461	22,330
1930	63,073	24,592
1931	62,085	25,210
1932	59,628	25,998
1933	65,445	31,104
1934	74,312	34,209
1935	64,663	30,620
1936	67,165	33,516
1937	78,155	42,235
1938	81,923	42,045
1939	89,372	49,437
1940	93,632	52,076
1941	106,327	61,329
1942	113,427	64,614
1943	112,041	65,776
1944	111,947	69,557
1945	113,517	72,221
1946	120,906	84,508
1947	134,079	100,908

Note: End of year data except for 1945 when numbers are as of January 1st, 1946.

Military vehicles are excluded.

Passenger cars: motor cars seating less than eight persons, taxis included, buses and two and three-wheeled motorcycles excluded.

Commercial vehicles: including lorries (trucks), buses and tractor trailers; excluding light trailers for passenger cars, farm and road tractors.

Source: Statistical Office of the United Nations.

Table 8. Mexico: Imports of motor vehicles and parts as percentage
of total commodity imports, 1925-1948

1925	5.9	1937	11.7
1926	5.1	1938	6.1
1927	4.1	1939	13.0
1928	6.9	1940	14.1
1929	6.8	1941	15.7
1930	6.6	1942	9.2
1931	4.0	1943	3.3
1932	5.9	1944	4.1
1933	6.5	1945	6.2
1934	8.5	1946	12.6
1935	10.2	1947	11.7
1936	10.3	1948	9.9

Note: Excludes motor-cycles

Source: United Nations Economic Commission for
Latin America; basic data from
Dirección General de Estadística.

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imports of tires attained record levels in postwar years. Domestic tire production, however, may well have prevented a partial paralization of motor transport during the war and will certainly increase the future as highway traffic develops. (See Section 9)

Nearly 90 per cent of the batteries used are manufactured in the country, mostly by nine producers. The quality of the more expensive batteries is reported as being quite good. The wood separators and the cases are imported. However, the latter could be produced locally should demand expand sufficiently, lead for the making of plates and battery acid are produced in the country.^{1/} A company operated by the local branches of General Electric and Westinghouse produces standard automotive bulbs.

Commercial output of metal automotive parts is still rather limited, comprising mainly leaf, coil and seat springs; certain types of bearings and pistons. There is also a very small output of radiator cores. Other items are made on special order and at high cost, such as transmissions, rear axle gears, main drive gears, spline shaft, tail pipes and mouldings.

The activities of the numerous shops repairing automotive vehicles are not reflected in a comprehensive way in statistical sources and are largely beyond the scope of the present survey.

III Electrical products industry

The electrical products industry in Mexico is characterized by a large number of small plants making the simpler types of equipment and parts, and by a large producer, Industria Eléctrica de México, which began operations in 1948 and which accounts for about 85 per cent of the value of the electrical products manufactured in the country.

The electrical products industry has had a rapid growth since the 1930 census, when it comprised only 8 establishments employing 30 persons, to the preliminary census survey of 1944, when it included 951 establishments employing 4,021 persons. During the same time gross value of output increased from 153,000 pesos to 35.2 million pesos ^{2/}

^{1/} Industrial Survey of Mexico, op. cit.

^{2/} Banco de México, Industria de aparatos eléctricos, México, D.F., 1948.

/A large part

A large part of this value probably consisted of repair services since despite its expansion imports of electrical products did not decline in 1935-1945, varying between 2.4 and 3.1 per cent of Mexico's total imports.

The Industria Eléctrica, constituted in 1945 with a capital of 50.5 million pesos ^{1/}, mostly Mexican, under an agreement with the Westinghouse International Electric Company. The latter supervised the design and the construction of the plant, located at Tlalnepantla near Mexico City. The agreement stipulates the licensing of a series of Westinghouse patent rights, training of personnel, and technical advice in management and production. Industria Eléctrica also became the distributor of Westinghouse products, previously distributed in Mexico through other channels.

The numbers employed in the new enterprise are approximately 3,000 persons and estimated gross value of output in 1948 was 50 million pesos. This suggests that productivity in the plant is about 7.5 times greater than in the rest of the electrical products industry in the country ^{2/}. A preliminary estimate placed the value of output at 35.50 per cent of national consumption ^{3/}.

A very broad range of products is manufactured by the Industria Eléctrica, with durable consumer goods predominating. These include refrigerators, electric irons, heaters, water heaters, air-conditioning units for domestic use, radio receiving sets and other products. In nearly all cases production depends in varying degrees upon imports of essential parts, such as motors for refrigerators, and nearly all components for the assembly of radio sets. Capital goods production includes mainly motors and generators of up to 500 KW, and transformers.

^{1/} Equivalent to 10.4 million dollars. The balance sheet of the company, as of 31 December 1948, showed an investment of nearly 87 million pesos.

^{2/} Calculated on the basis of numbers employed in 1944; the ratio is greater to the extent that employment in the other enterprises increased in 1944-1948. It is likely, however, that the output in these enterprises has been underestimated in the official statistics.

^{3/} Memorandum of Banco de México, not dated.

The agreement with Westinghouse provides for the licensing of patents and for technical assistance for an additional broad range of products, especially capital goods.

The postwar demand for electric products gave rise in 1947 to two medium-size plants with a capital of 5.0 million pesos and 2.5 million, respectively, destined to the assembly of radio receiving sets, and to two small plants, one for the manufacture of heaters and the other for transformers. Three small plants for the manufacture of various electric products were established in 1948 with a total capital of about 300,000 pesos.

The decree of July 11, 1947, prohibiting the entry of a series of import items brought about a considerable expansion of radio assembly activities. At the beginning of 1949 there were already seven concerns assembling 16 United States name-brand radios and several local brand radios.^{1/} Whereas at the beginning of 1948 the rate of production was not in excess of 2,500 units per year, output during that year reached 71,590 sets even though most of the new establishments did not start operations until late in 1948. The combined 1949 production planned by the firms that were operating at the beginning of the year was estimated at between 160,000 and 180,000 sets, but may have reached 200,000 units with the addition of other producers. The relative magnitude of this output may be assessed by considering that the number of sets in use was estimated at 1,113,534 as of February 1, 1949.

Only two United States radio producers have a direct investment in the local assembly plants while the others operate on the basis of an agreement stipulating a percentage of the profits in return for technical assistance and the franchise. Those planning the establishment of radio assembly plants in Mexico include a large European producer.

It is reported that on the whole the quality of output is being kept

^{1/} Information on this industry is based on Report No. 103, "Annual Report on Radio Receiving Sets, Radio Receiving Tubes and Radio Components", by Alan E. Hood, Embassy of the United States, Mexico, D.F., February 14, 1949.

at standard and that in some instances it is even better than in the United States. For the time being only some of the wooden cabinets are being made in Mexico but it is probable that in the near future all of them will be made locally; it is also expected that the plastic cabinets will be made in the country. Some components are manufactured in Mexico but no radio receiving tubes will be made probably for many years to come, mainly because of the small size of the market. All packing materials are obtained from local cardboard and paper producers. Only two firms have been given the tax and import duty exemptions granted to new industries in Mexico, and they will be obliged in 1949 to manufacture or obtain from local sources 20 per cent of their components and within five years to increase this share to 70 per cent.

The effect of the prohibition on imports of assembled radio sets and the establishment of an assembly industry was as is shown below:

		<u>Imports of</u> <u>radio sets</u>	<u>Imports of</u> <u>components</u>	<u>Production of</u> <u>radio sets</u>
	Units	Value (thousands of pesos)	Value (thousands of pesos)	Units
1947	176,653	29,964.0	8,097.9	2,500 ^{a/}
1948	5,863	2,177.9	17,003.3	71,590

These data suggest that in terms of pesos there has been no saving in foreign exchange since in 1947 imports per set available (imported or domestically produced) amounted to 212.4 pesos, while corresponding imports in 1948 were 247.7 pesos. In terms of dollars imports per set seems to have increased from approximately US\$43.7 to \$44.8 ^{1/} which may be due to an increase in unit costs and possibly an increase in the potency of the sets; also domestic production may have been underestimated.

^{a/} Estimate

^{1/} Import values in 1947 calculated at the 4.86 pesos per dollar rate; imports in 1948 have been calculated at the same rate of January-July and at 6.81 for August-December, assuming uniform monthly imports.

There is no information available as to the payment for franchise and technical services which would permit a fuller estimate of the foreign exchange expenditure involved.

Even though it appears that the introduction of the radio assembly industry in Mexico has not brought about a saving of foreign exchange, it is likely that such a saving actually occurred since the unit price of imported assembled radios increased from 167.3 pesos in 1947 to 371.5 pesos in 1948 (approximately US\$34.4 and \$67.2, respectively); changes in the quality of such imports may, however, partly distort the change. The industry therefore largely absorbed the increase of foreign exchange expenditure which the rise of prices would have produced.

Finally, among the electric products industry the production of lamp bulbs should be mentioned. Manufactures being carried out by three producers, two of whom are in Monterrey and one in Mexico City. The most important of the three, ^{1/} located in Monterrey, is operated by the local branches of General Electric and Westinghouse and produces the most common sizes of household bulbs. ^{2/} To this has been added the assembly of fluorescent bulbs. The products of the industry, classified by types were as follows, according to the 1940 census:

<u>Bulbs</u>	<u>Units</u> (thousands)
40 Watts	2,503
60 "	961
100 "	1,182
over 100 Watts	1,405
Less than 40 Watts	<u>2,750</u>
Total	8,801

A considerable part (over 81 per cent) of the value of the materials used by the industry in 1940 was imported. The most important items upon

^{1/} Cia. Mexicana de Lámparas Eléctricas

^{2/} Industrial Survey of Mexico, op.cit. The output of automotive bulbs has already been noted.

/which the industry

which the industry is dependent from foreign sources are, in terms of value, bulb filaments, filament bases, bulbs and caps.

Due to the relatively small size of the market, production costs are higher than among the main production countries so that the existence of the industry depends upon tariff protection.

The significance of the domestic incandescent bulb production can be assessed from the fact that in 1940 only 864,000 bulbs were imported as compared to a domestic production of 8.8 million. The volume and value of imports are shown in Table 9.

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Table 9. Mexico: Imports of incandescent electric bulbs,
1925-1948.

	<u>Volume</u>	<u>Value</u>
	(Thousand bulbs)	(Thousand pesos)
1925	1,816	1,059
1926	1,862	1,076
1927	1,810	1,021
1928	31	17
1929	580	262
1930	539	278
1931	420	182
1932	305	133
1933	260	121
1934	888	204
1935	1,794	310
1936	2,713	283
1937	2,589	305
1938	895	203
1939	845	280
1940	864	385
1941	1,213	421
1942	770	424
1943	506	407
1944	500	473
1945	1,300	1,040
1946	3,162	1,840
1947	5,409	2,904
1948	4,463	2,231

Source: Dirección General de Estadística.

SECTION 5 CEMENT

I. Production and supply

The development of the cement industry in Mexico was largely determined by two factors: the concentration of the manufacturing activities and of the urban population on the central plateau, and the high incidence of transportation costs upon the prices of bulky commodities when imported into the interior of the country. In contrast to such Latin American countries as Argentina, Chile and Brazil where cement can be imported at lower unit prices due to the fact that most of the population lives near the sea and that their bulky exports permit cheap transport rates on the ships' return, Mexico's cement production for the inland market is protected by topography and constitutes therefore to an appreciable degree a localized industry.

It is for this reason that Mexican imports of cement were always relatively small, having surpassed the 100,000 ton mark only on three occasions during this century: in the fiscal year 1907/1908 and in 1945-1946, being appreciably lower for most other years. It is for the same reason that the Mexican cement industry developed at an earlier stage than in most of the other Latin American countries and was localized mainly on the central plateau. The first cement plant was established in 1903 near Mexico City and by 1910 three other plants were in operation. In the early 'twenties five additional plants started production.

Already in 1925 domestic output amounted to 84 per cent of apparent consumption. It is for this reason that during the "great depression" the cement industry was not stimulated as strongly as several other manufacturing activities by the pressing need of replacing imports by an expanded domestic output. During 1929-1936 production increased only some 28 per cent. (See Table 1 and Chart 1).

From 1937 on, the development of cement production has been spectacular, reflecting partly the rate of investment, and partly a change in technology in the use of materials by the construction industry. Between 1937 and 1947 output increased by 190 per cent, being appreciably greater than in the three Latin American countries /which have

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Table 1. Mexico: Production, foreign trade and supply of cement, 1925-1949.

	Production	Imports ^{a/}	Exports	Supply for domestic consumption	Per capita supply
	(..... thousands of metric tons)			(kilogrammes)	
1925	130.5	24.3	-	154.8	10.2
1926	151.4	23.7	-	175.1	11.3
1927	158.3	27.9	-	186.2	11.8
1928	211.2	22.0	-	233.2	14.6
1929	221.9	39.9	-	261.8	16.1
1930	223.9	24.0	-	247.9	14.9
1931	157.4	13.2	-	170.7	10.1
1932	137.8	7.9	-	145.6	8.5
1933	172.8	10.2	-	183.0	10.5
1934	266.0	16.0	-	281.9	15.9
1935	251.7	15.4	-	267.0	14.8
1936	286.0	6.9	0.3	292.6	15.9
1937	344.7	11.8	0.3	356.2	19.0
1938	373.7	13.9	0.5	387.1	20.3
1939	409.8	5.1	0.6	414.2	21.3
1940	485.0	4.5	1.0	488.4	24.7
1941	537.5	4.1	0.8	541.7	26.8
1942	560.4	6.4	-	566.8	27.4
1943	596.7	43.0	-	639.6	30.2
1944	623.8	69.6	0.2	693.2	32.1
1945	808.3	109.0	-	917.3	41.3
1946	878.8	155.4	-	1,034.2	45.4
1947	998.9	72.0	-	1,070.9	45.7
1948	1,080.2	4.3	34.6	1,049.9	44.1
1949	1,212.0	2.0	5.0	1,209.0	49.5

Source: United Nations Economic Commission for Latin America: Production data for 1925-1933 from trade sources; for 1934-1941 from Dirección General de Estadística, and for 1942-1949 from Asociación de Productores de Cemento. Foreign trade data from Dirección General de Estadística.

a/ Until 1942 imports of cement include lime.

which have manifestly entered the industrialisation stage, since the increase in Argentina amounted to 30 per cent, in Brazil 60 per cent and in Chile 92 per cent. Among the less industrialized countries of Latin America only Bolivia, Peru and Venezuela showed a greater increase than Mexico, although Colombia and Guatemala followed closely, in relative terms.^{1/} By the end of 1949 cement production in Mexico had increased some 250 per cent over the 1937 level.

Since 1939 the cement industry has been working at full capacity mainly due to the building boom which characterized the war period in Mexico. Most of the cement production was absorbed by private construction building even though the requirements of governmental bodies, mainly for highway and irrigation projects assumed large proportions, amounting to 30-50 per cent of output in 1944-1946.^{2/} Any slacks that occurred during the boom were mainly due to the fact that at times the railway system was unable to transport the necessary raw materials or fuels.

The trebling of cement production in Mexico took place mostly during the war and was made possible by a combination of various favourable factors. Chief among them was the fact that the fuel utilized by the industry, namely, fuel-oil, is of domestic origin so that production was not hamstrung by the wartime diversion of shipping as was the case in Argentina. Furthermore, at the beginning at least, there was a surplus plant capacity which could be used. The main cause, however, of the large-scale expansion of output was the fact that the Mexican industry was able to obtain a substantial amount of equipment from the United States. In this way the number of plants grew from eight in 1940 to 17 in 1945 and 19 in 1948, and yearly capacity from 0.6 million tons in 1942 to 1.5 million in 1948.^{3/}

The geographical distribution of installed capacity, as of October

^{1/} United Nations Economic Commission for Latin America, Economic Survey of Latin America, 1948, Lake Success, New York, 1949.

^{2/} Industria del Cemento, memorandum by Joaquín Ramírez Cabañas to the Bank of Mexico, 1948.

^{3/} Calculated on the basis of 300 working days.

1948, was as follows: 1/

Distribution of installed capacity of cement producers in Mexico, 1948.

Zone	Number of plants	Yearly capacity (thousands of tons)	Per cent of total
Centre	10	868.5	56.4
North	4	381.0	24.8
Northern Pacific	3	198.6	12.9
Gulf	1	60.0	3.9
Southern Pacific	1	30.0	2.0
Totals:	19	1,538.1	100.0

An additional capacity of some 580,000 tons, representing an increase of 37 per cent, was scheduled for installation in October 1948, some of it to be completed by the end of that year and the rest in the course of 1949 and 1950. This expansion consisted both in additions to the capacity of existing plants or in the construction of new ones. 2/

In mid-1949 capacity amounted to 1,763.1 thousand tons and by mid-1950 was expected to reach 2,120.7 thousand tons. 3/

II. Productivity

The fact that relatively high transportation costs give the Mexican cement industry a substantial degree of protection against foreign competition has at the same time a certain disadvantage since the reduction of transportation costs that is gained by a localized and somewhat dispersed industry are partly offset by an increase in production costs due to the small size of most of the plants. Thus the average yearly capacity amounted to 81,000 tons per plant in 1948, as compared to an average of 258,000 tons in the United States in 1938-1940.

1/ Industria del Cemento, op. cit.

2/ Ibid.

3/ Asociación de Productores de Cemento, Fábricas de Cemento en la República Mexicana, 17 August, 1949.

Size of cement plants according to capacity, mid-1948.

Yearly capacity (thousands of tons)	Number of plants	Per cent of total capacity
200-299	1	14.6
100-199	5	42.1
50-99	7	31.0
Less than 50	6	12.3
Totals	19	100.0

The installations of four plants, including the largest one which possessed 20 per cent of the total capacity of the industry in mid-1949, can be considered as modern. Most of the other large enterprises were installed in the 'twenties. The remainder of the cement industry possesses rather antiquated equipment since in peace-time nearly all of the small producers installed their plants with second-hand, although well reconditioned, equipment. During the war second-hand equipment was installed almost exclusively, after numerous technical difficulties had been overcome. In this way, it is estimated that in 1949 about half of the equipment was modern.

Antiquated equipment is one of the main causes of the low labour productivity of the Mexican cement industry where 7 1/2 man-hours are necessary for the production of one ton of cement, as compared to the United States average of only 3 hours. ^{1/} The use of antiquated equipment leads to interruptions of output for repairs. Insufficient mechanisation, particularly in the handling of materials, is reflected in relatively high labour costs. The existence of several relatively inefficient plants leads to the high average consumption of fuel in the industry. Low productivity is also due partly to social legislation which stipulates high severance payments as a result of which producers maintain a

^{1/} F. Barahona de la O., "Panorám de la industria mexicana del cemento al finalizar el año de 1947", Revista Industrial, March 1948.

larger labour force than is economically justified. ^{1/} Under equal conditions, however, it is said that labour productivity in the modern plants could be comparable to that in the United States.

Most of the output of Mexican cement is of good quality, meeting the standards of the Dirección General de Normas (Bureau of Standards), and is similar to that produced in the United States. In contrast, however, to the United States cement industry which produces several types of specialized cement, the bulk of the Mexican output is Portland grey. However, one plant produces white cement exclusively and another slag cement. A third plant produces both grey and white cement. ^{2/}

III. Demand

In postwar years the expansion of plant capacity progressed at a greater rate than demand so that the former is expected to level off after 1950. For the first time since 1935 apparent consumption slackened in 1948, mainly due to a smaller volume of private construction. This was accompanied by a decline in public works so that public authorities absorbed only an estimated 10 per cent of cement output during that year. The termination of the supply shortage had a double effect upon foreign trade in cement: a reduction of imports, from a peak of 155.4 thousand tons in 1946 to 4.3 thousand in 1948, and an expansion of exports from nought to 34.6 thousand tons (mostly to the United States) during the same time. Nevertheless, producers do not expect Mexican cement to find a permanent outlet abroad mainly due to the localized character of the industry, relatively high production costs, and above all, transportation costs. In this way, already at the end of 1948, stocks were estimated at some 200,000 tons. ^{3/} In the following year, however, production and demand of cement attained the highest levels on record.

^{1/} For instance a large producer, prior to the modernization of his plant employed 600 men of whom half became subsequently superfluous; nevertheless, the same labour force was maintained as before.

^{2/} Two other plants produce white cement in a sporadic manner, in addition to grey.

^{3/} La industria del cemento, op, cit.

In the long run a further substantial expansion in output depends primarily upon an increase of private and public investment, and perhaps to an even greater extent upon an integration of the economic activities of the nation which would diminish the very considerable differences of income in the various parts of the country. At present differences in the per capita consumption of cement are very appreciable. Foreign trade of cement having been small in 1948, these differences can be approximately evaluated by production data for the six zones into which the Mexican market can be divided with a reasonable degree of accuracy. (See Table 2)

Mexican cement production averaging in 1948 44.1 kilogrammes per capita is still very low in comparison with the United States average of 240.3 kilogrammes. It is also considerably lower than that of several other Latin American countries, where production in Uruguay, for instance, amounted to 119.1 kilogrammes in 1947, or in Chile to 108.7 kilogrammes during that year.

There can be little doubt that a more rapid expansion of domestic production would be obtained should the industry be able to reduce costs by solving the technological obstacles and labour rigidities that hinder an increase in productivity. In this connection the need of an uninterrupted supply of fuel and electricity as well as an efficient transport system should be added. The gaspipe now being constructed from Poza Rica to supply the Federal District is expected to assure a satisfactory supply to the cement producers of that area, replacing part of the fuel-oil used. Moreover, the industry is a substantial consumer of electricity, requiring about 6 kilowatt-hours per ton of cement produced, and its expansion depends upon the availability of power.

IV. Cement and investments

In most countries there is generally a long-run parallel development in the consumption of steel and cement, reflecting changes in the level of real capital investment. Also in Mexico the general trend in the apparent consumption of the two commodities is rather similar. The major variations that have occurred were due to an appreciable extent to the fluctuations in the supply of imported steel which was determined since /1940 by the war

Table 2. Mexico: Estimated production of cement by zones, 1948.

Zone	Estimated production (thousand tons)	Population (thousands)	Per capita production (kilogrammes)
Metropolitan	489.4	5,450	89.8
Bajío	128.8	4,400	29.3
North-northeast	197.7	4,800	41.2
Northern Pacific	63.1	1,600	39.4
Eastern	114.1	3,800	30.0
Southeastern	20.4	3,800	5.3
Totals:	1,013.5	23,850	42.5

Source: United Nations Economic Commission for Latin America.

Note: Division by zones as in F. Barahona de la O., op. cit. Production data based on output of 17 plants during the first half of 1948, as reported in Industria del cemento, op. cit., and covering on a 12 months basis 94 per cent of the production of the cement industry during that year. States and territories comprising zones: (1) Metropolitan: Federal District, México, Morelos, Querétaro and Hidalgo; (2) Bajío: Aguascalientes, Colima, Jalisco, Guanajuato and Michoacán; (3) North-northeastern: Nuevo León, Tamaulipas, Chihuahua, Durango, Zacatecas and San Luis; (4) Northern Pacific: Lower California, Sonora, Sinaloa and Nayarit; (5) Eastern: Puebla, Tlaxcala and Veracruz; (6) Southeastern: Campeche, Oaxaca, Chiapas, Guerrero, Tabasco, Yucatán and Quintana Roo.

1940 by the war and its aftermath. It is also likely that part of the variations were accounted for by changes in the utilization of the steel supply, as between building purposes and other uses. Furthermore, certain distortions should be attributed to changes in stocks for which no data are available. (See Chart 2).

The outstanding fact concerning the utilization of cement and steel as capital goods in Mexico as well as in the other countries of Latin America is that steel has an appreciably higher unit value than in the industrialized countries and particularly so when compared to the United States. Thus the ratio between producers' prices of cement and structural steel in Mexico in 1943-1948 varied between 6.3 and 7.5. In comparison, the wholesale price ratio of steel in Pittsburgh and of cement in New York in 1946-1948 was only between 2.9 and 3.1. To the extent, therefore, that cement consumption reflects levels of investment, it appears that there is a relative shortage of steel in Mexico of a long-range character. One of the consequences of the relative scarcity of steel is the general tendency to substitute cement for steel within certain limits given by technology. (See Chart 3).

The increased proportion of modern cement plants which is being obtained since the termination of the war may still widen the price differential between cement and the output of the high-cost Mexican steel industry.^{1/} The respective price changes that have taken place during the last six years seem to point in this direction.

Changes in Producers' Prices of Cement and Structural Steel, 1943-1948.

Index numbers - 1943 = 100.0

	Cement	Structural steel
1944	110.4	110.1
1945	124.2	134.5
1946	144.4	163.0
1947	175.0	209.3
1948	174.0	238.8

Source: United Nations Economic Commission for Latin America. Basic data from Dirección General de Estadística.

^{1/} The price structure of steel in the country is determined by domestic production; moreover, the proportion of domestic output in total consumption shows an increasing trend which was particularly noticeable in 1947/1948.

SECTION 6. CHEMICAL INDUSTRY

I. Position within the manufacturing industry

The chemical industry is still of a minor significance within the overall structure of manufacturing in Mexico. The main retarding factors seem to have been the limited domestic demand, the highly specialised knowledge required for the organisation and operation of modern chemical production and, above all, the relatively high investment necessary for most enterprises in this field.

The more rapid growth of the chemical industry as compared with the other branches of manufacturing combined is an indication of the progressing industrialization of Mexico. In this way, data of the 1930 census and of the 1944 preliminary census survey, whose coverage is comparable, reveal that while employment in the other industries increased 84.5 per cent, the increase in the chemical industry was 156.2 per cent; similarly the gross value of output of the other industries rose 467 per cent and that of the chemical industry 782 per cent. (See Table 1).

II. Causes of growth

It seems that the development of the chemical industry was moderate until the late 'thirties and that it was accelerated mainly during the war. The long-run underlying causes of this development were the growth of domestic demand resulting from the expansion and diversification of the other branches of manufacturing, the somewhat larger use of chemicals by agriculture and, in general, the rise in incomes. Of immediate consequence was the deliberate industrialization policy pursued by the government and particularly its financial support of certain enterprises that was carried out by Nacional Financiera. United States participation of a governmental character by means of Export-Import Bank loans to

/Nacional Financiera

Table 1 Mexico: Position of the chemical industry within all
manufacturing industries

	Census of 1930	Census of 1935	Census of 1940	Preliminary census survey of 1944
Number of establishments	1,098	338	400	866
Per cent of total	2.2	4.8	3.0	1.7
Value of investment (millions of pesos)	37.7	39.7	68.7	208.4
Per cent of total	3.8	2.3	2.2	4.8
Value of output (millions of pesos)	48.2	65.4	79.6	425.3
Per cent of total	5.2	3.4	2.6	8.0
Numbers employed	8,235	9,578	12,991	21,102
Per cent of total	2.6	3.1	3.3	3.5

Notes: Includes: industrial gases, chemical products, pharmaceutical products, explosives, celluloid products (in 1935, 1940 and 1944), matches, essential oils and extracts (in 1940 and 1944), fats and bitumens (in 1940 and 1944), soap, candles, paints and varnishes, printing inks, and rubber products (1940 and 1944).
Data for 1930 and 1944 comprise all establishments; those for 1935 and 1940 comprise only establishments with a yearly gross output of 10,000 pesos or more.

Source: Census data.

Nacional Financiera or private capital participation, particularly in the pharmaceutical production, also contributed to the development of the Mexican chemical industry.

Considering 1937 as a base year, it appears that in general the unit prices of four selected groups of chemical imports show an unfavourable trend from the standpoint of Mexico's export prices. It can be noted that during the great depression the prices of three of the four import commodities increased while the country's export prices declined very considerably. Also during 1937-1947 the general trend was unfavourable and only in 1948 was the ratio favourable to Mexico. (See graph 1).

This implies that to the extent that the four chemical groups selected are representative of total imports of chemicals, their prices increased when the demand in Mexico was greatest. Such a trend may have been one of the long-run causes of the development of the industry in the country.

III. Production and imports

Already in 1930 domestic production of chemicals and pharmaceuticals represented about two-thirds of the value of the apparent consumption of chemicals 1/. The trend is towards domestic production meeting a larger share of the demand even though the aggregate volume of imports seems to have risen in absolute terms. Since the 1944 preliminary census survey does not state the value of imported raw materials used by the industry, only indirect data show the probability of the trend. Thus the gross value of domestic chemical production increased about 782 per cent between 1930 and 1944, as shown above, while imports of chemicals rose only 457 per cent. It is likely, however, that part of the increase in domestic output was achieved by a larger use of imported raw materials; that this might have taken place is suggested by the comparable data of the 1935

1/ The value of the domestic chemical production less the value of imported raw materials amounted to 37,005 thousand pesos while imports of chemical were in the amount of 19,957 thousand pesos.

and 1940 censuses when the share of domestic raw materials declined from 58.2 per cent to 52.3 per cent of total raw material used.

Data for imports of chemicals reflect in part the development of manufacturing in the country. (See Table 2). The relatively small imports of chemicals in 1925-1930 when they constituted only 5-6 per cent of total imports took place at a time when the chemical industry was still small and the requirements of chemicals by the economy were rather limited. The 'thirties witnessed an expansion of demand which led domestic production to utilise a larger share of imported raw materials while the growth of manufacturing in general, still unable to rely on a basic chemical industry, required larger imports. Furthermore, the demand for chemicals being relatively inelastic, the respective imports represented an increased share within total imports, which had declined in the early 'thirties. Both causes led to the fact that imports of chemicals rose to between 7.9 and 10.4 per cent in 1931-1939. During the war chemical imports varied more widely, fluctuating between 5.6 and 11.7 per cent of total imports in 1940-1945. However, due to the proximity of the United States the supply shortages were smaller than in most Latin American countries, and were largely compensated by an expanding domestic output. In post-war years the reduced share of chemicals within total imports, varying between 5.6 and 6.4 per cent, indicates the coming into being of a basic chemical industry and a considerable diversification of output. In this way domestic production was able to reduce the proportion of chemicals within total imports which had prevailed in the earlier phase of the industrialization process and bring it to approximately the same relative level as in 1925-1930: the average share in 1946-1948 amounted to 5.9 per cent of the total and was only slightly higher than the 5.7 per cent average for the pre-depression years. Had the chemical industry not progressed more rapidly than the other branches of manufacturing, increased imports of chemicals would

/have to

have to be made partly at the expense of imports of capital goods, thereby retarding the development process.

It may also be noted that the proportion of chemicals within total imports has responded primarily to the structural changes in the country's economy rather than to international cyclical movements, or short-run price changes. At a given stage of development, therefore, imports of chemicals represent a not easily reducible magnitude.

At the present level of output the chemical industry of Mexico supplies the bulk of the demand for alkalis. There is a surplus capacity for the production of sulphuric acid and there will be a sufficient domestic supply of synthetic ammonium probably by 1951.

With the essentials of a basic chemical industry in existence most of the development is likely to take place in the intermediate field, being based upon coal tar obtained in the coke plants 1/. This would permit the development of additional chemicals. Among these are plastics and insecticides. Certain pharmaceutical products and dyes, the demand for which is sufficiently large, would be stimulated in the process.

IV. Alkalis

Production of alkalis in Mexico has been slow to develop. During its establishment the main consideration has been the proximity of the brine deposits of Lake Texcoco to the industrial area of Mexico City, disregarding the considerable deposits of sodium chloride (common salt) in the country.

Numerous attempts at alkali production were made prior to 1938, but due to their small scale all of them failed. Subsequently two enterprises maintained their output: one has a negligible capacity (2 tons per day of soda ash) and that of the other, utilising the electrolytic process, amounts to 8 tons of caustic soda per day even though production includes several other chemicals.

1/ Antonio Medinaveita of Sosa Texcoco, letter to the Banco de México, 18 May 1949.

The backbone of the alkali industry was constituted when the Compañía de Sosa Texcoco started commercial production in the middle of 1947 and attained a daily output of 60 tons of sodium carbonate (soda ash) at the end of the year. 1/ The pilot plant previously built by the government suspended operations when Sosa Texcoco was organized.

By 1949 Sosa Texcoco reached capacity production of 100 tons of soda ash per day of which 45 tons are further processed into approximately 30 tons of caustic soda. The company obtained permission to produce common salt (which constitutes 55 per cent of the original brine) and started production which may reach an annual volume in excess of 30,000 tons. This might satisfy almost half of the demand of the Central Plateau region which it could economically supply. Expansion plans include the production of 5-10 tons of chemically pure bicarbonate per day. 2/ It should be added that the plant of Sosa Texcoco has been planned so as to permit the expansion of production facilities to a total capacity of 200 tons of soda ash per day.

With Sosa Texcoco producing at full capacity, as it did in 1949, the output of the Mexican alkali industry was estimated as follows: 3/

	<u>metric tons per year</u>
Caustic soda	13,680
Sodium carbonate (soda ash)	21,600
Sodium bicarbonate	10,800

However, demand increased to such an extent that the great expansion of domestic alkali production achieved by the inauguration of the Sosa Texcoco plant did not reduce imports of alkalis, as is shown below:

-
- 1/ The company's nine million pesos capital was subscribed by the Banco Nacional de México, the Sociedad Mexicana de Crédito Industrial and by the Vidriera Monterrey.
- 2/ Report No. 386, Alkali Production by Sosa Texcoco, S.A. Alan E. Hool, Embassy of the United States, México, D.F., 9 June 1949.
- 3/ Banco de México, Industria Química, 1947.

/Mexico:

Mexico : Imports of alkalis, 1945-1948

(Volume in metric tons, values in thousands of pesos)

	Caustic Soda		Sodium and potassium carbonates and sulphates a/		Sodium and potassium bicarbonates b/	
	Volume	Value	Volume	value	Volume	Value
1945	17,737	4,562	36,139	5,088	2,849	826
1946	15,644	6,401	25,089	3,862	2,176	663
1947	24,566	13,781	35,040	9,699	4,220	1,739
1948	25,167	9,428	47,639	8,818	1,614	477

a/ Separate data for sodium carbonate are not available

b/ Separate data for sodium bicarbonate are not available

V. Sulphuric Acid

The production of sulphuric acid in Mexico is based essentially upon the utilization of gases produced by the roasting of mineral ores. A much larger output could be obtained, if necessary, by means of the utilization of a greater part of the gases obtained in the process. At present production of about 30,400 metric tons fully meets demand and leaves an idle capacity of nearly 9,000 tons ^{1/}.

Among the five producers of sulphuric acid in Mexico, the two plants of the American Smelting and Refining Company account for 69 per cent of the output and 66 per cent of capacity.

Overproduction of sulphuric acid is expected probably in 1951 when the plant of Guanos y Fertilizantes ^{2/} located near Mexico City will start operations. The enterprise is to have a daily capacity of 180 metric tons of ammonium sulphate, which is to be produced from ammonium synthesised from natural gas (brought by pipeline from Poza Rica to the Federal District), and sulphuric acid. The latter is to

^{1/} Report No. 232 The Production of Sulphuric Acid in Mexico,
David Post (Embassy of the United States, Mexico, D.F.,
8 April 1949)

^{2/} See following sub-section.

be manufactured from raw sulphur obtained from the desulphurisation plant which will clean the gas prior to transmission through the pipeline. In addition to the amounts required for the production of ammonium sulphate, the plant will be able to place a surplus of about 15,300 metric tons of sulphuric acid on the market. ^{1/}

VI. Chemical Fertilizers

The consumption of chemical fertilizers in Mexico is extremely small but attempts are being made, principally by governmental agencies, to increase it as a means towards an expanded production of foodstuffs. This policy is being carried out mainly by Guanos y Fertilizantes de México, a semi-governmental agency ^{2/} which enjoys the financial support of Nacional Financiera.

One of the two main fertilizer deficiencies of Mexican agriculture is phosphates. An independent survey of the country's needs of chemical fertilizers and of the possibility of meeting them by domestic production estimated "minimum requirements" of superphosphates at 1,170 thousand tons a year ^{3/}. To meet part of such requirements Guanos y Fertilizantes built a modern calcium superphosphate plant, at San Luis Potosi, with a yearly capacity of 25,000 tons when operating with one shift. In addition, three small plants also produce super-phosphates: one operated by Guanos y Fertilizantes in the Federal District with a yearly capacity of 1,500 tons of bone meal; a private enterprise in the District producing 2,000 tons of animal phosphates; and a private concern in the State of Durango with a yearly output of 3,000 tons derived from phosphate rock. This output as well as that of the San Luis plant of Guanos y

^{1/} Report Number 232. op. cit.

^{2/} The government promoted the creation of this corporation and subscribed 51 per cent of its shares.

^{3/} La Industria Química Pesada en México (Monografías Industriales del Banco de México, México D.F., 1948) contains the survey made by Ford, Bacon and Davis, Inc., at the request of the Bank of México.

Fertilizantes is derived from phosphate rock partly mined in the country and partly imported from the United States. The need, however, of a more thorough exploration of Mexican phosphate deposits is generally recognized.

Guano deposits on the Pacific coast are another source of phosphate and nitrogen fertilizer and are administered by Guanos y Fertilizantes. Their output in 1945-1947 varied between 1,500 and 2,500 tons per year and is not liable to a rapid increase.

The second main fertilizer deficiency of Mexican agriculture is nitrogen. If supplied in the form of ammonium sulphate its "minimum requirements" have been estimated at 1,118 thousand tons a year ^{1/}. At present the only domestic source of ammonium sulphate is a by-products plant utilizing gases of the coke ovens of a coal company at Nueva Rosita, Coahuila, with a yearly output of 3,000 tons. However, as has been indicated above in connection with sulphuric acid, Guanos y Fertilizantes is building near Mexico City a plant with a yearly capacity of about 54,000 tons of ammonium sulphate. The estimated cost of the plant is ten million dollars, of which seven million have been granted as a loan by the Export-Import Bank.

Despite the great deficiency of fertilizers, not even the small capacity of the industry is being fully utilized as is shown below:

^{1/} Ford, Brown and Davis, Inc. in "La Industria Química Pesada en México," op. cit.

Estimated Production of Fertilizers, 1945-1947

(in thousands of metric tons)

	<u>1945</u>	<u>1946</u>	<u>1947</u>
Ammonium sulphate	2.5	3.5	3.0
Calcium super-phosphate	3.0	3.0	12.0
Bone meal	5.0	6.0	6.0
Guano	<u>2.5</u>	<u>1.6</u>	<u>1.5</u>
Totals:	13.0	14.1	22.5

Source: Guanos y Fertilizantes de México.

Imports of chemical fertilizers in 1945-1947 were also quite small and represented an average of about 55 per cent of the apparent consumption during the three years. (See Table 3).

The main factors limiting a greater utilization of chemical fertilizers in Mexico are economic and educational. The bulk of the foodstuffs being produced by backward methods and utilizing poor seed does not warrant a general utilization of fertilizers since increased yields are not sufficient to cover their cost. Experiments made with Chilean nitrates at Chapingo and other parts of the Central Plateau show that only by utilizing modern machinery and improved seeds does the use of fertilizer allow a profit ^{1/}. It is for this reason that sugar cane, which is generally produced along efficient lines and where the increase of yields with the use of fertilizers is proportionately greater than in the case of grains, absorbs about 60 per cent of the nitrates sold in Mexico.

In addition to the production activities of Guanos y Fertilizantes, efforts are being made to increase the use of chemical fertilizers by small-scale free distribution, subsidies, credit facilities, and by an educational campaign. For instance, in the latter part of 1948 the Banco Nacional de Crédito Ejidal started a programme of granting

1/ Compañía de Nitratos Chilenos, México, D.F.

at least 10 per cent (about 20 million pesos a year) of its loans for the specific purpose of financing fertilizer purchases.

A large-scale utilization of fertilizers which may warrant an expansion of their domestic production seems to depend upon the success of the efforts made by public and private agencies for the improvement of seeds, the progress of mechanization and, above all, the cheapening of transport.

Table 3 Mexico: Imports of Chemical Fertilizers, 1937-1948

(In thousands of metric tons)

Years	Potassium and sodium nitrates	Ammonium sulphate	Potassium and phosphorus fertilizers	Mixed and organic fertilizers	Total
1937	10.0	4.1	0.8	0.3	15.4
1938	7.5	2.7	1.6	0.4	12.6
1939	12.8	1.9	0.6	0.1	15.5
1940	11.1	0.6	0.2	0.1	12.1
1941	18.6	-	0.3	-	19.0
1942	7.8	-	0.3	-	8.1
1943	18.3	0.9	1.2	0.1	20.4
1944	12.8	1.0	0.4	-	14.2
1945	16.0	4.4	0.3	-	20.8
1946	11.4	3.0	0.4	0.1	14.9
1947	20.0	3.0	0.5	0.4	23.8
1948	..	..	..	..	17.9

Source: Guanos y Fertilizantes for 1937-1947;
Dirección General de Estadística for 1948.

VII. Paint and varnish industry

Production of paints and varnishes in Mexico entered the manufacturing stage in the early 'twenties, partly under the stimulus of tariff protection. Already at the time of the 1930 census the
/industry comprised

industry comprised 26 establishments, most of them small-size, employing 320 persons.

Until the outbreak of the war production of paints and varnishes depended to a considerable extent upon imports of raw materials. Subsequent supply difficulties stimulated domestic production of a number of raw materials such as linseed oil, lead, turpentine, rosin, tuluol and earth colours.

The decline of foreign competition during the war led to an expansion of the domestic production of paints and varnishes, as is indicated by the fact that the preliminary census survey of 1944 indicated employment as having increased to 701 persons. Nevertheless, demand increased at a more rapid rate so that production was able to meet a decreasing proportion of apparent consumption, as is shown below:

Percentage of the volume of the apparent consumption of paints met by production and imports, 1939 - 1947

	<u>Production</u>	<u>Imports</u>
1939	65.5	34.5
1940	60.2	39.8
1941	65.5	34.5
1942	63.3	36.2
1943	61.1	38.9
1944	63.3	36.2
1945	60.2	39.8
1946	58.6	41.1
1947	47.2	52.8

Source: Orlando Barahona: "La industria nacional de pinturas y tintas" (Memorandum to the Bank of Mexico, January 9, 1948)

The rather rapid decline in the relative share of domestic consumption in post-war years was due in part to continued high levels of demand and particularly to the increase of imports which rose from 9.6 million pesos in 1946 to 14.8 million in 1947. Despite the improvement of quality achieved by the industry in Mexico, consumer preference generally favoured imported paints at equal prices. At /the same time,

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the same time, production costs remained comparatively high partly due to the industry's dependence upon imports of some of its materials and the small scale of its plants.

Nevertheless, in post-war years the Mexican paint industry continued to grow, its employment amounting to 1,284 persons at the end of 1947. Its capacity also expanded even though, in contrast to war-time years, it was being utilized only 8 hours per day. It is likely that the devaluation of the peso in 1948 gave domestic paint production a new impulse by increasing the relative price of competitive imports.

VIII. Soap Industry

The quickened pace of Mexico's industrialization since the middle 'thirties has also affected the country's soap industry which had until then been characterized by a large number of small plants throughout most of the country, usually utilizing only a small amount of equipment. Since then a process of concentration has taken place, the number of enterprises having decreased from 329 in 1930 to 176 in 1944. This was accompanied by a greater use of equipment since employment decreased from 2,538 persons to 2,141 during the same period, while production showed a gradual increase. The process was accelerated by the emergency of enterprises operating under franchise of several United States producers and which account for the major part of domestic production.

During the war the soap industry had to meet a drastic reduction of copra imports; this was partly compensated by domestic copra production which increased one-third in 1937-1947. Nevertheless, the shortage of vegetable oils led to a partial replacement by animal fats. (See Table 4).

The development of the production of vegetable oils and of caustic soda in the country indicate that an increased consumption of domestic raw materials seems to be a permanent feature of the Mexican soap industry.

As in several consumer goods industries, production of soap increased at a moderate rate only, in contrast to the rapid development

/of investment

Table 4. Mexico: Principal raw materials used by
the soap industry, 1938 - 1948
(In metric tons)

	Vegetable oils	Animal fats	Caustic soda
1938	27,638	4,938	7,237
1939	26,359	3,011	7,022
1940	25,107	2,907	3,558
1941	26,050	3,172	6,965
1942	22,396	4,784	6,602
1943	21,882	5,921	5,912
1944	24,220	5,280	5,788
1945	24,004	8,127	5,986
1946	19,815	11,953	5,829
1947	24,502	6,111	6,586
1948	26,121	8,405	8,617

Source: Dirección General de Estadística.

of investment goods production.

Appreciable exports were made in 1945-1947, largely at the expense of domestic consumption, but these were reduced to negligible proportions in 1948. During the war and immediate post-war years, per capita consumption was somewhat smaller than pre-war, but an improvement has taken place since that time. (See Table 5).

A substantial increase of soap production is limited by the low purchasing power of the population, particularly in the rural sector, where the use of manufactured soap is only spreading slowly. The type of demand is also indicated by the fact that toilet soap represented only 5.8 per cent of aggregate toilet and laundry soap production in 1938, a large part of the low-income groups purchasing laundry soap also for personal use. By 1948 the proportion of toilet soap had increased to 8.2 per cent. In this way increased consumption was reflected not only in a greater quantity used per capita but also in an improvement of the product.

Table 5. Mexico: Production, Foreign Trade and Supply of Soap, 1938-1948

	Production a/	Imports	Exports	Supply	Apparent consumption per capita
	(..... in metric tons.....)			(kilogrammes)	
1938	66,857	20	5	66,872	3.5
1939	67,970	53	-	68,023	3.5
1940	61,573	48	1	61,620	3.1
1941	68,279	84	2	68,361	3.4
1942	65,545	104	3	65,646	3.2
1943	63,707	67	1	63,773	3.0
1944	69,442	161	1	69,605	3.2
1945	68,574	114	1,539	67,149	3.0
1946	79,340	415	3,983	76,072	3.3
1947	75,926	296	3,142	73,080	3.1
1948	85,378	-	3	-	3.6

Source: Dirección General de Estadística.

a/ Includes toilet and washing soap only.

SECTION 7. GLASS INDUSTRY

The glass industry in Mexico increased production at a more rapid rate than most other industrial branches in the country. Its expansion was particularly rapid during the war, production in 1945 being about three times as large as in 1937. As will be indicated below, of the two main products plate-glass increased the most in relative terms; in absolute terms, however, glass containers are the most important, and the absolute increase is due principally to them.

In view of the variety of products made and of the different units of their recording, no direct measurement of production can be attempted. However, the consumption of raw materials can be considered as a satisfactory indication of the changes in the volume of production. Based upon the aggregate consumption of silica, waste glass, limestone and soda ash, the relative changes in the output of the glass industry are as follows:

Mexico: Relative changes in the output of the glass industry, 1937-1948
Index numbers, base year 1937 = 100

1937	100	1943	244
1938	112	1944	265
1939	128	1945	308
1940	165	1946	259
1941	186	1947	217
1942	186	1948	259

Source: Basic data from Dirección General de Estadística.

From the standpoint of concentration of production, the Mexican industry is a heterogeneous group of enterprises, depending mainly upon the type of product, namely, plate-glass, bottles and other containers, and table and ornamental ware ^{1/}. Its growth cannot be traced from census data since the industry was not included in the

^{1/} For electric bulbs production see Section on Mechanical Industries: Electrical Products.

1930 census. Its significance can be roughly measured by employment data, the total of persons engaged in this industry having amounted to 5,268 in 1944.

Plate-glass up to a thickness of 8 millimetres is produced by a single enterprise located in Monterrey.. Its output and its position as a supplier of national demand is determined principally by the volume of building construction and by the effectiveness of foreign competition. (See Table 1).

The glass container industry has been stimulated principally by the increased output of the beer and soft drinks industries which increased nearly 150 per cent in 1940-1948, even though the peak may have been attained in 1946. The bulk of the output is produced by automatic equipment (96.4 per cent in 1948). However, increased demand and the inability to import equipment during the war led to an increase of semi-automatic production which accounted for 24.7 per cent of total container output in 1942. Due to the presentation of foreign trade data it is not possible to estimate the share accounted for by domestic production within total supply. The increase of the glass container industry is shown below:

Mexico: Production of the glass containers industry, 1937-1948
(In thousands of units)

1937	92,862	1943	148,320
1938	80,333	1944	171,662
1939	114,925	1945	193,935
1940	107,510	1946	219,594
1941	139,268	1947	192,447
1942	178,520	1948	168,655

Source: Dirección General de Estadística.

It should be noted in connection with the fact that the production of glass containers increased at a slower rate than that of beer and soft drinks, that part of the containers are not returned for refilling being used for other purposes, particularly by the low-income groups. It is likely, however, that their recovery increased, particularly during the war.

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Table 1. Mexico: Production and imports of plate-glass, 1938-1948

	Production	Imports	Supply	Production as per cent of supply
	(In thousands of square meters)			
1938	785	338	1,123	69.9
1939	985	574	1,559	63.1
1940	2,293	401	2,694	85.1
1941	2,631	318	2,949	89.2
1942	2,841	436	3,277	86.7
1943	4,098	606	4,704	87.1
1944	3,145	851	3,960	79.4
1945	3,838	1,010	4,848	79.2
1946	2,012	852	2,864	70.2
1947	2,066	2,049	4,115	50.2
1948	2,819	1,074	3,893	72.4

Note: Import figures given in kilogrammes have been converted at the rate of 5 kilogrammes per square metre.

Source: Basic data from Dirección General de Estadística.

The third main group of the glass industry is constituted by tableware, kitchen ware and ornamental products, which was accounted for in a substantial measure by handicraft shops and small enterprises. It is likely that the statistical data pertaining to this group is not sufficiently comprehensive, but there are indications that a concentration of production is taking place since in recent years the bulk of the output is reported as having been produced by automatic equipment.

A more recent industry, that of vials and ampoules for pharmaceutical use has been able to utilize locally produced neutral glass since 1941. Output of these items more than doubled in 1943-1946, but subsequently suffered a decline as a result of a shrinkage of exports of pharmaceutical products.

In terms of volume the foreign trade of glass products (except plate glass) shows that while both imports and exports increased during the war and immediate post-war years, the import gap has been reduced, if 1948 is considered as representative. Mexico's net exports, in terms of volume, in 1940-1943 were due to the exceptional circumstances of the war. In terms of value, and including imports of plate-glass, the country is a net importer of glass products. (See Table 2).

The Mexican glass industry depends to a large extent upon imports of raw materials, particularly of the two main ones, silica and soda ash. This is partly due to the fact that the largest producer located in Monterrey possess two silica sand mines in Texas and partly that the deposit in the state of Puebla has a high content of iron oxide which does not permit its sand to be used in the production of colourless glass. On the other hand, a glass factory in Guadalajara obtains silica from quartzite which is ground in its own mill reportedly at a lower cost than that of imported sand. The recent growth of the alkali industry in Mexico has led to a reduction of soda ash imports for glass production, but the capacity of the main producer, installed in recent years, is not yet sufficient to meet demand. It should also be noted that during the period under survey there has been an increasing relative use of

/glass waste,

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Table 2. Mexico: Foreign trade in glass products, 1937-1948

	<u>Glass products except plate glass</u>			Imports of plate glass	Net imports of glass products
	Imports	Exports	Net import balance		
	In metric tons		In thousands of pesos		
1937	3,604	488	3,409	929	4,338
1938	2,607	557	3,453	1,156	4,609
1939	1,983	296	3,406	1,151	4,557
1940	987	2,305	2,647	1,828	4,475
1941	3,176	5,539	1,455	2,108	3,563
1942	4,710	6,944	4,072	2,101	6,173
1943	6,016	8,803	4,382	1,823	6,205
1944	6,007	1,616	6,454	1,029	7,483
1945	6,074	4,984	4,774	1,653	6,427
1946	7,990	4,150	4,811	1,853	6,664
1947	9,378	2,910	9,236	2,251	11,487
1948	3,501	2,607	1,779	1,540	3,259

Source: Basic data from Dirección General de Estadística.

glass-waste, particularly in the production of containers. In the glass industry as a whole the ratio of glass scrap to silica increased from 20 per cent in 1937 to 28 per cent in 1948.

SECTION 8. PAPER INDUSTRY

The industrialization process of Mexico is being reflected in multiple ways upon the consumption and production of paper. The increased industrial output in the country, its concentration in larger and better equipped enterprises and the growing use of containers led to a consumption of paper and paperboard that was even greater than the expansion of manufacturing production as a whole. The population growth and particularly that of its urban sector, together with the expansion of literacy and other causes nearly doubled consumption of newsprint in 1937-1947, while consumption of paper increased only at a slightly lower pace. On the whole, aggregate consumption of paper, newsprint and paperboard increased in 1937-1949 by about 90 per cent and per capita consumption by about 47 per cent. Despite the progress achieved, the consumption per capita is still only about one-twelfth of that in the United States. (See Table 1).^{1/}

To an increasing degree consumption is being satisfied by domestic production. This is particularly the case of paperboard, the output of which has increased about fourfold since 1937 and has led to a decrease of imports in absolute terms. Production of paper increased at a slower rate than imports until 1947 but since then the trend has been reversed, even though imports are at a higher level than pre-war, in absolute terms. Finally, Mexico depends almost exclusively upon imports of newsprint. (See Table 2).

The technological structure of the Mexican paper industry as well as the composition of the demand caused paperboard production to increase more rapidly than that of paper. For similar reasons, among the various grades of the latter, coarse papers, including wrapping paper, experienced the most rapid growth. The diversification of paper production which accompanied the general expansion of the industry also caused the category of "other paper" to increase considerably.

^{1/} In view of the fact that production data by the Dirección General de Estadística do not seem to include the output of new establishments, it has been thought preferable to utilize more comprehensive data based upon trade sources.

Table 1. Mexico : Apparent consumption of paper, newsprint and paperboard, selected years

	<u>Paper</u>	<u>Newsprint</u>	<u>Paperboard</u> <u>b/</u>	<u>Total</u>	<u>Per capita</u>
	In metric tons				(Kilogrammes)
1937	87,077	30,165	27,950	145,192	7.7
1942	127,005	38,205	30,957	196,167	9.4
1946	136,265	55,130	54,309	245,704	10.7
1947	139,595	54,624	47,547	241,766	10.3
1948	166,663	59,380	43,144	269,187	11.2
1949	171,700 <u>a/</u>	60,000 <u>a/</u>	45,050 <u>a/</u>	276,750 <u>a/</u>	11.3 <u>a/</u>

Source: Report No. 375 "Pulp and Paper - Annual Report Review and Current Market Development - Mexico", May 14, 1947, and Report No. 579 "Pulp and Paper - Annual Market Review - Mexico 1948", August 29, 1949, by Fred Hajjar, Embassy of the United States, Mexico, D.F. Production data are from trade sources and foreign trade data are from official Mexican statistics.

a/ Estimated

b/ Includes building and insulation board.

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Table 2. Mexico: Relative changes in the production and imports
of paper, newsprint and paperboard, selected years
 (Index numbers: 1937 = 100)

	Paper		Newsprint	Paperboard	
	<u>Production</u>	<u>Net imports</u>	<u>Imports</u>	<u>Production</u>	<u>Net imports</u>
1937	44,584 tons <u>100</u>	42,493 tons <u>100</u>	30,165 tons <u>100</u>	10,461 tons <u>100</u>	17,489 tons <u>100</u>
1942	108	186	127	143	91
1946	152	161	182	261	152
1947	158	162	181	334	71
1948	210	171	197	388	14
1949	233 <u>a/</u>	160 <u>a/</u>	199 <u>a/</u>	404 <u>a/</u>	15 <u>a/</u>

Source: Data calculated from Reports No. 375 of May 14, 1947, and No. 579 of August 29, 1949, Embassy of the United States, Mexico, D.F., op.cit.

a/ Estimated.

Production of writing and other fine paper grew at a slower rate, having only doubled in 1937-1948. That of printing paper reached a peak in 1946, followed by a decline, even though in 1948 production was still 41 per cent higher than in 1937. (See Table 3).

Until 1946, production of paper and paperboard in Mexico depended to an extent of two-thirds of its total requirements upon imports of pulp. Production of mechanical pulp, suitable only for the manufacture of low-grade products, meets the requirements of the industry but its demand grew much less than for chemical pulp so that output in 1948 was only about 46 per cent higher than in 1937. While production of sulphite pulp remained practically stationary, that of sulphate pulp which was non-existent before the war accounted for most of the increase in domestic pulp output. This was largely due to the fact that a factory near Mexico City started production of sulphate pulp and that an integrated plant at Atenquique, Jalisco, entered into operation at the end of 1946.

Mexico : Production of chemical pulp, selected years
(In metric tons)

	<u>Sulphite unbleached</u>	<u>Sulphate unbleached</u>
1937	4,518	-
1942	3,454	3,030
1946	4,621	7,200
1947	4,116	28,855
1948	3,558	47,456
1949	5,000 <u>a/</u>	47,900 <u>a/</u>

Source: Reports No. 375 of May 14, 1947, and No. 579 of August 29, 1949, Embassy of the United States, Mexico, D.F., op.cit.

a/ Estimated

Newsprint was produced in Mexico in a volume that varied between 13 thousand and 18 thousand metric tons annually in 1928-1935, and which met the bulk of the relatively small demand of that time. In 1935, however, imports of newsprint were declared duty free as a result of which domestic production was discontinued, available capacity being used for the production of other grades of paper enjoying tariff protection.

/During the war and

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Table 3. Mexico: Production of paper and paperboard, selected years
(In metric tons)

	1937	1942	1946	1947	1948	1948 as per cent of 1937	1949 estimate
Printing paper	10,906	13,147	18,170	13,345	15,438	141	16,950
Writing and other fine paper	9,148	10,397	10,309	14,814	18,458	201	21,950
Coarse papers, including wrapping	20,131	22,587	33,599	34,914	49,826	247	53,000
Tissue	2,500	1,034	3,000	3,095	3,653	146	5,100
Other	1,899	849	2,661	4,534	6,445	339	7,000
Total paper	44,584	48,014	67,739	70,702	93,820	210	104,000
Paperboard	10,461	15,027	27,704	35,026	40,626	388	42,300
Total paper and paperboard	55,045	63,041	95,443	105,728	134,446	244	146,300

Source: Reports No.375 of May 14, 1947 and No.579 of August 29, 1949, Embassy of the United States, Mexico, D.F., op. cit.

Note: Printing paper includes book, magazine, catalogue and poster and other printing papers, except newsprint. Writing and other fine papers include ledger, drawing, cover, text, bristol and thin paper specialties such as cigarette tissue, carbonizing and condenser. Coarse papers include Kraft and sulphite bleached and unbleached paper, including admixtures of groundwood. Tissue paper includes wrapping tissue, industrial tissues, and sanitary tissues.

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During the war and immediate post-war years, production of the paper industry, despite the fact that it generally worked three shifts, could not meet domestic demand mainly due to shortages of imported pulp. In subsequent years, a small decline of demand, together with an appreciable increase of domestic chemical pulp production caused the latter to increase from 11.1 per cent of the supply in 1937 to 61.2 per cent in 1948. As a result, imports of pulp in 1948 were lower, even in absolute terms, than in 1937. (See Table 4).

The expansion of domestic pulp production was due to the desire to integrate the paper industry and thus prevent shortages similar to those that occurred during the war and its aftermath. Another factor was the relatively greater increase in the unit prices of imported pulp as compared to imported paper and paperboard which took place since 1941 and was particularly accentuated in 1947 and 1948. (See Table 5).

It appears, however, that unit prices of domestically produced paper increased even more rapidly than those of imports, as is shown below. The 1948 devaluation of the Mexican currency, however, might have narrowed the gap.

Mexico : Relative changes in unit prices of domestically

produced paper 1937-1946

Index numbers 1937 = 100

	<u>Printing paper</u>	<u>Writing paper</u>	<u>Wrapping paper</u>
1937	100	100	100
1938	115	117	112
1939	132	147	119
1940	171	172	147
1941	178	177	150
1942	263	217	178
1943	229	221	197
1944	263	234	216
1945	288	232	247
1946	290	266	278

Source: Departamento de Barómetros Económicos, Secretaría de Economía Nacional, as quoted in Fausto Urencio, "La Industria del Papel en México", memorandum to the Bank of Mexico, November 1947.

One of the reasons of the relatively late development of pulp production lies in the fact that it requires a relatively large
/initial investment.

Table 4. Mexico : Production, imports and supply of wood pulp, selected
years

(In metric tons)

	<u>Production of pulp</u>		<u>Imports of chemical pulp for the paper industry</u>	<u>Production as per cent of supply of chemical pulp</u>	<u>Production as per cent of total supply of pulp</u>
	<u>Mechanical</u>	<u>Chemical</u>			
1937	14,118	4,518	36,024	11.1	34.2
1942	17,761	6,484	40,604	13.8	37.4
1946	15,189	11,821	49,136	19.4	35.5
1947	18,137	32,971	36,736	47.9	58.2
1948	20,684	51,014	32,297	61.2	68.9
1949	20,050 a/	52,900 a/	..	..	..

Source: Reports No. 375 of May 14, 1947, and No. 579 of August 29, 1949, Embassy of the United States, Mexico, D.F., op. cit., for production; Dirección General de Estadística for imports.

a/ Estimated

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Table 5. Mexico : Relative changes in the unit prices of imported pulp and paper and paperboard, 1937-1948 a/

Index numbers; 1937 = 100

	<u>Finished paper and paperboard</u>	<u>Unprocessed paper and paperboard</u>	<u>Woodpulp</u>
1937	100	100	100
1938	159	106	128
1939	194	119	117
			161
1940	189	139	178
1941	165	129	172
1942	164	152	
			189
1943	144	168	211
1944	143	187	217
1945	138	168	
			261
1946	189	206	461
1947	210	287	600
1948	249	445	

Source: Basic data from Dirección General de Estadística

a/ Excludes newsprint, cigarette tissue, paper bags and paperboard boxes and non-specified paper and paperboard manufactures.

Note: The data above, particularly the two series for paper and paperboard indicate a trend rather than exact magnitudes, particularly due to the fact that only two broad categories of paper and paperboard are considered, involving the possibility of considerable changes in their composition.

initial investment^{1/}. Even more important is the fact that Mexico's forest reserves are rather scattered and not easily accessible. Furthermore, three chemical pulp producers and all of the five small mechanical pulp producers are located in the vicinity of Mexico City. Their production, together with the activities of the lumber industry, resulted in considerable deforestation so that it is not expected that the forest reserves of the region would permit an expansion of pulping capacity. To secure future production a reafforestation programme is reported as having been initiated. On the other hand, the paper mill at Atenquique has a reserve of 46,600 hectares (115,000 acres) of forest from which it can obtain sufficient lumber and maintain its supply by reafforestation.

No rags are used by the Mexican paper industry and the only source of the pulp produced is wood or waste paper. The one exception is a recently built cigarette tissue plant utilizing linen^{1/}. An increasing proportion of waste paper is being utilized, probably due to the greater expansion of paperboard and coarse paper production as compared to other grades of paper.

Mexico: Relative use of chemical pulp, mechanical pulp and waste paper
by the paper industry, 1938-1948

(As per cent of the aggregate consumption of the three raw materials)

	Chemical pulp	Mechanical pulp	Waste paper
1938	64.6	12.9	22.7
1939	56.6	15.3	28.1
1940	55.9	13.6	30.5
1941	58.8	10.8	30.4
1942	56.2	8.5	35.6
1943	61.4	11.0	27.8
1944	59.4	10.4	30.2
1945	56.8	10.1	33.8
1946	62.7	9.7	27.6
1947	66.4	9.9	23.7
1948	59.8	9.4	30.8

Source: Basic data from Dirección General de Estadística.

^{1/} The 57 million pesos paper mill at Atenquique was financed to an extent of 32 million by Nacional Financiera (as of June 30, 1949); this is equivalent to 6.6 million and 3.7 million U.S. dollars, respectively, at the 8.65 rate of exchange.

^{2/} The possibility of utilizing banana stalks and sugar cane bagasse is being studied.

/While the expansion

While the expansion of the paper industry has contributed to a considerable saving of foreign exchange, it has progressed at a slower rate than demand. Partly for this reason, and partly due to the increase in unit prices, the value of imports of wood pulp, paper and similar products show a generally increasing trend. The year 1947, however, may mark the division between two periods with the possibility of a gradual decline resulting from the rapid postwar expansion of domestic pulp and paper production. (See Table 6).

Considering the total value of Mexico's commodity imports, the share spent on imports of pulp and paper shows a general increase until the end of the war and a substantial decline thereafter, as is shown below.

Mexico : Value of imports of wood pulp and paper as percentage
of total commodity imports, 1925-1948

(Averages)

1925-1929	2.1
1930-1934	2.6
1935-1939	3.4
1940-1944	4.3
1945-1948	3.0

Source: Imports of wood pulp and paper according to
Dirección General de Estadística; total commodity
imports according to Banco de México.

Table 6. Mexico: Imports of wood pulp and paper, 1925-1948

(In thousands of pesos)

	Woodpulp	Paper and paperboard	Newsprint	Paper and paperboard products	Total	U.S. dollar equivalents (thousands)
1925	957	5,049	558	2,425	8,989	4,439
1926	1,018	4,576	810	2,140	8,544	4,130
1927	1,754	4,524	182	1,634	8,094	3,825
1928	1,165	4,703	56	1,798	7,722	3,716
1929	1,978	4,168	113	1,876	8,135	3,920
1930	2,288	8,754	86	1,308	12,436	5,861
1931	1,634	2,267	86	664	4,651	2,074
1932	1,831	2,551	71	342	4,795	1,513
1933	2,210	3,265	55	273	5,803	1,644
1934	3,697	4,488	36	329	8,550	2,375
1935	3,214	5,018	478	352	9,062	2,518
1936	3,835	8,386	2,286	431	14,938	4,149
1937	6,644	10,257	4,687	586	22,174	6,159
1938	6,192	7,772	5,432	463	19,859	4,398
1939	7,484	9,452	8,088	517	25,541	4,930
1940	10,839	11,597	7,950	577	30,963	5,733
1941	10,740	14,319	7,140	754	32,953	6,780
1942	12,649	19,862	17,632	937	51,080	10,532
1943	11,958	15,764	10,304	1,046	39,072	8,056
1944	10,079	15,258	16,844	1,098	43,279	8,924
1945	14,973	17,072	16,745	1,312	50,102	10,309
1946	23,126	24,704	16,548	2,876	67,254	13,838
1947	30,212	33,138	30,867	3,939	98,156	20,197
1948	34,955	27,920	36,867	2,518	102,260	17,450

Source: Data from Dirección General de Estadística. Exchange rates according to International Financial Statistics, International Monetary Fund.

SECTION 9. RUBBER PRODUCTS INDUSTRY

The rubber products industry in Mexico where the output consists mainly of motor vehicle tyres, is characterised by a higher degree of concentration of production than most other manufacturing branches in the country. It comprises approximately 28 establishments but only 10 of them can be considered as factories. The output of tyres is accounted for by four enterprises with various degrees of United States financial and technical participation; they produce 37 per cent, 29 per cent, 22 per cent and 12 per cent, respectively, of total output.

The expansion of the tyre industry was stimulated principally by the rapid increase of automotive vehicles in the country. (See Section on Engineering Industries: Transportation Equipment). Data for production and foreign trade in tyres are not comparable, but the latter represent a small quantity in comparison with the former. It should be noted that the 1943-1945 exports were made by virtue of an agreement with the United States and partly in exchange for crude rubber.

Production, which is by far the most important source of supply of the usual sizes of tyres, more than trebled in 1937 - 1948. (See Table 1).

Table 1 Mexico: Production and Foreign Trade of Tyres for
Motor Vehicles, 1937-1948

Years	Production	Imports a/ Exports	
	(in thousands of units)	(in metric tons)	
1937	206	251	-
1938	192	160	-
1939	256	262	-
1940	228	160	4
1941	249	245	3
1942	280	39	17
1943	235	142	158
1944	248	296	1,118
1945	337	518	985
1946	511	1,922	8

/1947

Table 1 (Continued)

Years	Production	Imports a/ Exports	
	(in thousands of units)	(in metric tons)	
1947	580	1,392	17
1948	668	679	7
1949	379	..	..

a/ Excludes wheels with tyres.

Source: Dirección General de Estadística.

Even though certain parts of Mexico, particularly the tropical section of the State of Chiapas, is suitable for the production of crude rubber, the industry is almost exclusively dependent upon imports for its raw materials. The relatively small production of plantation rubber in Mexico which existed at the beginning of the century could not withstand competition in the world market and almost disappeared, since the domestic rubber industry was then in its infancy. During the Second World War an effort was made to increase domestic rubber production, chiefly by tapping the trees in the forests, but their yield could satisfy only a fraction of the demand. Another source of rubber in Mexico is guayule which grows wild in several arid regions. However, since it can be used only in small proportions in conjunction with rubber from other sources, most of it is exported. (See Table 2).

It is believed that Mexico could not become self-sufficient in crude rubber without a long-term effort and a considerable increase in prices which would reduce demand for tyres and other products. This seems to be contrary to the interests of the industry which has expanded its capacity and had large stocks on hand by the end of 1948; consequently, its production showed a considerable decline in the following year.

/Under these

Under these circumstances the industry is requesting that it be granted certain customs tariff privileges for the import of its raw materials and that imports of tyres also be prohibited in the duty-free zones.

Table 2 Mexico: Production and Foreign Trade of Rubber

1937 - 1948

(in metric tons)

Years	Production of natural rubber	Imports of natural and synthetic rubber	Exports of guayule rubber
1937	52	4,376	3,482
1938	92	2,970	2,561
1939	122	5,191	2,635
1940	181	3,620	4,593
1941	185	6,620	5,396
1942	598	822	7,036
1943	..	2,374	9,004
1944	..	4,539	7,951
1945	..	5,910	12,073
1946	323	5,756	5,839
1947	..	10,870	3,062
1948	..	12,033	..

Sources: Dirección General de Estadística and Armour
Research Foundation.

SECTION 10. FOODSTUFF PROCESSINGI. General aspects

Foodstuffs, beverages and tobacco constitute the second most important group in Mexican manufacturing, following that of textiles. Most of the activities of this group entered the manufacturing stage at a later date than textiles and even now a substantial part of foodstuff and beverage processing is being carried out in households or in family enterprises with the characteristics of cottage industries.

The relative increase of the foodstuffs industries cannot be measured with sufficient accuracy since the 1930 census and the 1944 preliminary census survey, both of which cover enterprises regardless of the value of the output, but do not include the same groups. Considering only those foodstuffs industries for which data are available both in 1930 and 1944, they show a 43.3 per cent increase of persons employed. On the other hand, considering all manufacturing groups for which data are available both in 1930 and 1944, employment increased 45.9 per cent. This seems to indicate a slower growth of the foodstuffs industry than in manufacturing activities as a whole. This is all the more likely since new types of industrial activity had been introduced in Mexico in the intervening years.

Despite a considerable expansion of output the growth of the beverages industry was greater than that of foodstuffs since the increase of the labour force amounted to 48.3 per cent between 1930 and 1944.

The foodstuffs and beverages group rests almost exclusively on the domestic production of foodstuffs, the only major exception being flour mills, beer and certain categories of soft drinks which depend partly upon the importation of raw materials. Insofar, therefore, as foodstuffs and tobacco are subject to industrial processing, the activity of this group depends on the output of agriculture, where after a slow increase of several crops for more than two decades, the rate of increase of production is greater than that of population. Between 1935/39 and 1947, for instance, output of foodstuffs in Mexico increased 41 per cent as compared to a 24 per cent growth of the population.

of the population during the same time.

Most industries in this group seem to have favourable prospects.

To an appreciable extent they are constituted by industries or processes which due to the bulky or perishable nature of the products are wholly or in part localised, such as wheat and maize mills, sugar mills, milk processing establishments, slaughterhouses, rice and coffee hulling plants, oilseed mills, and most of the bottling plants. Besides stimulating a greater volume of output, increased demand tends also to bring about a displacement of direct consumption of certain foodstuffs by processed articles, such as those supplied by the canning industry.

In addition to supplying the domestic market, the processing industry is active also for the export market, particularly in the case of coffee, cacao and vanilla, and occasionally sugar. More recently, industrial processing has been expanding the foreign market of such commodities as fruits, vegetables, fish, seafoods and meats, increasing thereby the hitherto limited sector of Mexican manufactures which can meet foreign competition.

The low capital intensity of most industries in this group indicates the relative advantage their expansion signifies from the standpoint of an increase of exports as well as from the standpoint of employment. In view of the fact that compared to other manufacturing categories they utilise the highest percentage of domestic raw material, the development of the food processing industries should also have a more direct effect upon agricultural real incomes by increasing and steadying the seasonal demand for agricultural produce.

In Mexico, where the difference of productivity in agriculture and non-farming activities is very considerable it seems that an expansion of the industries based upon agricultural production could be one of the most effective ways of narrowing the gap. At the same time it is possible that several of the food processing industries might find a permanent place in the foreign market.

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II. Foodstuffs

In comparison to most American and European countries, wheat milling in Mexico has a relatively smaller significance among the other food-processing industries because maize constitutes the staple diet of the bulk of the population. Moreover, this output has been supplemented by imports of wheat flour. (See Table 1).

The bread, flour-paste and biscuit industry is showing a moderate growth only, employment in such enterprises having increased by 31 per cent between 1939 and 1945. Production takes place mostly in a large number of small establishments, nearly one-third of which are concentrated in the Federal District. The main limitation is the output of the flour mills and the provision that two-thirds of the available flour be used for bread-making and one-third for biscuits.

The large amount of maize consumed by the population is processed either in households or in small establishments which are not taken into account by the statistical services.

Until recent years the meat processing industry consisted almost entirely of slaughterhouses producing for the local market. The meat products industry is relatively small but increasing rapidly, the output of ham, for example, amounting to 113 tons in 1936 and to 689 tons in 1948.

The meat processing industry had a late start when in the early 'forties a packing house was installed in Tampico to supply the capital city. The outbreak of the foot-and-mouth disease in Mexico in 1946 gave a vigorous impulse to the establishment of a canning industry since it was necessary to find an outlet for the 400,000 head of cattle that were normally exported on the hoof each year from Northern Mexico to the United States. By 1948 a network of plants had been established, partly with Export-Import Bank credits in the states of Chihuahua, Sonora and Coahuila. Furthermore, three meat canning corporations have been organised in Chapas, Michoacan, and Veracruz but to date have not proceeded to the building of plants. Part of the canned meat output is directed to the Federal District where the import of cattle from the north had been prohibited. European

/countries absorb

Table 1. Mexico: Position of the wheat milling industry, 1938-1948.

Years	Imports of wheat (flour equivalent)	Output of wheat flour	Imports of wheat flour	Apparent consumption of wheat flour	Apparent consumption of wheat flour per capita
	(In thousands of metric tons)				(Kilogrammes)
1938	62.8	248.3	0.1	248.4	13.27
1939	37.8	285.4	0.1	285.5	14.37
1940	0.8	283.7	0.1	283.8	14.61
1941	85.1	303.6	0.1	303.7	15.02
1942	80.0	354.6	0.2	354.8	17.17
1943	201.8	366.0	0.2	366.2	17.30
1944	302.3	330.5	54.4	434.9	20.06
1945	218.3	380.4	11.5	391.9	17.62
1946	181.8	303.3	43.7	347.0	15.23
1947	195.3	291.0	20.4	311.4	13.28
1948	187.0	290.4	6.5	296.9	12.43

Sources: Dirección General de Estadística, Food and Agriculture Organization of the United Nations, Bank of Mexico, Statistical Office of the United Nations and United Nations Economic Commission for Latin America

countries absorb most of the exports. Moreover, the plant of Sabinas has installed a meat-freezing department for export, thereby adding a new product to Mexico's exports. Some difficulties were experienced by the meat canning industry and by the Mexican canning industry as a whole due to the fact that it depended on the import of containers, the supply of which was not sufficient during the war.

In 1940 nearly three-fourths of the containers used by the canning industry were imported but in postwar years a sufficient number of container-producing plants were established to meet requirements.^{1/}

The fish and seafood canning industry has experienced a very rapid growth, particularly in postwar years when the shortages of containers were eliminated. (See Table 2).

The wealth of the sea resources along the coasts of Mexico and the rapidly expanding demand for fish and seafood in the United States indicate that a further expansion of the industry may be expected. Also an increasing volume of fish and seafood is exported in frozen or quick-frozen form. The domestic consumption of these commodities is still very small, being largely hampered by the insufficient development of transport and storage facilities.

An important fruit and vegetable canning industry has developed in Mexico in recent years which is located mainly in the producing regions. With the exception of some pineapple and tomato canneries, the canning of most plants varies according to the crops of fruits and vegetables. During the last thirteen years output has increased approximately fourfold. (See Table 3).

The most important single pack is that of pineapple and pineapple juice. The output, concentrated mostly in six plants in the producing regions amounted to 409,681 cases (including 31,702 cases of No. 2 cans and 1,111 cases of No. 10 cans of juice) of the various can sizes in the 1948 season ^{2/} A large plant went into production in

1/ Chief among them is Envasas Generales Continental de México in which the Continental Can Company has a 20 per cent interest. Nevertheless this industry is dependent upon the import of tinplate since domestic output meets only a fraction of the demand.

2/ Report No. 536, Canned Fruits and Vegetables, by Fred Hajjar, Embassy of the United States, Mexico D.F., August 9, 1949.

Table 2. Mexico: Output of the fish and seafood canning
industry
1936 - 1948

(In metric tons)

Years	Quantity	Years	Quantity
1936	5,362	1942	4,096
1937	7,206	1943	3,412
1938	5,818	1944	5,786
1939	7,060	1945	10,307
1940	7,138	1946	14,765
1941	6,268	1947	15,547
		1948	16,387

Source: Dirección General de Estadística

Table 3. Mexico: Output of canned fruits and vegetables,
1936 - 1948

(In metric tons)

Years	Quantity	Years	Quantity
1936	2,450	1942	6,686
1937	2,973	1943	8,713
1938	2,498	1944	9,309
1939	3,748	1945	9,719
1940	3,925	1946	9,852
1941	4,483	1947	5,846
		1948	10,471

Source: Dirección General de Estadística.

1949, increasing the capacity of the pineapple industry some 30 per cent. Exports of pineapple preparations and conserves increased steadily from 371.4 tons in 1942 to 6,077.5 tons in 1948, their value having increased from 0.4 million pesos to 6.9 million. Most of the exports, which are more important than any other in the fruit and vegetable canning industry, are shipped to the United States and Canada.

The annual pack of other canned fruits is estimated, using can No. 2 as a basis, comprising the following number of cases: peaches, 100,000; fruit salad, 3,000; apricots, 10,000; other fruits (such as figs, mangoes, guavas, papayas and quinces) 15,000. Moreover, about 10,000 cases of grapefruit juice were produced in 1948.

Tomatoes constitute by far the most important canned vegetable. They are packed on a large scale by three canneries. The 1948 output in cases (can No. 2 basis) is estimated as follows: whole tomatoes, 10,000; purée and paste 400,000 cases; tomato juice 250,000 and ketchup 50,000 cases (No. 10 cans). With the exception of peas the canning of other vegetables is carried out in a small volume, but that of maize is expected to increase considerably. Exports of prepared or canned vegetables reached a peak in 1945 with 641 tons, valued at 1.6 million pesos, but by 1948 were only a fraction of these amounts. Most of the output is destined for the domestic market, only canned tomatoes being of any consequence in foreign trade.

Baby food production is limited to one plant with an annual capacity of 300,000 cases, which has been in operation since the end of 1948.

The sugar-refining industry, concentrated mainly in the cane-growing states of Veracruz, Tamaulipas, Morelos and Sinaloa, is an old-established one, which has played a fairly important role in Mexican exports in the early 'thirties. Possessing antiquated equipment and depending on a high-cost sugar cane output it is producing almost exclusively for the expanding domestic market. Several modern refineries, however, have been added in recent years.^{1/} Output and foreign trade

^{1/} This had been facilitated to a considerable extent by the participation of Nacional Financiera which by the end of 1949 had extended credits to the sugar industry totalling 79.3 million pesos and was holding debentures amounting to 12.8 millions.

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Table 4. Mexico: Sugar and piloncillo: production, foreign trade and apparent consumption, 1929-1948

Years	R e f i n e d S u g a r				Piloncillo a/	Per capita supply of sugar and piloncillo
	Production	Imports	Exports	Available supply	Production b/	
	M e t r i c t o n s					Kilogrammes
1929	180,980	2,043	21	183,002	82,147	16.3
1930	215,710	874	256	216,328	78,815	17.8
1931	246,368	189	26,825	219,732	67,809	17.0
1932	222,467	62	18,962	203,567	72,997	16.1
1933	184,083	62	86,775	97,370	69,961	5.7
1934	186,364	10,216	51	196,529	71,477	15.1
1935	270,464	476	191	270,749	50,102	17.7
1936	312,348	466	31	312,783	61,045	20.3
1937	279,955	17	78	279,302	62,832	18.3
1938	297,955	16	584	297,387	70,024	19.3
1939	331,055	21	5,525	325,551	89,345	21.4
1940	294,078	20	28	294,070	92,300	19.6
1941	328,181	51,407	8	379,580	118,517	24.6
1942	424,090	50	663	423,477	115,077	26.1
1943	412,207	12,464	196	424,475	130,497	26.2
1944	390,202	36,984	-	427,186	135,224	25.9
1945	372,875	92,556	-	465,431	141,069	27.3
1946	376,281	111,198	2	487,477	139,700	27.5
1947	494,317	5	211	494,111	158,700	27.9
1948	610,723	19	47,258	563,474	149,700	29.9

a/ Unrefined brown cane sugar.

b/ Practically equivalent to apparent consumption.

Source: United Nations Economic Commission for Latin America; basic data from Dirección General de Estadística.

Table 5. Mexico: Output of main vegetable oils, 1937-1948

(In metric tons)

Years	Cottonseed oil	Sesame oil	Linseed oil	Coconut oil	Coquito oil	Peanut oil	Total
1937	14,671	7,791	184	16,035	362	522	39,565
1938	17,023	8,202	116	20,370	165	753	46,629
1939	11,179	7,284	244	28,119	119	602	47,547
1940	12,343	5,992	146	23,772	536	571	43,360
1941	12,802	5,693	315	27,684	1,109	968	48,571
1942	16,110	9,532	396	13,747	825	2,476	43,086
1943	16,206	18,156	487	2,199	977	5,144	43,169
1944	17,214	13,265	...	2,851	2,329	3,910	39,569 ^{a/}
1945	15,251	14,598	1,638	3,623	1,033	2,053	38,596
1946	16,684	10,919	302	1,590	503	986	30,984
1947	16,764	16,465	4,093	7,363	1,242	1,781	37,708
1948	16,373	20,263	2,027	2,126	1,366	2,064	44,219

^{a/} Excludes linseed oil.

Source: Dirección General de Estadística.

of sugar as is shown in Table 4.

A large number of small enterprises and a few medium-sized ones producing chocolates and candy use sugar as their principal raw material. Only in hard-candy production and in some chocolate factories are operations carried out with modern equipment. It is estimated that during the war output of the industry increased some 50 per cent, declining 20 per cent in the following two years partly as a result of increasing imports. In 1947 it was estimated that the industry operated at only 30 per cent of capacity.

The milk processing industry is still largely undeveloped, consisting mainly of pasteurising plants supplying Mexico City and other urban centres. In recent years two plants producing evaporated, powdered and condensed milk have been established. The production of butter and cheese takes place almost entirely in cottage industries and is of small economic significance.

The vegetable oil industry (including cottonseed, sesame, linseed, coconut, coquito and peanut oils) shows an increase from 39,565 tons in 1937 to 44,219 tons in 1948. However, the increase in the output of some oils has been partly compensated by a decline in others. (See Table 5). It is likely that there has been an increase in the productivity of the industry since employment declined slightly between 1938 and 1948. Moreover, a structural change is taking place in the industry, since the milling process is carried out more often in conjunction with refining operations; as a result the number of enterprises has declined.

The vegetable oils industry received its main impetus during the war when imports of most oilseeds, particularly copra, were drastically reduced. Its development, together with the import restrictions subsequently introduced caused Mexico's foreign trade balance of vegetables to show, in terms of value, an export surplus in 1947-1948. (See Table 6).

/III. Beverages

III. Beverages

During the past ten years the beverage industries of Mexico have undergone a considerable change reflecting in part the increase of demand, and in part a change in consumer preference. Even though there seems to have been no decline in the consumption of the traditional beverages of the bulk of the population - namely, pulque and other alcoholic beverages - a very considerable expansion of beer and particularly of soft drinks has taken place. In view of the fact that about 80 per cent of the output of alcohol that is consumed in the domestic market is used by the liquor industry, a comparison of beer output and the apparent consumption of rectified alcohol shows a development in favour of the former beverage (See Table 7).

Appreciable as the expansion of the beer industry may have been, that of soft drinks has been even more rapid, having tripled between 1940 and 1945. In 1948 its output amounted to 478.5 million litres ^{1/} or 20 litres per capita, as compared to an apparent consumption of beer of 14 litres.

Despite a general increase in the demand for beverages of all types the situation of the alcohol, beer and soft drinks industries varies considerably. The alcohol industry is the oldest of the three in Mexico, being based on sugar-cane industry; the alcohol refineries are usually adjuncts of the sugar mills. Even though there has been a decline in the number of alcohol refineries since 1935 due to a tendency towards concentration of output, its equipment is generally out of date. During the war the industry exported an appreciable amount of alcohol which reached a peak of 50.7 million litres in 1944. Due to its high cost the industry lost shortly thereafter its market abroad and alcohol exports were replaced by molasses. This has aggravated the excess capacity problem of the industry which the "Sociedad Nacional de Productores de Alcohol", (National Association of Alcohol Producers), a government-created organ, is attempting to alleviate by establishing production quotas.

^{1/} Data on the soft drink industry, based on report No. 536, Soft Drink Industry - Mexico by Allan E. Hool, Embassy of the United States, Mexico, Distrito Federal, August 24, 1948.

/In contrast,

Table 6. Mexico: Foreign Trade in vegetable oils, 1937-1948

Years	Volume (in metric tons)			Value (in thousand pesos)		
	Imports	Exports	Balance	Imports	Exports	Balance
1937	55,058	46	- 55,012	14,658	5	- 14,651
1938	36,890	16	- 36,874	7,580	6	- 7,574
1939	58,540	3	- 58,537	12,075	1	- 12,074
1940	68,677	5	- 68,672	15,987	5	- 15,982
1941	96,223	1,186	- 95,037	21,554	1,363	- 20,191
1942	13,143	937	- 12,206	3,961	1,080	- 2,881
1943	1,296	1,096	- 200	978	901	- 77
1944	2,448	603	- 1,845	825	648	- 177
1945	507	84	- 423	796	694	- 102
1946	5,447	1,265	- 4,182	7,750	3,389	- 4,361
1947	12,448	10,649	- 1,799	14,761	27,385	+ 12,624
1948	629	2,208	+ 1,579	801	6,446	+ 5,645

Source: Dirección General de Estadística

Table 7. Mexico: Production of beer and alcohol, 1937-1948

(In millions of litres)

Years	Beer production ^{a/}	Alcohol production
1937	120.8	23.6
1938	129.8	23.9
1939	160.5	18.0
1940	171.2	23.5
1941	183.6	25.4
1942	219.7	35.0
1943	259.3	42.0
1944	325.7	50.7
1945	340.8	37.7
1946	420.5	29.4
1947	322.2	39.6
1948	336.0	34.9
1949	400.8	..

a/ On draught and bottled

Source: Dirección General de Estadística.

In contrast, the beer industry is technically more advanced, several enterprises having attained high levels of quality in their output. During the war supply shortages in the United States led to Mexican beer exports which, however, could not be maintained after 1946 due to the tariff protection and expanded output in the former country. The proportion of imports, consisting mainly of hops, in the total value of raw materials used by the beer industry declined from 62 per cent in 1929 to 40 per cent in 1944.

Soft drinks are purchased in about 150 establishments which account for two-thirds of the output, the remainder being supplied by small producers, most of whom are not registered with the Federal authorities. An appreciable part of the output, 42 per cent, takes place under United States franchise (50 per cent of the orange drinks and 95 per cent of the cola drinks), and imports of extracts and colouring compounds represent between ten and 35 per cent of production costs of the main brand bottlers. The industry reached a peak in 1946 followed by a decline of demand. Contributing factors were the establishment of a special production tax in March 1948, and the effects of the currency devaluation upon production costs.

IV. Tobacco products

The tobacco industry is characterised by the predominant role of cigarette manufacturing which accounts for 98 per cent of the gross value of output of the group. From the mid-twenties there has been a tendency toward concentration in cigarette production so that by 1946 over 93 per cent of the output was accounted for by three large enterprises with modern equipment. The small enterprises are mainly located in the southeastern states of the Republic where they produce exclusively for the local market. In order to protect the small establishments the government in 1944 declared cigarette manufacturing a "saturated" industry and large enterprises were not allowed to expand their plant capacity. This was intended to permit a fuller utilisation of the fixed capital of the medium and small producers, but even in 1947 they were operating at about 25 per cent of capacity, whereas the large /enterprises operated

enterprises operated at 80 per cent. It is also possible that this measure accounts for a reversal in the productivity per worker in the industry as a whole, which had increased from 298,600 packages in 1940 to 372,800 packages in 1945 and subsequently declined to 294,775 in 1948.

As a result of increasing demand and changing habits, particularly among women and a part of the agricultural population, where the use of hand-rolled cigarettes is declining, consumption of factory-produced cigarettes rose from an estimated 45.5 packages per capita in 1940 to 56.2 in 1946. This development, together with the growth of the population is reflected in a fairly uniform increase in output except for 1946. (See Table 8).

The Mexican cigarette output is based almost entirely on domestic tobacco whose output increased appreciably during the period under consideration, partly due to higher unit yields. Despite an increased production of Virginia type tobacco, this output is not sufficient to meet entirely the requirements for the manufacturing of light cigarettes as a result of which imports of tobacco rose from 113.9 tons in 1937 to 902.8 tons in 1946, consisting mainly of Virginia and non-classified tobacco.

According to the 1940 census 77.8 per cent of the raw materials utilised by cigarette manufacturing was of domestic origin. It is likely, however, that this proportion is increasing since a cigarette-paper factory has been recently established near Mexico City with a five-ton capacity per day which should meet most of the domestic demand. Another enterprise producing tinfoil, among other articles, will make the Mexican cigarette industry independent of imports of this commodity.

Table 8. Mexico: Estimated production of cigarettes,1937-1948

(In millions of packages)

Years	Quantity	Years	Quantity
1937	894.3	1943	917.3
1938	848.7	1944	1,122.7
1939	944.9	1945	1,118.4
1940	895.8	1946	1,272.3
1941	897.7	1947	1,149.1
1942	951.5	1948	1,179.1
		1949	1,276.4

Source: Dirección General de Estadística

SECTION 11. TEXTILE INDUSTRY

I. Cotton textiles and the general problems of the textile industry

1. Production, supply and consumption

During the past half century the cotton textile industry in Mexico expanded from about 500,000 spindles and 15,000 looms in 1900 to 935,532 spindles and 34,133 looms in 1950. Its production doubled from a yearly average of 27.2 thousand tons in 1900-1904 to 51.4 thousand in 1945-1948.

The cotton textile industry entered the manufacturing stage in the 1830's with the support of the government-sponsored Banco de Avio which financed the importation of machinery. It is one of the oldest in Latin America and still constitutes the single most important manufacturing group in Mexico. The early development of the cotton textile industry, both in the weaving and spinning phases, is revealed by the fact that already in 1900-1904 imported yarns represented, by weight, not more than 5 per cent of the fabrics produced and that imported fabrics and their manufactures averaged only about 12 per cent of apparent consumption. In this way imports of cotton yarns, fabrics and their manufactures absorbed not more than 8.2 per cent of the value of total commodity imports in 1900-1904. As a result, there was left a larger share of foreign exchange for the import of other commodities, including capital goods, than in Brazil or Argentina, for instance, where the cotton textile industry had a later development.

Having achieved maturity at a relatively early stage, at least insofar as it met the bulk of domestic demand, the cotton textile industry had a slow subsequent development, increasing not much more than population. Thus, while population increased 66 per cent between 1900-1904 and 1945-1948, cotton textile production increased only some 100 per cent. Moreover, part of the increase in 1945-1948 was due to exports, so that per capita consumption was smaller than at the beginning of the century.

Production, imports and exports, and the supply of cotton textiles are shown in Table I. Per capita consumption is summarized below.

MEXICO: Per capita consumption of cotton fabrics on their
manufactures, 1900-1948.

(In Kilogrammes)

<u>Yearly Averages</u>	<u>Quantity</u>	<u>Years</u>	<u>Quantity</u>
1900-1904	2.3	1940	2.2
1905-1909	2.3	1941	2.4
1922-1924	2.1	1942	2.4
1925-1929	2.4	1943	2.3
1930-1934	2.0	1944	2.3
1935-1939	2.4	1945	1.9
1940-1944	2.3	1946	1.9
1945-1948	1.9	1947	1.9
		1948	2.0

Source: United Nations Economic Commission for Latin America;
basic data from Dirección General de Estadística.

Note: No population numbers are available for 1911-1921,
when population declined from 15.2 million in 1910
to 14.4 million in 1922.

Changes in the supply of cotton textiles, which are the principal consumer goods in manufactured form in general use throughout the country, contrast with those of iron and steel which can be considered as being representative of investment. Thus, the per capita supply of iron and steel rose from a yearly average of 10.1 kilogrammes in 1900-1902 before the establishment of the steel industry in the country to 13.1 kilogrammes in 1937-1939 and 22.9 kilogrammes in 1945-1948. During the same periods of time iron and steel production rose from 0.3 kilogrammes to 7.4 and 11.2, respectively. (See Graph I).

This seems to illustrate the tendency that in the face of a rapidly growing population in Mexico, real income has not risen enough to permit a substantial increase of consumption at the present rate of investment. Whereas numerous consumer goods other than cotton textiles show an often remarkable increase; their use is generally limited to the urban population. In the absence of data on income distribution, the stagnant per capita consumption of cotton textiles indicates that the pressure which investment exerts upon consumption is felt mainly by the rural population. It is possible that per capita consumption of clothing

/materials has not

Table 1. Mexico: Production, imports, exports and supply of cotton textiles or their manufactures, 1900-1948

(In metric tons)

	Mill consumption of cotton	Imports of yarns	Production of fabrics	Imports of fabrics and their manufactures	Exports of fabrics and their manufactures	Apparent consumption
1900	25,079	764	25,843	4,022.8	..	29,865.8
1901	35,293	838	36,131	3,978.0	..	40,109.0
1902	22,560	689	23,249	4,311.4	..	27,560.4
1903	23,650	770	24,420	3,378.9	..	27,799.9
1904	25,609	783	26,392	3,075.2	..	29,467.2
1905	29,378	723	30,101	3,481.6	..	33,582.6
1906	30,057	781	30,832	3,794.5	..	34,626.5
1907	29,553	931	30,484	4,021.7	..	34,505.7
1908	29,057	902	29,959	3,492.7	..	33,451.7
1909	28,484	864	29,348	2,435.3	..	31,783.3
1910	<u>28,839</u> a/	983	<u>29,822</u>	2,762.0	..	32,584.0
1911	26,944	1,033	<u>27,969</u>	1,688.5	..	29,657.5
1912	26,944	1,015	27,969	513.7	..	28,482.7
1913	26,944	1,027	27,969	607.2	..	28,576.2
1914	26,944	..	26,944	..	..	..
1915	26,944	..	26,944	..	..	..
1916	<u>26,944</u>	..	<u>26,944</u>	..	..	..
1917	12,559	..	12,559	..	..	..
1918	14,336	714	15,050	182.8	..	15,232.8
1919	22,685	491	23,176	287.5	..	23,463.5
1920	25,990	685	26,675	4,282.6	..	30,957.6
1921	30,278	909	31,187	9,516.8	..	40,703.8
1922	28,417	724	29,141	4,019.6	..	33,160.6
1923	26,523	843	27,366	2,799.0	..	30,165.0
1924	25,024	912	25,936	3,058.0	..	28,994.0

a/ Average 1911-1916

/Table 1.

ContinuationTable 1. México: Production, imports, exports and supply of cotton textiles or their manufactures, 1900-1948

(In metric tons)

	Mill consumption of cotton	Imports of yarns	Production of fabrics	Imports of fabrics and their manu- factures	Exports of fabrics and their manu- factures	Apparent consumption
1925	33,618	930	34,548	4,279	23	38,804
1926	34,049	919	34,968	3,612	54	38,526
1927	33,760	967	34,727	2,471	6	37,192
1928	32,272	1,056	33,328	2,730	2	36,056
1929	32,339	1,068	33,407	2,462	5	35,864
1930	33,280	872	34,152	2,808	5	36,955
1931	28,395	538	28,933	921	3	29,851
1932	28,236	731	28,967	645	16	29,596
1933	33,808	589	34,397	1,013	1	35,409
1934	40,670	637	41,307	1,078	10	42,375
1935	41,023	633	41,656	1,144	3	42,797
1936	43,987	653	44,640	1,449	3	46,086
1937	45,759	726	46,485	2,001	8	48,478
1938	41,664	568	42,232	1,250	15	43,467
1939	40,278	350	40,628	1,751	132	42,211
1940	42,303	514	42,817	1,584	109	44,292
1941	46,847	417	47,264	1,967	647	48,584
1942	53,594	502	54,096	1,882	7,227	48,751
1943	55,893	262	56,155	1,505	9,062	48,598
1944	56,379	175	56,554	2,148	8,703	49,999
1945	56,894	141	57,035	1,487	16,306	42,216
1946	57,186	238	57,424	2,386	15,864	43,946
1947	51,212	345	51,557	2,627	10,705	43,479
1948	51,201	428	51,629	2,219	6,313	47,535

Source: United Nations Economic Commission for Latin America; basic data from Dirección General de Estadística.

Note: It has been assumed that there is an average loss of 18 per cent in the cotton consumed by the mills. Import or export data of certain commodities that are given in other units than weight for certain years have been converted into kilogrammes.

materials has not declined to the extent that per capita data on cotton textiles indicate. On the basis of official sources, which are the only ones available, it does not seem that consumption of woollen textiles has increased appreciably: between 1925-1929 and 1945-1948 consumption of wool by the woollen textile industry was practically the same, and imports of woollen textiles and their manufactures are of small significance in the total consumption of clothing materials. However, there has been a partial substitution of cotton textiles by rayon. Apparent consumption of rayon textiles in 1945-1948 amounted to a yearly average of 2,625 tons. Consequently, per capita consumption of cotton and rayon amounted to 2.0 kilogrammes in 1945-1948 instead of 1.9 kilogrammes when cotton textiles only are considered.

Having indicated the position of the cotton textile industry at the beginning and at the end of the first half of this century, changes in production during the intervening period can be briefly summarized. A comparison with the changes in output of the cotton industry of the United States reflects the distinct conditions of the Mexican cotton industry and of the economy of which it is part.

Both industries were well established in their respective countries at the beginning of the century and supplied primarily the domestic market. Nevertheless, the range of products of the Mexican textile industry was narrower than that of the United States, so that higher quality goods are still partly imported. Apart from considerations which affect the size, organization, productivity and other factors, it appears that the cotton textile industry in the latter country, being part of a more developed economy, has a relatively greater amount of unused plant capacity that permits a rapid increase of output in response to demand as occurred during the first World War. In Mexico, in contrast, the revolutionary wars depressed production. Subsequently, and until the "great depression" output of the cotton textile industry in Mexico rose less than in the United States partly because the relative rise of real income was probably smaller in the former country and partly because output was directly affected by imports of textiles. For the same reason, her increased protectionism introduced in the early 'thirties

permitted a certain substitution of imports by domestic production instigating the decline in 1931-1932. The depression of the cotton textile industry in Mexico during those years was considerably less severe than in the United States, mainly due to the lesser elasticity of the demand of textiles in a low-income country. From 1933 to 1937 there was a steady increase in output so that already in 1933 the pre-depression level had been regained and surpassed; in the United States this took place only in 1938 and again in 1940 and subsequent years. During the war the idle capacity in the United States allowed a very rapid increase of production to a peak in 1942, while in Mexico the stimulus was due mainly to exports, production having reached a peak in 1946. (See Graph 2).

2. Imports of capital goods

In view of the fact that practically all textile machinery is imported in Mexico, such imports, data for which are available since 1930, complement those on production as indicators of the industry's growth. (See Table 2).

As in several under-developed countries the "great depression" stimulated an expansion of investment in the textile industry. This was followed by a period of uncertainty on the part of entrepreneurs probably caused by the economic and social reforms of the late 'thirties, which led to a substantial reduction of investment. The outbreak of the war in Europe had a stimulating effect upon the demand for textiles. Mexico, which until then had imported mainly European machinery was able to find in the United States an alternate source of supply with greater ease than the other main textile countries of Latin America, and increased its imports of equipment. For the same reason, the decline in 1941-1943 was less drastic. Higher levels of output were attained by a fuller utilization of existing equipment and the domestic production of some spare parts and even of equipment; moreover, imports of spare parts were larger than in prewar years. Since 1944 the increase of imports of textile machinery, and to a lesser degree those of spare parts, has been remarkable. In 1948, however, the uncertainty of maintaining the export market for Mexican textiles that had been gained during the war together with other

/considerations such

considerations such as the exhaustion of funds accumulated during the war by numerous textile enterprises and the difficulty of obtaining long-term credit led to a decline in capital investments.

3. The textile industry and the balance of trade

Considering the textile industry as a whole, including the production of clothing fibers and imports of dyes as well as of equipment and spare parts, the balance has been a negative one until 1943. Already in the previous year Mexico ceased to be a net importer of manufactured cotton. From then on the balance became positive mainly because of increasing exports of cotton fabrics which reached a peak in 1946, in terms of value, and also because of exports of raw cotton which attained a record level in 1947. The balance turned negative again in 1948 when both exports of cotton fabrics and of raw cotton declined appreciably from the previous year. The total balance for 1937-1948, shows a small surplus of 26.9 million pesos, equivalent to 4.8 million dollars. (See Table 3).

On the whole, under normal international supply conditions, Mexican textiles cannot compete abroad. The considerable exports attained in recent years were of a temporary character only and have been declined steadily in terms of volume, since 1945. Even though they may not be depressed to their prewar level, it is not generally believed that textiles may represent in the future any significant item in the country's total exports.

It should also be noted that cotton textile exports were made largely at the expense of the previous level of domestic consumption so that the supply available for use in the country increased only when exports declined.

The foreign exchange expenditures made for the considerable imports of equipment and spare parts for the textile industry, particularly in 1945-1947, were more than compensated by the net exports of fabrics and their manufactures. However, a large-scale modernization of the textile industry would require imports of machinery to be appreciably higher even than their post-war level. Under these circumstances, and unless the low domestic consumption of textiles is to be compressed any further, it seems that for some time

to come imports of equipment for the industry will have to be paid for by foreign exchange accruing from other activities. Nevertheless, the prospects of maintaining a high level of raw cotton exports seem to be better than those of textiles, and they may produce an appreciable part of the foreign exchange necessary for the modernization of the industry. Only subsequent to its re-equipment, and even more important, the correction of the other causes of the present low productivity of the textile industry, is it possible that its operation might become a permanent source of foreign exchange.

Such a criterion, however, must be subordinated to the principal aim of the industry, namely, an increasing level of domestic consumption of textiles. It is only to the extent in which this has been achieved that the industry will have fulfilled its purpose.

Table 2. Mexico: Imports of textile machinery and
spare parts, 1930-1948
(in metric tons)

Years	Machinery	Spare parts
1930	1,180	203
1931	722	122
1932	904	164
1933	1,425	238
1934	1,449	323
1935	1,835	345
1936	2,729	507
1937	1,116	506
1938	567	316
1939	466	247
1940	672	332
1941	693	343
1942	162	382
1943	603	389
1944	1,645	411
1945	4,702	620
1946	5,362	717
1947	7,034	1,329
1948	5,802	1,661

Source: Dirección General de Estadística.

/Costs and

Table 3. Mexico: The Textile Industry and the Balance of Trade
1937 - 1948

(in millions of pesos)

Raw Materials, including Semi-Manufactures

	Imports			Exports			Balance
	Raw Materials ^{a/}	Thread and Yarns ^{b/}	Total	Raw Materials ^{c/}	Thread and Yarns ^{d/}	Total	
1937	9.1	21.8	30.9	8.4	-	8.4	- 22.8
1938	9.5	22.0	31.5	19.6	-	19.6	- 11.9
1939	12.6	21.3	33.9	6.5	-	6.5	- 32.4
1940	13.5	24.8	38.3	5.3	0.2	5.5	- 32.8
1941	23.1	30.9	54.0	13.8	1.0	14.8	- 39.2
1942	27.2	24.1	51.3	0.8	4.2	5.0	- 46.3
1943	17.7	27.4	45.1	9.1	5.1	14.2	- 30.9
1944	44.7	30.9	75.6	56.4	6.4	62.8	- 12.8
1945	43.8	31.4	75.2	39.4	7.0	46.4	- 28.8
1946	33.5	50.4	83.9	73.7	4.1	77.8	- 6.1
1947	37.6	64.1	101.7	216.6	5.1	221.7	+ 120.0
1948	60.6	81.8	142.4	149.0	1.0	150.0	+ 7.6
Totals	332.9	430.9	763.8	589.6	34.1	623.7	- 136.0

- a/ Includes cotton, wool and wool waste, and raw silk.
b/ Includes thread and yarns of cotton, wool and rayon.
c/ Raw cotton only
d/ Includes thread and yarns of cotton and wool.

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Table 3. Continuation
Mexico: The Textile Industry and the Balance of Trade
1937 - 1948

(in millions of pesos)

Raw Materials, including Semi-Manufactures

<u>Fabrics and their Manufactures^{a/}</u>			Estimated Imports of Dyes ^{b/}	Imports of Equipment & Spare Parts	General Balance	General Balance (millions of dollar equivalents)
Imports	Exports	Balance				
1937	15.8	-	5.2	2.9	-	12.8
1938	13.5	-	5.6	2.1	-	7.3
1939	18.0	0.4	6.6	2.1	-	11.3
1940	20.1	0.5	7.5	3.1	-	11.6
1941	30.1	3.0	8.6	3.7	-	16.1
1942	34.8	44.1	9.5	3.2	-	9.9
1943	44.7	73.9	8.5	3.5	-	2.8
1944	46.2	78.7	7.8	6.1	+	1.1
1945	51.9	196.4	9.0	11.5	+	19.5
1946	75.7	257.9	8.7	16.4	+	33.1
1947	90.6	153.5	10.2	35.5	+	28.2
1948	65.0	87.7	16.4	45.6	-	5.3
Totals	-507.3	+896.1	-102.1	-133.7	+ 26.9	+4.8

Source: United Nations Economic Commission for Latin America; basic data from official sources.

^{a/} Fabrics and their manufactures of cotton, wool silk and rayon
^{b/} Equivalent to 80 per cent of coal tar dyes.

4. Costs and prices

The principal cause depressing the consumption of cotton textiles in Mexico in recent years has been the worldwide shortage of textiles during the war and postwar years. Higher profit margins available in the textile export trade stimulated exports which, as indicated above, increased considerably more than production, reducing thereby the supply for domestic use: lower imports of textiles accentuated this development even more.

Since a licensing system was applied to textile exports only during part of the time of the shortage and was not effectively implemented, domestic wholesale prices of cotton textiles were determined by the supply and demand in the export market, and rose more rapidly than the general wholesale price index. Even though there are no data indicating the profit margins of the textile industry, these increased considerably as can be inferred from the fact that taking 1939 as a base year the index of textile wholesale prices soon surpassed the index of production costs. This development is generally known and is similar to that which took place in Latin America's principal textile exporting country, namely, Brazil.

It is possible that the increase in profits of the textile industry was even greater than is implied in the discrepancy in the indices of production costs and wholesale prices. This is due to the fact that there is in Mexico a considerable interlocking of ownership between production and distribution of textiles. In contrast, however, to most industrialized countries and with the exception of an important factory, it is not the producers who established sales outlets but the large stores which founded their own factories. Since retail prices of ordinary fabrics and clothing rose even more rapidly than the wholesale price index of textiles it can be assumed that the profit margins of the intermediaries also rose considerably and that producers participated in them in varying degrees.

/The consequence

The consequence of increased profit margins both among producers and distributors was that retail prices of ordinary fabrics and clothing rose more rapidly than the cost of living of the low-income groups (as represented by working-class families in Mexico City) and led to a reduction in their consumption. (See Table 4)

Table 4. Mexico: Textile industry and trade
cost and prices, 1939-1948

Index numbers: 1939 = 100

	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
Unit costs in the cotton textile industry <u>a/</u>	100	100	96	133	129	147	166	171	239	250
Wholesale price of fabrics and yarns <u>b/</u>	100	110	117	137	176	215	239	296	310	..
General index of wholesale prices <u>b/</u>	100	103	109	121	146	179	199	229	242	248
Retail price of "ordinary fabrics and clothing" <u>c/</u>	100	110	114	140	191	283	346	454	493	475
Cost of living of workers' family in Mexico City <u>d/</u>	100	101	104	121	158	199	214	267	300	319
Per capita consumption of cotton textiles <u>e/</u>	100	100	109	109	104	104	86	86	86	91

Notes and Sources:

a/ In order to present the index numbers for unit costs of the cotton textile industry for the whole period under consideration, only wages and the cost of raw cotton have been included. These two items averaged 79.1 per cent of total production costs of the industry in 1943-1948. The volume of production was considered in terms of the quantity of the cotton consumed.

Source: Dirección General de Estadística

b/ The wholesale price index in Mexico City comprising 210 commodities and published by the Bank of Mexico has been used in the absence of a national index. The index for fabrics and yarns does not distinguish between those of domestic or foreign origin, nor does it discriminate between cotton, woollen and other fabrics and yarns.

c/ Published by the Dirección General de Estadística which does not specify the items included.

d/ Dirección General de Estadística.

e/ Calculated by the United Nations Economic Commission for Latin America on the basis of official sources.

5. Productivity and wages

The fact that textile exports were made at the expense of domestic consumption rested in a large measure upon the low productivity of the industry, as will be indicated below.

Another consequence of low productivity is that it has prevented a long run increase in the real wages in the textile industry, at least as can be inferred from data available for 1937-1948. This, however, was also caused in part by the rise in prices in an inflationary period. It is also probable that despite the rigidities of collective contracts, the fact that a substantial proportion of the labour force in the industry is unskilled or semi-skilled, makes it difficult to increase nominal wages in the face of an abundant supply of low paid applicants from other occupations. (See Table 5).

Table 5. Mexico: Nominal wages and index numbers of real wages in the cotton textile industry, 1937-1948

Years	Nominal average yearly wage (in pesos)	Real wages; index numbers 1937 = 100
1937	1,030	100
1938	1,221	105
1939	1,421	119
1940	1,512	126
1941	1,589	127
1942	1,657	115
1943	1,904	101
1944	2,157	91
1945	2,388	94
1946	2,865	90
1947	2,990	98
1948	3,150	112

Sources: United Nations Economic Commission for Latin America; basic data from Bank of Mexico and Secretaría de Economía, Barómetros Económicos.

Note: The two series merely indicate a trend in nominal and real wages in the industry since data on nominal wages have been calculated by dividing the yearly wage payroll by the yearly average employment of workers based on end-of-month data: the index numbers of real wages were obtained by deflating nominal wages by the cost of living index of a worker's family in Mexico City. Some of the increases in wages seem to be due to the fact that during the war numerous factories operated night shifts where wages equivalent to overtime prevailed.

6. Productivity

The productivity of the Mexican cotton textile industry has been recently the subject of a special study together with that of several other Latin American countries^{1/}. The following is a summary of the salient features of the analysis made, to the extent that they are relevant to the purposes of this chapter.

The measurement of labour productivity has been made in terms of kilogrammes per mass hour of yarns, fabrics and intermediate products. Spinning and weaving were investigated separately; measurements were made process by process; and productivity was determined, whenever possible, for five to six counts of yarn and three or four types of fabric.

The results obtained were measured against representative cross-sections of the industry in the country as well as against best attainable levels. The survey revealed that on the average the productivity of the Mexican cotton textile industry was extremely low.

Considering spinning operations, the old plants produce only between 22.5 and 34.0 per cent of the productivity obtainable with modern equipment and the best working methods, and from 28.3 to 37.9 per cent of what could be attained with good working methods, and with the same equipment, although well maintained. The average modern spinning plants in Mexico produce 49.7 to 76.7 per cent of the standard performance for well organized mills.

In the weaving industry, the old mills produce per man-hour 13.2 to 13.8 per cent of the output attainable with modern equipment and the best organization, and 37.1 to 49.4 per cent of what they could achieve with the same equipment but with good management and organization. The average modern weaving plants have a labour productivity of 29.0 to 33.0 per cent of the standard performance for well organized mills of their kind.

^{1/} United Nations Economic Commission for Latin America, Productivity of the Cotton Textile Industry in Selected Latin American Countries, Document E/CN.12/170, May 1959.

/On the aggregate,

On the aggregate, operational factors were of greater significance in determining the low productivity of the spinning industry than those pertaining to physical equipment or size of plant. In the case of weaving, this condition is reversed.

The significance of operational factors is reflected mainly in excess labour and low process efficiency. Traditional working methods have been embodied in the contract law which determines small labour assignments and by its rigidity makes it in most cases uneconomical to introduce modern equipment. In the modern plants the contract law is not applied since it does not take into account modern machinery; special agreements between labour and management leave a greater measure of freedom to the latter to determine workloads without, however, preventing excess labour being imposed also in such plants. Furthermore, over employment in the new mills is caused in part by the fact that the labour force is still under training.

Operational factors in spinning increase labour requirements 135 to 254 per cent in the old mills and 30 to 101 per cent in the new mills. In weaving they account for an increase of 76 to 170 per cent in the old mills and for 110 to 154 per cent in the new mills.

In spinning operations as a whole, and as far as productivity is concerned, the correction of operational factors is more important than the modernization of equipment. However, considering the interdependence of the two operations modernization is equally important in spinning as in weaving since the former process produces yarn that is more suitable for operating automatic looms at a high number of units per weaver. Even with their present installations the productivity of the old spinning mills could increase 2.11 times its present level should operational factors be corrected. On the other hand, in weaving operations as a whole modern equipment can improve productivity more than the correction of operational factors. It should be noted, however, that in the modern weaving mills the situation is reversed, the correction of operational factors being more important than any

/improvement

improvement attainable by means of better equipment.

The significance of the use of over aged equipment is indicated by the fact that only 14.5 per cent of the spindles and 6.1 per cent of the looms are modern. This is due to a number of factors chief among which is the fact that the industry is sheltered from foreign competition, the proportionality between wage rates and output as stipulated in collective contracts and postwar price increases of equipment, particularly as resulting from the devaluation of the Mexican currency.

7. Raw materials

The various deficiencies of the cotton textile industry in Mexico are partly compensated by the fact that in contrast to numerous industrialized countries it rests upon a domestic production of cotton. The existence of the domestic raw material assisted the development of the industry. However, until the first world war Mexico was a net cotton importer, not only of the long-staple fiber it generally imports, but also of part of the short-staple fibers which constitute the bulk of the requirements of the industry. In subsequent years, however, production of raw cotton probably did not surpass the pre-revolutionary peak until the beginning of the second world war. The export surplus began to increase rapidly under its stimulus attaining a peak in 1947 with 88.6 thousand tons, so that raw cotton became the second most important commodity export, following lead. (See Table 6).

In prewar years the industry suffered from the relative handicap of cotton prices being higher than those prevailing in the United States, since then the increase in cotton prices has been more rapid in the latter country, and despite the fact that the Mexican crop is still entirely hand-picked, the position has been reversed. The relative price advantage of the Mexican cotton has been further increased by the devaluations of the currency.

/Table 6.

Table 6. Mexico: Production, imports
and exports of raw cotton, 1900-1948

(In metric tons)

Averages	Production	Imports	Exports	Stocks
1900-1904	32,338	12,555	147	..
1905-1909	80,250 <u>a/</u>	6,726	2,700	..
1910-1913	..	3,799	380	..
1918-1919	..	657	77,428	..
1920-1924	..	4,464	..	..
1925-1929	54,813	111	21,002	..
1930-1934	42,178	1,699	4,587	..
1935-1939	69,466	352	23,549	..
1940	65,550	175	5,238	23,690
1941	81,190	785	12,871	26,220
1942	103,040	947	535	36,110
1943	115,920	266	5,269	62,100
1944	106,030	83	29,288	102,810
1945	97,520	178	28,381	103,500
1946	91,310	150	47,664	74,060
1947	92,000 <u>b/</u>	466	88,566	44,850
1948	104,420 <u>b/</u>	288	48,836	..

Source: Dirección General de Estadística and Dirección de Economía Rural.

a/ 1905-1907 only.

b/ Preliminary

Note: In Report No.61, "Mexican Cotton - Recent Trends in Production and Trade", John Newton Smith, Embassy of the United States, Mexico, D.F., January 28, 1949 production was estimated as follows: 1946 - 103,960 metric tons; 1947 - 109,250 tons and 1948 - 126,500 tons: stocks in 1943-1948 were estimated as being lower than official data; for 1948 they were estimated at 13,800 tons.

/II. WOOLLEN

II. THE WOOLLEN TEXTILE INDUSTRY

Even though the woollen textile industry of Mexico entered the manufacturing stage at the same time as the cotton textile industry, it is of a considerably smaller economic significance. The gross value of its production is about one-sixth and its labour force about one-seventh that of the cotton textile industry. This is mainly due to the fact that for reasons of climate the demand for woollens is much smaller than for cotton fabrics, that its products are relatively more expensive and that the supply of domestic wool is deficient.

Of these three causes the last one seems to offer the greatest possibilities for improvement, both as to the volume and quality of domestic wool. A technical report on the subject states that "if proper steps were taken, there is no reason why Mexico could not meet her own domestic demand for wool for her textile industry". 1/

One of the main causes of the insufficient production of wool seems to lie in the distribution of land on which sheep are raised. According to the 1940 agricultural census 28.3 per cent of the wool was produced on land units of less than five hectares, 46.5 per cent on land units of more than five hectares and 24.7 per cent on ejidal land. It should be noted, however, that even before the land reform large-scale sheep raising was practiced in a few cases only. Instead of the present system where most of the wool is produced on small units of land and is incidental to the other operations of the individual owners, the report recommends that production be carried out on large ranges. It is there that proper breeding practices can be applied in order to bring about a greater volume and a better quality of wool.

In 1938-1942 when a distinction was made between domestic and imported wool used by the industry, imported wool represented 36 per cent of the total volume and 50 per cent of the value. It is not feasible, however, to make a direct comparison of imported wool with mill consumption since it seems that the statistical services cover only a

1/ Technological Audit of Selected Mexican Industries, op. cit.

part of the wool mills. In this way, for instance, it would appear that imports of wool were greater than stated mill consumption during several years.

In addition to its insufficient volume, Mexican wool is generally of the short-staple type. The main difficulty of the industry, however, is the condition in which the wool is received, being full of burrs, insects and dirt particles. In contrast to other countries which have centralized wool cleaning and classifying enterprises on a more economical scale, these operations have to be undertaken in Mexico by the mills themselves. 1/ Even so, wool washing facilities are reported as being entirely inadequate. Only a few mills are equipped with them and this seems to be the main reason for the preference for foreign wool. Moreover, there is no recovery of lanolin in the country.

In 1948 the woollen textile industry comprised 59 mills, 128,024 spindles, 174 sets and cards, 93 combs and 1,994 looms. 2/ With a few exceptions, operations are carried out in relatively small plants with antiquated equipment where similar considerations concerning productivity apply as in the cotton textile industry. Nevertheless, some high quality fabrics are being produced with antiquated machinery.

In contrast to cotton, the woollen textile industry is a rather stagnant one. Considering its output on the basis of mill consumption of wool, it appears that the peak years during 1925-1948 were in 1936 and 1937. Output was at a high level only at the beginning of the war, declining subsequently as a result of shortages of imported wool, and there seems to have been no post-war recovery. (See Table 7).

The relatively small exports made particularly in 1942-1946 were undertaken mostly at the expense of decreased domestic consumption. Comparing post-war years with the late 'twenties, it seems that there has been a sufficient expansion of the industry as to make it unnecessary to import as much as before the great depression; shortages in the

1/ Technological Audit, op. cit.

2/ Report 478, "Wool Manufacturing Machinery Installed in the Mexican Woollen Textile Industry" by Fred Hajjar, Embassy of the United States, Mexico, D.F., 15 July 1948.

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Table 7. Mexico: Consumption of wool by the woollen textile industry1925-1948

Years	Metric tons		Index numbers 1937 = 100
1925	2,709		63
1926	2,896		68
1927	2,410		56
1928	2,497		58
1929	2,968		69
1930	2,665		62
1931	1,906		44
1932	1,922		45
1933	3,361		79
1934	3,628		85
1935	2,751		64
1936	4,303		101
1937	4,276		100
1938	3,682		86
1939	4,057		95
1940	3,865		86
1941	4,106		95
1942	4,052		95
1943	3,625		85
1944	3,562		83
1945	3,356		78
1946	2,850	4,249	67
1947	2,494	3,915	58
1948	2,232	3,512	52

Source: Dirección General de Estadística.

Note: In 1925-1945 the published series includes only washed, unwashed and regenerated wool; such series is continued in the left-hand column for 1946-1948. The new series, started in 1946, which also includes carded wool appears in the right-hand column for the last three years.

exporting countries, however, may have influenced this development. (See Table 8). It should also be noted that in terms of value Mexico's foreign trade in fabrics and their manufactures shows a net import balance.

III. RAYON TEXTILES

The rayon textile industry plays a small but increasingly important role within the textile industry of the country. According to the 1935 census it employed only 5.0 per cent of the labour force in textiles and 9.1 per cent in 1940. In the same period the value of raw materials rose from 4.6 per cent to 11.8 per cent of the total used by the textile industry.

Despite its rather recent establishment in the 'twenties the rayon industry suffers some of the weaknesses that seem to be common to the various branches of the Mexican textile industry. One of them resides in the existence of a considerable number of plants, most of them of a small size. Thus in 1945 there were 165 rayon textile establishments in the country (of these 138 were engaged both in weaving and spinning). This dispersion exists despite the fact that 95 per cent of the 53,935 spindles of the industry and 84 per cent of its 3,649 looms were concentrated in the Federal District.

The second weak point of the industry is that most of its equipment is antiquated, particularly in the weaving mills which possess only a few automatic looms. Moreover, some of the equipment processing staple fibre was originally built for the cotton industry, and its adaptation for work in the rayon mills resulted in a loss of efficiency. The diversity of equipment used in the same process, spinning, for instance, contributes to increased costs and inferior quality.

Finally, in contrast to the cotton textile industry and partly also to the woollen industry, rayon manufacturing depended until recently almost entirely upon imports of rayon yarns. This dependence led to a decline in output during the war, particularly in 1941-1942, when imports were not available in a sufficient volume. The development of production

/and foreign trade

Table 8. Mexico: Imports and exports of woollen fabrics and
their manufactures, 1925-1948

Years	Imports of woollen fabrics and their manufactures	Exports of woollen yarns, fabrics and their manufactures
	In metric tons	
1925	490	-
1926	429	-
1927	293	5
1928	321	6
1929	296	5
1930	267	4
1931	113	7
1932	60	16
1933	63	6
1934	65	12
1935	79	12
1936	153	13
1937	122	17
1938	185	19
1939	130	11
1940	116	7
1941	147	23
1942	159	254
1943	136	358
1944	117	164
1945	174	226
1946	262	477
1947	337	237
1948	243	47

Source: Dirección General de Estadística.

and foreign trade of rayon fabrics is shown in Table 9.

In the post-war years several developments have contributed to the strengthening of the position of the Mexican rayon industry. The dependence on imported yarns is being gradually reduced by the following developments. 1/ In 1947 a large plant for the production of acetate yarns, controlled by the Celanese Corporation of America, 2/ started operations in Ocotlán, Jalisco; its output in 1948 amounted to about 4,000 tons. The operation of the new plant is nevertheless dependent upon imports of cellulose acetate (partially refined wood pulp) from one of the Celanese plants in Texas. At the beginning of 1949 commercial production was started in a large viscose yarn plant at Zacapu, Michoacán, with a yearly capacity of 2,740 tons (six million pounds). This output is in addition to that of two firms, one in Monterrey and one in Mexico City, which in 1948 produced 250 and 300 tons of viscose yarn, respectively. Moreover, staple fibre production, accounted for by the plant in Mexico City, amounted to 600 tons. The cellulose wood pulp required for viscose yarn and staple fibre production is obtained by imports.

As a result of the substantial increase in the domestic production of rayon filament yarn, imports of this commodity in 1948 were reduced to 2,555 tons as compared to 6,306 tons in the preceding year, whereas consumption rose to an estimated 6,800 tons. Consumption of staple fibre in 1948 was estimated at 6,350 tons, of which 5,768 tons were supplied by imports. While domestic production of acetate yarn in 1949 is sufficient to meet the requirements of the industry, it is not likely that this will be the case of viscose yarn and fibre in the near future.

It seems that productivity in the Mexican rayon industry is progressing at a greater rate than in other textile branches, employment having increased only slightly between 1942 and 1947, from 3,071 to 3,469

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- 1/ Data from Report 335, "New Plant for the Production of Rayon Yarn Inaugurated", 22 April 1947, by Guy O. Long, and Report 212 "Rayon Yarn and Staple Fibre: Mexico 1948", 30 March 1949, by Alan E. Hool, United States Embassy, Mexico, D.F.
- 2/ Other investors in Celanese Mexicana S.A. include various Mexican groups headed by the Banco Nacional de México and Fomento Industrial y Mercantil. The Celanese Corporation of America also controls Artisela S.A., producing filament yarn and staple fibre in Mexico City as well as Viscosa Mexicana S.A., producing viscose yarn in Zacapú, Michoacán.

/workers.

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Table 9. Mexico : Production and foreign trade of rayon fabrics,
1937 - 1948
(In metric tons)

	<u>Production</u>	<u>Imports</u>	<u>Exports</u>	<u>Supply</u>
1937	1,651	97	-	1,748
1938	1,908	62	-	1,970
1939	2,244	73	-	2,317
1940	1,989	73	-	2,061
1941	1,762	151	-	1,913
1942	1,380	147	-	1,527
1943	1,517	298	4	1,815
1944	1,869	226	-	2,095
1945	2,332	268	42	2,558
1946	2,437	389	120	2,706
1947	2,087	201	20	2,268
1948	2,886	114	34	2,966

Source: Dirección General de Estadística.

workers. ^{1/} Moreover, many of the weaving plants in Mexico are reported to have installed modern versatile equipment which will also handle acetate yarns.

The recent progress of the rayon industry signifies that despite an increased domestic demand its operation will mean relatively smaller foreign currency expenditures. These are not likely to be eliminated in the near future since the production of wood pulp and cellulose acetate for the industry is not being actively considered, and the production of viscose yarns and fibre is still small. At the same time, the industry has not yet reached the stage where its products might compete in foreign markets.

IV. HENEQUEN ^{2/}

The processing of henequen is directly dependent upon the production of the fibre which underwent considerable variations, marked by the expansion brought about by the two world wars and by a low resulting from the breaking up of the large estates into ejidal (cooperative) holdings in 1937-1940. From the long-range point of view the production of henequen in Mexico presents a declining trend, peak exports having been attained in 1920 with 175.4 thousand tons. Due to the rapid development of sisal production, particularly in British East Africa, Mexico's share in the combined henequen and sisal world output which amounted to a virtual monopoly at the beginning of the century declined to about 20 per cent in 1938, rising again to approximately 35 per cent in 1947. ^{3/}

Some of the causes of the long-range stagnation of henequen production in Mexico may be found in its inferior physical qualities as

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- ^{1/} It is probable, however, that because of the great shortage of yarns in 1942, an appreciable proportion of the workers worked only part time during that year.
- ^{2/} Includes a small amount of sisal, data for which are not reported separately.
- ^{3/} This is partly due to the decline of production in the Netherlands East Indies resulting from the war.

/compared with

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compared with sisal, 1/ higher production costs and the absence of any appreciable technical advance in its cultivation.

Other causes reside in the processing of the fibre. Here, too, few technological changes have taken place during the past fifty years. Until the land reform in Yucatán, where the bulk of henequen is produced, most of the fibre-processing estates had their own power-driven decortivating plants. The land reform did not affect the ownership of the plants and of the surrounding land up to a certain limit. Since then the plants have been processing on a fixed fee basis the fibre produced by the "ejidatarios". Until the war boom the tendency was toward a reduction of the number of plants in operation, which decreased from 243 in 1930 to 160 in 1940, together with an expansion of the area served. With increased production a number of inactive plants have been put into service again.

Most of the decortivating machines are produced in Mexico and having been in use for a considerable time, should have been completely amortized. Moreover, no major improvements have been made in their construction. A technical report on the subject points out that "there is every reason to believe that current operating shortcomings can be overcome to a great extent through the application of modern principles of decortication". 2/ The same report points out: "One of the drawbacks is that there is a tendency to bruise and flatten the fibre, causing weak spots. Another is that the violent beating and scraping breaks many of the fibres, so that a considerable quantity of short fibre appears in the bagasse. A third defect is that the cleaning action is not complete and an appreciable amount of pulp adheres to the finished fibre. Finally, it would appear that the machines require an abnormal amount of power for the work that they do".

Other drawbacks are that drying is done in the open while the losses that are incurred in the process and which amount to as much as 15 per cent

1/ The tensile strength of henequen is about 25 per cent less than that of sisal.

2/ Armour Research Foundation, op. cit.

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of the fibre could be avoided in a heated chamber. The advantage of artificial drying have not been sufficiently investigated. Moreover, the combing of the fibre has been abandoned. ^{1/}

Some of the deficiencies of the processing of henequen seem to be due to the fact that the Asociación de Henequeneros de Yucatán has a trade monopoly of the fibre which precludes the consumer from identifying the producer and also that the fixed fee paid to the decorticating plants does not encourage technological development by giving a premium for the delivery of better processed fibres.

It seems that unless a technological change takes place either in the production or the processing of henequen, or both, the industry, which is the mainstay of Yucatán's half-million inhabitants will be largely displaced from the world markets. In peace-time the principal use for henequen is as binder twine, the market for which may be doubtful in the future due to the introduction of the combine harvester. Its most likely alternative use is as baler twine (used for the baling of hay) but for that purpose it would either have to be used with sisal and abaca fibres, or the tensile strength of henequen would have to be increased through better processing and grading methods.

A further method of improving the henequen industry's prospects is being studied by the Armour Research Foundation by means of utilising its by-products. The extraction and processing of henequen wax, similar to that of carnauba, has passed the laboratory stage and is being tried out in a pilot plant. It is estimated that 5,000 tons of wax might be obtained yearly as a by-product whose value would approach that of the fibre exported in 1946. ^{2/}

The volume of henequen production is being maintained at high levels due to a fortuitous circumstance, namely, large purchases of cordage by the Soviet Union. ^{3/} Nevertheless, no basic technological change has

^{1/} Ibid.

^{2/} Report by E. Alanís Patiño; "Notas sobre el henequen en Yucatán", to the Bank of Mexico, May 1947.

^{3/} In 1948 about three-fourths, by volume, of exports of henequen cordage from Progreso were directed to the Soviet Union.

/taken place

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taken place in the industry during the war boom which might have placed it in a more competitive position upon the return of normal supply conditions in the world market.

The future of the cordage industry in Yucatán is probably even more precarious than that of the fibre processing which is an entirely distinct operation. From an economic standpoint it is second only to the latter. In 1948 the cordage industry consisted of an estimated 90-120 mills in operation, mostly in the Mérida area, with a monthly capacity of about 5,550 metric tons of fibre.

During the same year employment was between 1,500 and 3,000 workers, mostly working in three shifts. 1/ Nevertheless, the main uncertainty in its future is the declining demand for binder twine and its disadvantageous position in the United States market where baler twine is subject to duty whereas American mills import henequen fibre duty free.

1/ Report No. 409, "Hard Fibre Finished Products - Mexico", by Fred Hajjar, Embassy of the United States, Mexico, D.F., 13 June 1949.

SECTION 12. THE SHOE INDUSTRY

The Mexican shoe industry still has considerable progress to make, particularly since the rise of the potential domestic market may require a great expansion of output in the future. In view of the fact that the shoe industry supplies at least 95 per cent of the demand, the expansion that is to be achieved, should the increase of real income of the population permit a general use of shoes in the country, is indicated by the 1940 population census according to which in a total of 19.8 million inhabitants only 48.8 per cent used shoes, 1/ 23.6 per cent used "huaraches" (cheap handicraft sandals) and 26.6 per cent used no footwear at all.

In addition to the small purchasing power of the population, demand is limited by the fact that the shoe industry is a relatively high cost producer. The shoe industry enjoys tariff protection and it seems that most lines of shoe production could not subsist without it. 2/ Essentially, high production costs reside in the fact that low wages in Mexico do not compensate for the difference in productivity between its shoe industry and that of the industrialized countries. Thus it is reported that average production per worker in the Mexican shoe industry as a whole is 2.6 pairs daily; in the shoe factories it is somewhat more than four pairs per day, as compared to six pairs in the United States. 3/ Demand is further depressed by the marketing system which allows markups to range between 100 and 150 per cent, and occasionally to 200 per cent as compared to an average of 40 per cent in the United States. 4/

The low productivity of the Mexican shoe industry rests in a series of factors, many of which are institutional. As one of Mexico's oldest industries it originally consisted entirely of handicraft shops. These

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- 1/ Of these, however, only one-half, or 5 million people are estimated as wearing leather shoes all year round. (Roberto Rodriguez Sotelo, Industria del Calzado, memorandum to the Bank of Mexico, 1948).
2/ This might be less true since the devaluation of the peso when several Mexican shoe manufacturers were considering exports; wartime exports were caused by exceptional circumstances.
3/ Industria del Calzado, op. cit.
4/ Ibid.

/and small shoe

and small shoe factories still account for the bulk of the shoe output. Thus enterprises with an investment of 10,000 pesos or more produced in 1946-1947 an average of 2,563 thousand pairs of shoes which, according to the Cámara Nacional de la Industria del Calzado (National Chamber of the Shoe Industry) represented only 16.9 per cent of total average production estimated at 15,175 thousand pairs per year. 1/

In this way, in addition to 145 factories of various sizes utilizing mechanical equipment there are 850 registered workshops and an unknown number of non-registered or clandestine ones, the latter accounting for an additional 25 per cent of total production. Altogether about 33,000 persons are engaged in shoemaking, excluding clandestine workshops.

Considering that the average yearly production of shoes accounted for by factories and registered workshops averaged 15.2 million pairs and an estimated 3.8 million pairs produced by clandestine shops, total production might have been in the order of 19.0 million pairs. This is about 33 per cent of the amount that would be necessary for all inhabitants to wear shoes all year round, assuming yearly average requirements of 2.5 pairs of all kinds per person per year, or 40 per cent assuming a yearly average requirement of 2 pairs. 2/

Not only are there considerable differences in productivity between factories and workshops but also among the factories themselves. Even though none of them has reached a dominating position, the two largest produce about 250 thousand pairs a year; one of them employs 1,250 workers in shoe production, tanning and manufacture of paper-board boxes. Five other factories are also fairly large.

The progress of concentration of manufacturing is continuing and it is in the larger enterprises that most of the progress, particularly as to uniformity of quality is being made. It is likely that concentration is accelerated whenever there is a reduction in demand as apparently took place in 1947, 3/ when numerous workshops are forced to liquidate.

1/ Of this 2.5 million pairs were not all-leather shoes.

2/ In the United States yearly consumption was nearly 3.5 pairs per person in 1947.

3/ The shoe factories, the output of which is recorded in official statistics showed a decline of production from 3.0 million pairs in 1946 to 2.1 million in 1947.

However, several factors contribute to the continued existence of the handicraft sector of the industry. One of them is that workshops often sell directly to customers thereby compensating for part or most of their higher production costs. In the case of higher income groups the preference for custom made shoes is still fairly prevalent, especially in the smaller urban centres. Un-registered workshops can avoid labour legislation regarding wages, working conditions, social insurance, severance pay and payment of taxes, thereby reducing costs. Finally, the dispersion of the population and the small volume of sales in the rural communities does not generally warrant the establishment of specialized sales outlets.

The limitation of demand is also indicated by the fact that there is considerable idle capacity in the shoe industry. Part of this is due to the nature of shoe production in general, resulting, for instance, in work stoppage when production is to be changed from one style to another. In part the system whereby the bulk of the machinery is not purchased by shoe producers but is rented on a fee basis from a single enterprise (The United Shoe Machinery Company) permits its utilization even by small producers with little initial capital. As a result the tendency towards concentration of production is being delayed.

Most of the raw materials required by the shoe industry are produced in the country. Thus, in 1946, according to the National Chamber of the Shoe Industry 78.1 per cent of the value of the raw materials used was of domestic origin, the rest being imported. Imports are mainly accounted for by the deficiencies of the tanning industry since high quality shoe producers generally import leather for uppers and findings. However, a gradual improvement of the tanning industry ^{1/} is reported and particularly since the devaluation of the peso the trend toward a replacement of imported materials by domestic ones has been accelerated.

Imports of shoes, consisting exclusively of high priced products from the United States, never amounted to more than 5 per cent of demand and have been effectively reduced since the devaluation of the peso. ^{2/}

^{1/} The principal problems of the tanning industry have been analyzed in Technological Audit of Selected Mexican Industries, op. cit.
^{2/} Report No. 542, "Shoes and Leather Manufactures - Trends and Developments", Don Vasque, Embassy of the United States, Mexico, D.F., 25 August 1948.