MEXICO

Profile of the Metal and Mechanical Industry

Benemérita Universidad Autónoma de Puebla

International Metalworkers' Federation

Benemérita Universidad Autónoma de Puebla

&

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Profile of the Metal and Mechanical Industry in Mexico

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DIAGNOSIS OF THE METAL AND MACHINE INDUSTRY IN MEXICO

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INTRODUCTION

Mexico is the second largest metal manufacturer in Latin America after Brazil. Mexico excels especially in the production of automobiles, autoparts and electronics. The total number of metalworkers is estimated to be over 1.6 million, up from one million just five years ago. Hence the International Metalworkers' Federation is focusing its attention on Mexico. This research report was initiated in order to obtain accurate and up-to-date information on the composition and location of the metal industry. The report was commissioned to the University of Puebla (Benemérita Universidad Autónoma de Puebla), where Professor Huberto Juárez Núñez was responsible for the research, together with Everardo Fimbres Ocaña. We hope that the information will be useful in organising metalworkers in the country. To assist in this process, the IMF opened a project office in Mexico in March this year.

Marcello Malentacchi
General Secretary

Presentation

The following text is the final result of the study entitled "Profile of the Metal and Machine Industry in Mexico". This text was agreed in March 1999 as a joint project between the Benemérita Universidad Autónoma de Puebla (buap) and the International Metalworkers' Federation headquartered in Geneva, Switzerland (imf). Its primary objective was to combine efforts to quickly develop an industrial profile of the main features of the Metal and Machine Industry in Mexico.

For six months the research team of the project on *"Effects of Just-in-time/Kanban Systems on Developing Regions"* attached to the Research and Postgraduate Studies Center of the BUAP Faculty of Economics, investigated, recorded, processed and analyzed information and the most important variables to arrive at this Profile.

As regards the features of our study, it should be noted that the Metal and Machine industry is not a very popular concept in economic analyses in Mexico, as it is in Europe or South America, and for that reason statistical aggregations on this area do not exist in publications put out by the government and the private sector, for which reason our study is based on the international classification which groups together activities involving the use of metal as a commodity in the production process, ranging from extraction and processing of iron and steel to aeronautics.

Due to their marginal presence, or total absence, some activities in this series have not been considered in our study (when necessary we have included references in footnotes or, as in the case of mining, references in the appended study on the iron and steel industry).

Based on their impact on the Mexican manufacturing scene, we have concentrated on 13 industrial branches ranging from metal processing to the production of transport equipment, and also including metal products, electric and electronic products, and the automotive and auto parts industries.

I would like to express my gratitude for the help of Mónica Ruiz and Javier Santiago (the project research assistants) as well as for that of the group of students of the BUAP Faculty of Economics (graduate students, social service, degree seminar students and scholarship students of the Mexican Academy of Sciences) who helped with enthusiasm and efficiency in the various processes of collecting and processing information.

December 1999
Huberto Juárez Núñez
Academic Project Supervisor

I. General Introduction

The Mexican economy is the second largest economy in Latin America, after that of Brazil. Its growth and development during this century have been permeated by the effects of a long colonial heritage and thus, of dependency on the world centers of economic and political power, a dependency fostered by forcible inclusion in circuits of trade and production which the expansion or North American and European capital generated in their search for markets, raw materials or spheres of geopolitical interest in our region.

The modern history of this economy may be observed in the post-World War II period, when based on statist economic policies and within a nationalist discourse it was sought to convert an economy based on the primary sector and agricultural exports into a structure with a diversified industrial profile and thus one less dependent on the outside world.

Thus, the various phases of the process of industrialization of the Mexican economy have in fact followed the path of what in the economic literature has been observed for so-called *developing* or *delayed development* countries: agrarian reform; transfer of resources to the private sector to encourage industrial development—for example, infrastructure for transport, subsidized prices for raw and auxiliary materials, cheap credit; encouragement of import substitutes in many cases on the basis of foreign direct investment; overvalued exchange rates; all elements which led to a long phase extending to the end of the 1970s and christened *stabilizing development* which for 20 years of high growth rates seemed to have consolidated industrial sectors strong enough to compete internationally.

However, assessments of the manufacturing structure of this period indicate that despite high growth rates there remained problems[1], such as insecure development in the substitution of capital goods imports or in the fact that other problems had worsened, such as the displacement or replacement of national capital groups by foreign capital in the most dynamic industrial branches—under the cover of a 1973 law which regulated and promoted foreign investment.

By 1980 the industries with a majority presence of transnational corporations were: *rubber goods, pharmaceuticals, coal and petroleum products, electrical machinery, non-electrical machinery, and transport equipment,* precisely the most rapidly developing industries with the highest level of participation in the manufacturing value at that time.

Ultimately, it was found that although the state had reserved strategic areas such as oil, basic petrochemicals, electricity and the railroads as its areas of intervention, by those years it had also extended its direct intervention in the economy for reasons which ranged from saving bankrupt enterprises or preserving sources of employment to keeping the productive chains in operation. (Casar, 1990).

In this context, the function of the Mexican state has important distortions which make it not very effective in consolidating and developing the process of import substitution and generating solid domestic bases for increasingly competitive international scenarios.

That was the situation in the early 1980s, characterized by phenomena such as the fall in the prices of oil and agricultural commodities, a manufacturing structure with very low indices of competitivity and hence low export capacity, a heavy foreign debt burdening the national finances and in an international context characterized by the increasing cost of credit in the capital markets and, in particular, the adoption of a new economic orthodoxy stressing cost cutting and enhancing competitivity through participation in

[1] "Despite the great influx of wealth, the Mexican economy was unable to avoid a resurgence of its structural problems, experiencing an even greater decline in all types of factors, unemployment, inflation, debt..." (Rivera Ríos, 1986, p. 97)

the international market; the Mexican economy entered a period of severe recession (Guillen Romo, 1984).

"Poor enterprises, rich entrepreneurs" aptly sums up the failure[2] of this model of growth[3]—later called *statist*—which transferred public funds to the personal fortunes of a small group of industrialists, bankers and politicians and at the same time generated decapitalized and obsolete enterprises which had operated with subsidized input prices and a captive domestic market. (Casar, 1990. Rivera Ríos, 1986).

All of this was the basis for imposing a redefinition of the "statist" model and the inclusion in planning of restructuring of national economies which was fashionable the 1980s and which required three elements to be accomplished in the shortest possible time: *adjustment, stabilization and economic liberalization.* As may be expected, for the Mexican context in the '80s, the adoption of these remedies in the purest orthodox style by economic decision-makers had a severe impact on every level of the Mexican economy and Mexican society, but particularly on workers' purchasing power and incomes and on employment levels which had existed up to 1980-1982[4].

Starting in 1983, supply-side policies generated a new dynamic in which the liberalization, the foreign direct investment and the requirements of the new competition defined the "efficient" sectors of the economy. Now the performance of the Mexican economy was to be measured by its export capacity, by the amount of capital entering the country, by the formation of new areas of industrialization and by the behavior of modern economic indicators associated with labor productivity.

However, despite the expectations proclaimed by the new decision-makers in economic policy, over the last 18 years the Mexican cycle has not been able to generate prolonged periods of stability, and it is clear that the weaknesses of the national production chain persist in many areas. The dependence on imports of intermediate and capital goods remains an item on future agendas, as it shows that the breaks in the national manufacturing chains are the clearest evidence of the fragility of the supply-side model.

Observing the performance of the GDP in this period, we can see that a ponderation of the six year averages shows very poor performance in the '60s and '70s, but the most serious element was probably that the apparently most successful moments—e.g. the period from 1989-1994—prepared and/or recreated the conditions for phases of recession such as that which began in December 1994 and extended throughout 1995, when the exchange rate crisis developed into a financial crisis and almost automatically spread to the entire productive structure with consequent unemployment, worsening or loss of purchasing power and in general, the process of generalized impoverishment of the majority of the population.

For the reasons explained above, our analysis of the metal and machine industry will be limited to the already lengthy period of adjustment, stabilization and liberalization applied to the Mexican economy, in the context of the new guidelines to stimulate projects such as new poles of development and successful entry into the world market.

To develop our topic, we must note as a general point of reference the increasing presence of direct foreign investment in the new industrialized areas where activities such as the *maquiladora* and auto industries have been flourishing, the evolution of which clearly shows the type of integration and opening up which this model of growth has imposed on the economy as a whole. The unquestionable success in

[2] López Portillo, José. Sexto Informe de Gobierno. 1982.

[3] GDP growth rates in those years were the highest in the second half of the century, v. the following averages per decade: 1949-1959, 6.3%; 1959-1969, 7.1%; 1969-1978, 6.0% (Velenzuela, 1986).

[4] According to official statistics, in the first two years of adjustment, workers in manufacturing lost 40% of their purchasing power and maintained that level until the early 1990s. Employment levels in manufacturing, which in 1981 were approximately 2.5 million, had fallen by 1983 by 10% to the level at which they remained for the rest of the 1980s.

the indices of manufactures exports in both areas and the chronic weakness of the domestic market are, for example, two ingredients which have been constant in these years of increasing integration of the Mexican economy into the new circuits of economic globalization.

The Metal and Machine Industry in Mexico in the Context of the National Economy

In accordance with the most common statistical classification of the various activities which make up the Mexican economy, they may be identified based on how the National Added Value or Gross Domestic Product (GDP) are structured. In the sectorial version of this classification, the metal and machine industry, as an aggregate of the productive activities characterized by the processing of raw materials of metallic origin (ferrous and non-ferrous), is part of the manufacturing industry which in turn is a component of the industrial sector[5].

Following the methodology of the System of National Accounts in Mexico, we have designed an organizational chart of the national economy which specifically identifies the various segments constituting the metal and machine industry in Mexico[6] (hereinafter the MIM) and which serves as a guide in this presentation (organization chart 1).

The MIM consists of two big manufacturing divisions, viz. DIVISION *VII*, *Basic Metal Industries*, and DIVISION *VIII*, *Metal Products, Machinery and Equipment*.

DIVISION VII includes two big industrial branches, BRANCH 46, Iron and Steel Production, and 47, Non-ferrous Metal Production (copper, zinc, lead, antimony, bismuth, etc.).

DIVISION VIII extends from Branch 48 to branch 58, i.e. it is a range of 11 industrial branches from Metal Furniture to Production and Repair of Transport Equipment, and also including production of machinery, electric and electronic equipment, trucks, tractor trucks and all types of auto parts.

An overview of how these two divisions fit into the overall economy is given in *Figure 1*, where the respective shares of nine divisions making up the manufacturing industry in the generation of aggregate national manufacturing value in the period 1980-1998 are shown.

In this structure the behavior of DIVISION VIII is particularly significant. In the early years it was at the same level as DIVISION I (*Food, Beverages and Tobacco*), but then, in the mid-'80s it fell by five percentage points, still maintaining its positions as the second most important division, and then in the early '90s it recovered its share of 25% and established itself as the most important manufacturing division.

DIVISION VII, BASIC METAL INDUSTRIES, occupies a very modest position, with notable oscillations over the period covered in the figure and revolving around an axis of about 5%.

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[5] For reference, in 1998 the Mexican GDP had a value of approximately 400 billion dollars, the industrial sector accounts for a quarter of that product, and the manufacturing is the most important component of the industrial sector, accounting for 75% in recent years.

[6] According to the international classification, the metal and machine industry would include, aside from the parts indicated here, activities related to the extraction and processing of ferrous and non-ferrous metals which in Mexico are classified under Mining (an area dominated by the extraction and processing of precious metals). The share of Mining in the Industrial Sector is marginal (less than 5%). In the final section we have added an annex on mining and the iron and steel industries.
In the classification of highly developed countries, the metal and machine industry includes industrial branches which either do not exist or are just beginning to emerge in Mexico, such as the aerospace and shipbuilding industries; those activities are recorded under the branch of transport equipment.

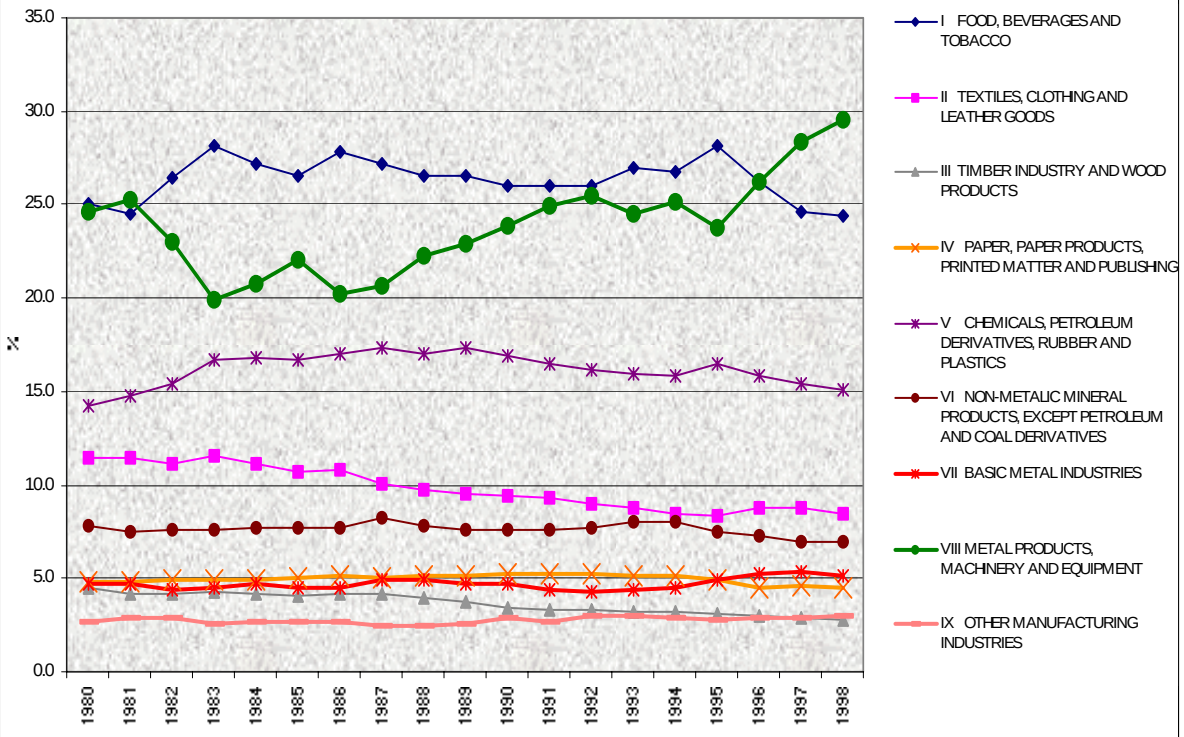
INSERT CHART

GROSS DOMESTIC PRODUCT

Thus, from the point of view of added value the production of metal products, machinery and equipment over the last 20 years has been a fundamental activity in Mexican manufacturing.

Figure 1

Mexican Manufacturing Industry.
Percentage share of its 9 divisions.



Source: BDINEGI. March 1999

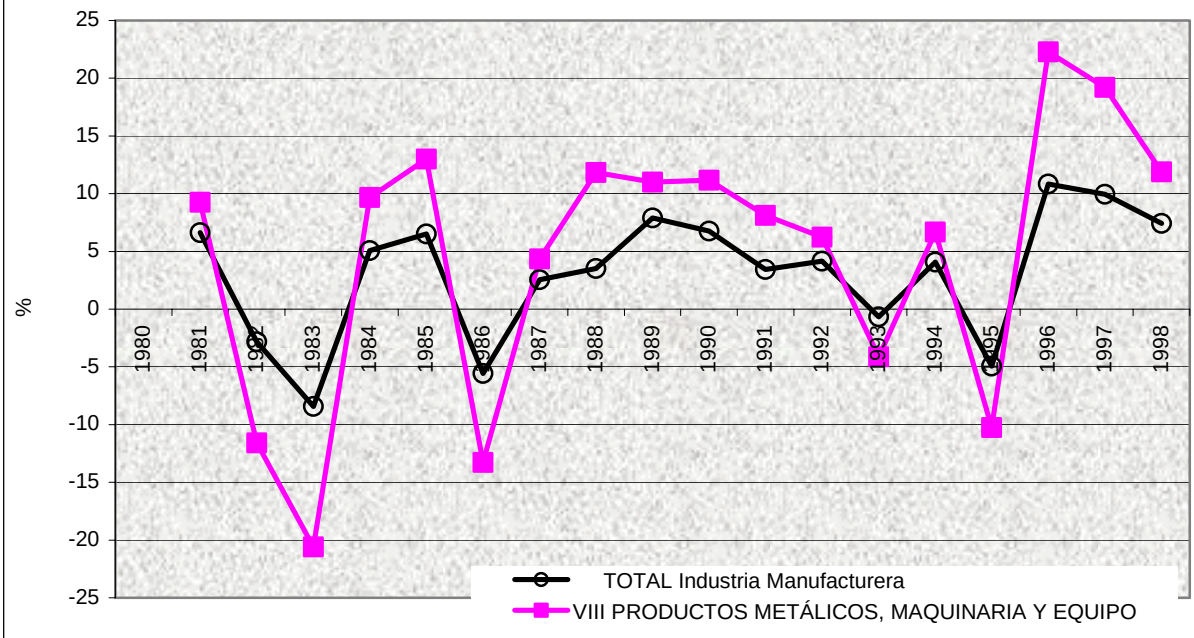
Having identified this aspect of the manufacturing profile, now in Figure 2, we can see its dynamics, which we associate with the percentage variations of the annual product both for manufacturing as a whole and for DIVISION VIII.

It can immediately be seen that machinery and equipment production exhibit greater "sensitivity" in the Mexican economic cycle. The recession years are very deep and the years of recovery and growth are faster and higher. The variations in the GDP of DIVISION VII reflect the fact that this activity experienced contractions of more than –20% (1983) as well as growth above the average for manufacturing as a whole, in the latter case on the order of 10% in 1989-91, and higher than 20% in 1996.

This behavior implies that DIVISION VIII best reflects one of the characteristics of the Mexican economy in the last two decades, i.e. an economy with very short and pronounced rebounds which has not achieved long periods of stability and growth (the longest extended from 1988-1992, i.e. five years).

Figure 2

Annual Growth Rates of the Manufacturing Industry and Division VIII



Source: Ibid

I.1. Location of manufacturing activity

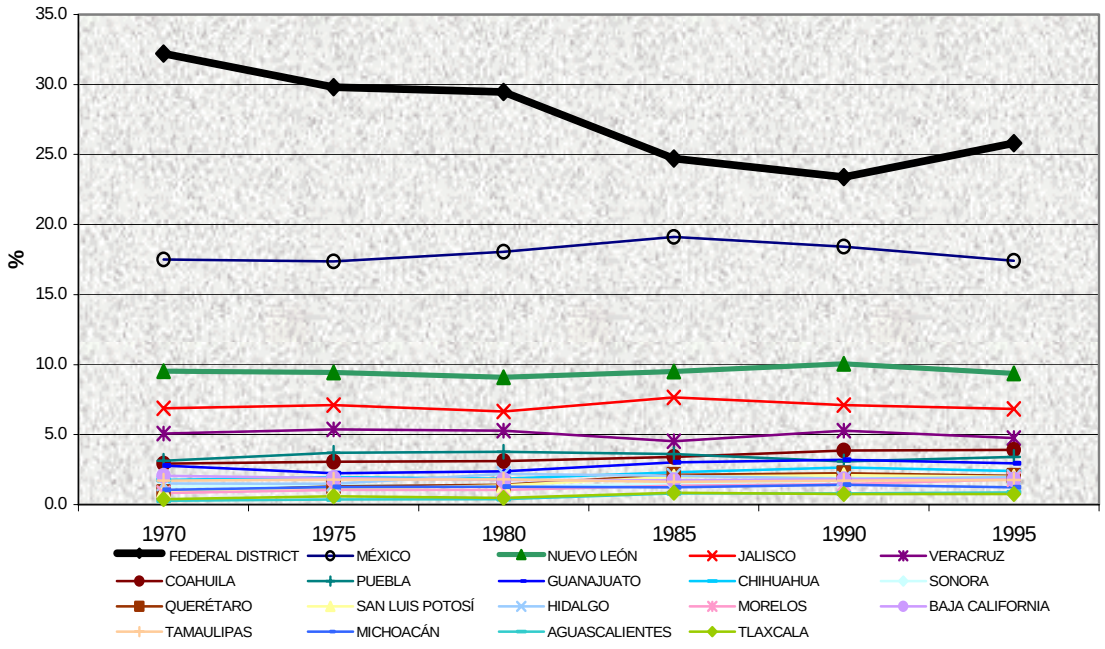
The manufacturing industry, the most important in the industrial sector, has in the case of Mexico been located as a result of the processes of centralization, which have particularly tended toward the center of the country since the 1950s. That means that the formation of its physical infrastructure is the result of a long process concentration in urban areas of the Central Valley of the Mexican altiplano, and especially in the Federal District and adjacent areas to the north and west.

Despite the various attempts by the government to decentralize the industrial agglomerations formed in the 1960s and '70s, which were in constant expansion and exerted various types of social and logistical pressure due to the population explosion, the constant need to expand housing, transport and industrial supplies, in the 1990s the location of the main manufacturing units continues to reflect the centralizing feature of the Mexican economy.

Figure 3 clearly illustrates our point: it contains a selection of the states most important in terms of generating manufacturing GDP and shows that in the 1990s the share of the Federal District and the state of Mexico—in a sequence of five-year periods starting in the 1970s—accounts for the lion's share in the formation of total manufacturing value, and that the share of the Federal District's share in 25 years lost between 6 and 8 percentage points. A geographic presentation of this distribution may be seen in Map 1.

MAP 1

Figure 3
Share of Selected States in the Manufacturing GDP 1970-1995



BDINEGI. Producto Interno Bruto Estatal. Marzo, 1999.

I.2. Location of the Metal and Machine Industry

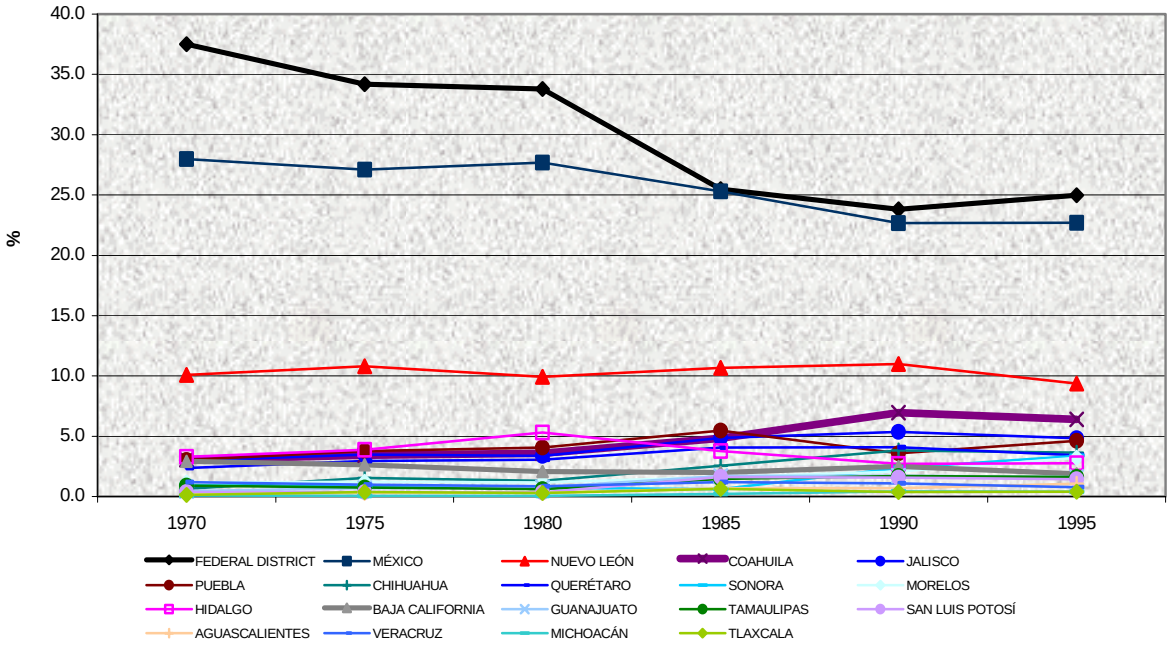
Considering the same criterion of the generation of added value and weighting the presence of the manufacturing divisions in the various federal entities, below we can see how the values corresponding to the two divisions making up the MIM are located and distributed.

Considering first of all the production of machinery and equipment, i.e. DIVISION VII (*Figure 4*), we find that its behavior is very similar to that of manufacturing as a whole. Two entities, the Federal District and the State of Mexico—with a tremendous share in the 1960s—at present still make a contribution of about 50% of the total added value for the Division.

At something of a second level we see Nuevo León with movement averaging around a share of 10% throughout the period. At a third level we can see from among the bundle of lines at the bottom of the graph the share of Coahuila stands out: since 1985 it has emerged above the level of 5% and in the ’90s it has shown a share significantly above those of Jalisco, a federal entity whose industrialization process started much earlier.

Figure 4

Division VIII. Metal Products, Machinery and Equipment.
Shares of Selected States.
1970 - 1995



Source: Ibid

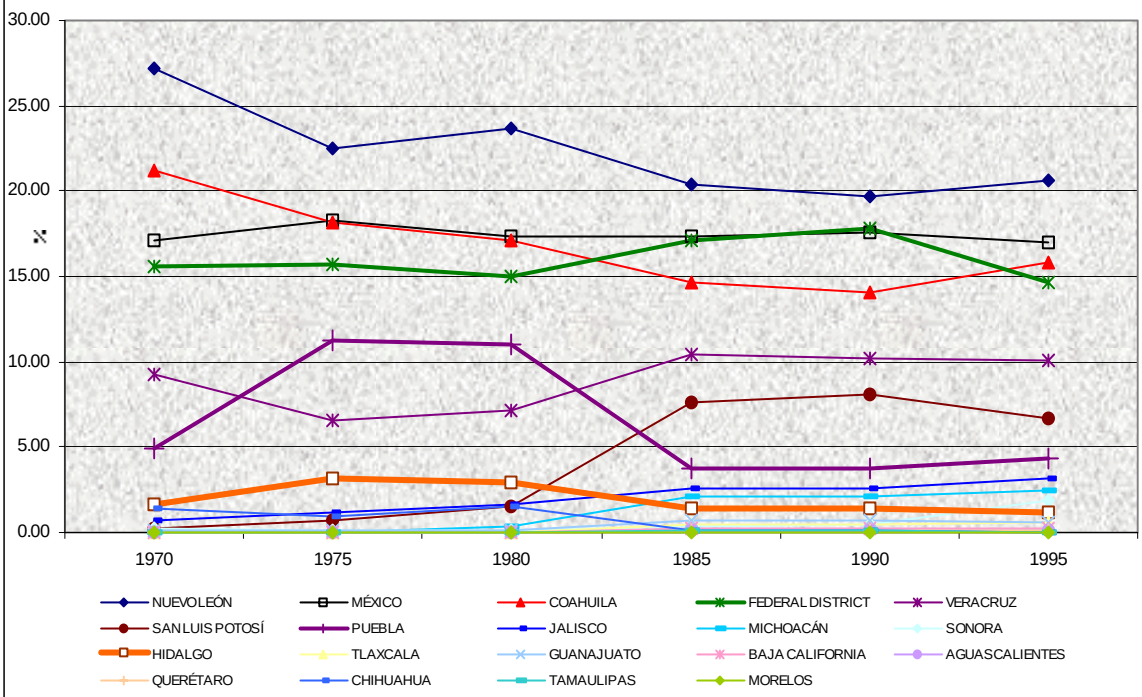
The geographic location of DIVISION VII, BASIC METAL INDUSTRIES, differs somewhat from the regional configuration exhibited by the DIVISION OF MACHINERY AND EQUIPMENT. Factors related to the proximity of places of extraction and processing of metal, places of embarkation, highways and railroads for distribution of the metals, have certainly influenced the degree of importance of the states where basic metal industries are produced.

Thus, in this case we see that the four main producing states in 1995 were: Nuevo León, State of Mexico, Coahuila and the Federal District, which among them account for slightly more than 65% of GDP generation in the Division.

In *Figure 5* we can see that after the first four states, there are another six with important positions: Veracruz averaging 10% in the last three quinquennia, San Luis Potosí averaging 7% and Puebla under 5% (after holding shares of above 10% in the 1970s). The selected states together represent 90% of the added value for 1990 (Figure 5).

Figure 5

Division VII. Basic Metal Industries.
Shares of Selected States.
1970-1995



Source. Ibid

II. The Metal and Machine Industry in the Census Configuration. Workers, Establishments, Assets and Industrial Districts.

The last industrial census in Mexico dates from 1994. Although its methodology of preparation, its treatment of variables and the procedures used in taking it are often incompatible with other statistical procedures for collecting information in the industrial sector[7], for our purposes it is a useful tool to the extent that it affords us a basis of reference to observe the evolution of the metal and machine industry in the most recent period.

In this context, we will consider in this section the census data corresponding to the manufacturing industry and the metal and machine industry, and all will be processed with reference to the following variables: *workers, establishments, assets and location by states and industrial districts*.

The 1994 census showed that the manufacturing industry employed 3,210,418 workers in 265,427 establishments and their fixed assets amounted to 248.9 billion pesos of that year (*Table 1*).

Organizing these data according to the criterion of employment, we see that the manufacturing Division with the highest level of employment was DIVISION VIII (metal products, machinery and

[7] E.g., the System of National Accounts and the Monthly Industrial Survey.

equipment) employing 955,267 workers, followed by DIVISION I (FOOD, BEVERAGES AND TOBACCO) with 686,358 workers and DIVISION II (TEXTILES AND CLOTHING) with 538,528 employees. These three divisions account for slightly more than two thirds of total manufacturing employment (67.9%).

Regarding the number of establishments which these three divisions had in 1994, their share was 68.7% of the total number of establishments. The three divisions accounted for 45.3% of total manufacturing assets.

In terms of employment, our DIVISION VII, BASIC METAL INDUSTRIES, comes in next-to-last with 59,448 workers distributed among 321 establishments, but its value in terms of assets appears relatively more important as it occupies fourth place among the nine divisions. Expressing these values in percentages, DIVISION VII accounted for 1.9% of manufacturing employment, 0.1% of establishments and 10.8% of total assets.

Of the additional information contained in Table 1, of particular significance is the fact that DIVISION V (Chemicals and Petroleum Products) accounted for 12.1% of employees and 2.1% of establishments, but almost a quarter of the value of assets for the entire manufacturing sector.

Table 1 National Manufacturing Industry
Distribution by Divisions
1994

	Employees	Establishments	Assets*
National Manufacturing Industry	**3,210,418**	**265,427**	**248,934,273**
DIVISION VIII **Machinery and Equipment**	**955,267**	**46,246**	**50,266,912**
DIVISION I Food, Beverages and Tobacco	686,358	91,932	46,329,596
DIVISION II Textiles and Clothing	538,528	44,126	16,276,750
DIVISION V Chemicals	387,318	7,091	61,701,416
DIVISION IV Printing	195,814	15,049	19,966,281
DIVISION VI Non-Metallic Minerals	180,972	24,361	22,514,414
DIVISION III Timber	163,177	31,606	3,963,330
DIVISION VII **Basic Metal Industries**	**59,488**	**321**	**26,772,252**
DIVISION IX Other Manufacturing Industries	43,496	4,695	1,143,321

**Expressed in thousands of pesos*
Source: INEGI, SAIC, Mexico 1994

II.1. Distribution of Personnel, Establishments and Assets of the Manufacturing Industry by Federal Entity.

The distribution of workers, establishments and assets of the manufacturing industry by federal entity follows a pattern similar to that of the generation of added value. That is, the levels of centralization of activities again reflect the census values. According to *Table 2*, in 1994 15.6% of workers (500,087), 10.6% of establishments (28,059) and 8.9% of assets were concentrated in the Federal District. The State of Mexico accounted for 4435,938 workers (13.6% of the national total) working in 22,616 establishments (8.5%) with assets valued at 32,502 million pesos (13.1% of national assets, the highest share of any federal entity).

Now, if we take into account the first five states (including Chihuahua, which surpasses Jalisco in employment), we find that they account for 50.7% of total employees, 32.2% of establishments and 42.7% of assets. Following that first group of states, the 1994 census registered some important behavior to be considered: the states of *Guanajuato, Baja California, Tamaulipas* and *Coahuila*, recently industrialized areas, have large numbers of employees in this register; for locations, see Map 2.

Table 2 National Manufacturing Industry
Personnel, Establishments and assets.
1994

	Employees	% of national personnel	Establishments	% of national establishments	Assets *	% of national assets
National	**3,210,418**	**100.0**	**265,427**	**100.0**	**248,934,273**	**100.0**
Federal District	500,087	15.6	28,059	10.6	22,097,749	8.9
Mexico	435,938	13.6	22,616	8.5	32,502,314	13.1
Nuevo León	250,016	7.8	9,682	3.6	26,484,212	10.6
Chihuahua	222,559	6.9	7,204	2.7	8,330,886	3.3
Jalisco	220,550	6.9	18,002	6.8	16,841,953	6.8
Guanajuato	157,585	4.9	14,219	5.4	8,757,094	3.5
Puebla	157,333	4.9	24,164	9.1	9,877,976	4.0
Baja California	141,946	4.4	4,099	1.5	4,041,936	1.6
Tamaulipas	129,452	4.0	5,908	2.2	7,289,471	2.9
Coahuila	125,517	3.9	5,918	2.2	10,443,531	4.2
Veracruz	105,314	3.3	14,749	5.6	24,268,519	9.7
Sonora	84,937	2.6	5,381	2.0	6,663,243	2.7
Michoacán	66,274	2.1	14,879	5.6	11,816,178	4.7
San Luis Potosí	64,968	2.0	5,545	2.1	7,470,095	3.0
Querétaro	61,194	1.9	3,054	1.2	6,786,043	2.7
Hidalgo	54,936	1.7	4,887	1.8	6,818,494	2.7
Aguascalientes	46,703	1.5	3,276	1.2	7,814,794	3.1
Morelos	38,008	1.2	4,078	1.5	3,466,380	1.4
Tlaxcala	33,052	1.0	3,065	1.2	3,319,475	1.3

**Expressed in thousands of pesos*
Source: INEGI, SAIC, Mexico 1994

MAP 2

II.2. Employees, Establishments and Assets of the Metal and Machine Industry by Federal Entity.

With the same format as in the preceding section, *Table 3* contains information on the distribution of employment, enterprises and assets of the two divisions which form the core of the metal and machine industry in Mexico.

The first part of *Table 3* indicates that of the 59,448 workers of DIVISION VII, most of them are to be found in the states of *Mexico (24.1%), Coahuila (17.9%), Nuevo León (14.2%), San Luis Potosí (8.5%), the Federal District (8.1%), Veracruz (5.7%), Michoacán (4.5%)* and *Puebla (3.6%). Those eight entities account for 87.7% of the total personnel of the* DIVISION OF BASIC METAL INDUSTRIES.

As regards establishments, prominent in terms of their numbers are: *State of Mexico (20.2%), Nuevo León (15.9%)* and *the Federal District (12.8%).* These three states represent almost fifty percent of the total number of establishments of the Division.

If we examine the distribution of the value of assets, the list of the most important entities takes on a different profile. At the top is *Michoacán, with 23.4%* of assets, followed by *Veracruz (16.4%), Coahuila (13.7%)* and *Nuevo León (13.4%).*

If we order the group of eight entities by the variables of establishments and assets of the Division as a whole, we can see that they account for 70.4% of establishments and 82.8% of the value of assets.

The value of our selection of federal entities corresponding to DIVISION VII in *Table 3* represents 98.8% of total personnel, 80.7% of establishments and 98.8% of the value of fixed assets.

In the right hand part of Table 3 we can see the values of DIVISION VIII, Metal Products, Machinery and Equipment. Classification by employment shows that the first place is occupied by Chihuahua with 141,605 workers, equivalent to 14.8% of total employment for the Division, immediately followed by entities with employment levels accounting for more than 10% of employment in the Division: State of Mexico (14.4%), Federal District (12.4%) and Nuevo León with 10.2%. The total of these first four states shows that together they account for 51.9% of total personnel for the production of machinery and equipment.

There is a group of federal entities with shares ranging from 2.5% to 8%, and including Baja California, Tamaulipas, Coahuila, Sonora and Querétaro, places where the process of industrialization is recent and which are dominated by agglomerations of maquiladora enterprises—making electric and electronic products—and/or the industrial complexes related to systems supplying the auto industry.[8]

Under establishments, the distribution by federal entities shows that the Federal District and Mexico are the most important (12.2% and 11.6% respectively), and as regards value of assets, Mexico (15.6%), Nuevo León (14.4%) and Aguascalientes (11.9%) are prominent.

The information in *Table 3* is a sample of the most important states in DIVISION VII and represents 96.8% of total employment, 83.6% of establishments and 97% of the value of assets.

[8] A subject which is discussed below.

Table 3

II.3. The Industrial Districts of the Metal and Machine Industry.

Based on these census classifications and bearing in mind the criterion of geographical location, we can now identify the various regions of the country where MIM manufacturing activities are to be found. To that end we have processed the working variables and establishments in accordance with their locations by *industrial districts*, and on that basis we will try to arrive at a profile which can show us precisely where and according to what hierarchy those areas of Mexico with metal and machine production are to be found.

In *Table 4* we have organized the data corresponding to the most important districts for DIVISIONS VII and VIII. Based on the figures for the number of employees and establishments, we have added a column indicating the average levels of employees per establishment, and have called that average the *density*; its function in this Profile is to indicate the degrees of concentration of personnel per manufacturing establishment in the industrial districts and in each of the two divisions under examination.

Thus, in the case of DIVISION VII, BASIC METAL INDUSTRIES, looking at the criterion of employment, we can observe that the most important district is Monclova (Coahuila), which employs 7,240 workers; next on the list are the districts with more than 2,000 employees: *Jocotitlán, Tlalnepantla, San Luis Potosí, San Nicolás de los Garza, Lázaro Cárdenas, Torreón, Monterrey* and *Veracruz* (see also Map 3).

Secondly, if we look at the criterion of density, the first 9 items are the ones which are the highest in that they combine high levels of employment with few establishments. We need only add to them the district of San Miguel Xoxtla, Puebla (location of one of the Hylsa subsidiaries) which in 1994 employed 1,162 workers[9].

The information in the columns corresponding to districts, establishment and employment of DIVISION VIII clearly show that the most important industrial manufacturing districts[10]—according to the criterion of employment—are: Ciudad Juárez (97,781 employees), Tijuana (49,707 employees), Chihuahua (32,430 employees), Matamoros (30,392 employees), Tlalnepantla (24,428 employees) and Mexicali (18,702 employees).

In this first classification, only Tlalnepantla belongs to an area with a long industrial tradition (the urban area of the Federal District and the State of Mexico); the rest are districts with assembly plants for electric and electronic goods to supply the automotive industrial clusters. Since the mid-1980s those places have been the most representative in terms of the economic and social impact of the new industrial settlements in areas of Northern Mexico, since that is where we see the use of temporary employment and employment of women on a large scale, as well as new systems of hiring, workload assignment and pay, combined with regional industrial structures based on the establishment of subsidiaries of the big corporations, with low consumption of national inputs and limited attractive effect on the native regional manufacturing structure.

[9] Our recent visit to the Hylsa plant in Puebla (November 1999) gave us the latest number of personnel employed at that plant: 650 workers in three shifts. The drastic cutback in personnel is due to the restructuring processes of 1995-98, in which new automated systems of metal purification, casting and finishing were introduced.

[10] Our database contains approximately 100 districts for DIVISION VII and more that a thousand for DIVISION VIII. In this case, *Table 4* contains a selection of the most important ones.

MAP 3

Next we identify 14 districts with a working population whose density is above 100 workers per plant, of which 8 are in recently industrialized states; the list of the most important districts according to this criterion of density shows that Cuautlancingo, Puebla (702 workers per plant), and Ramos Arizpe, Coahuila (253 workers per plant)[11], come in first. The data are eloquent testimony to the features of these districts, where two of the most important automotive CLUSTERS in Mexico are located. In the first case, we have the headquarters of the VW plant in Mexico and its cluster of suppliers and, in the second, the location of the GM and Chrysler complexes in Northern Mexico.

Next, we can see the existence of twelve districts with densities above 100 workers per plant which are a mixture of maquiladora districts and districts with a long industrial tradition of such as those in the state of Mexico (see also Map 4).

On this point, going through the census information has enabled us to get a basis for identification of the state of the industrial manufacturing network in Mexico and within it the importance of the various economic activities which come under the MIM.

We have evaluated the importance of the MIM in the Mexican economy based on criteria related to the generation of added manufacturing value, the structure of its divisions, its importance per federal entity as well as its levels of employment, its establishments, its assets and its location by industrial district.

In this regard we can state that, aside from being the most important manufacturing activity in terms of its contribution to the GDP, the MIM is an industrial activity with a high level of concentration, the latter measured according to the location of its assets and the ratios of establishments and workers.

On the other hand, taking into account the location of its enterprises, we see an industrial complex representative of the new trends in the development of Mexican capitalism in the process of relocating investments: new regions of operation which concentrate the new investments in assets and where new types of metal-based production are taking place, such as electric and electronic products.

In the next chapter we will observe in detail the development and profile of these phenomena in the recent period and the various products lines, sizes of establishments and numbers of employees.

[11] In the chapter on groups of enterprises we will provide information on and analysis of these and other automotive enterprises.

Map 4

Table 4 Manufacturing Industry 1994
Districts, employees, establishments and density

Division VII				Division VIII			
District	**Employees**	**Establish-ments**	**Density**	**District**	**Employees**	**Establish-ments**	**Density**
Monclova, Coa.	7,240	1	7,240	Juarez, Chi.	97,781	610	160
Jocotitlan, Mex.	5,800	1	5,800	Tijuana, BC.	49,707	563	88
Tlalnepantla, Mex.	5,381	26	207	Chihuahua, Chi.	32,430	475	68
San Luis Potosí, SLP.	5,078	22	231	Matamoros, Tam.	30,392	190	160
San Nicolás De Los Garza, Nln.	4,769	13	367	Tlalnepantla, Mex.	30,269	617	49
Lázaro Cardenas, Mic.	2,586	3	862	Reynosa, Tam.	24,428	186	131
Torreon, Coa.	2,496	2	1,248	Mexicali, BC.	18,702	251	75
Monterrey, NL.	2,197	13	169	Toluca, Mex.	15,792	322	49
Veracruz, Ver.	2,178	6	363	Nogales, Son.	13,254	111	119
Delegación Gustavo A. Madero	1,883	11	171	Apodaca, NL.	12,752	131	97
Delegación Azcapotzalco	1,842	8	230	Cuautlancingo, Pue.	11,927	17	702
Guadalajara, Jal.	1,666	7	238	Cuautitlan Izcalli, Mex.	11,806	125	94
Ecatepec, Mex.	1,181	6	197	Nuevo Laredo, Tam.	11,773	123	96
San Miguel Xoxtla, Pue.	1,162	1	1,162	Santa Catarina, NL.	8,544	153	56
Nacozarí De García, Son.	1,030	nd	nd	Acuña, Coa.	8,107	52	156
Cananea, Son.	866	nd	nd	Ramos Arizpe, Coa.	8,082	32	253
Panuco, Ver.	614	nd	nd	Jiutepec, Mor.	7,564	133	57
Tultitlan, Mex.	613	nd	nd	Tepeapulco, Hgo.	6,535	60	109
Cortazar, Gto.	515	nd	nd	Salto, El, Jal.	5,748	60	96
Delegación Iztapalapa	513	11	47	Piedras Negras, Coa.	4,943	66	75
Puebla, Pue.	477	6	80	Lerma, Mex.	4,440	53	84
Frontera, Coa.	475	nd	nd	Jesús María, Ags.	3,363	50	67
Cuautitlan Izcalli, Mex.	414	nd	nd	Nuevo Casas Grandes, Chi	3,157	58	54
Chihuahua, Chi.	410	nd	nd	Agua Prieta, Son.	3,115	41	76
Tijuana, BC.	398	nd	nd	Frontera, Coa.	2,915	46	63
Santa Catarina, NL.	383	5	77	Tultepec, Mex.	2,199	22	100
Cordoba, Ver.	343	nd	nd	Empalme, Son.	2,098	18	117
Mexicali, BC.	338	nd	nd	General Zuazua, NL.	1,959	10	196
Ramos Arizpe, Coa.	317	nd	nd	Tianguistenco, Mex.	1,915	27	71
Garcia, NL	309	6	52	Tepotzotlan, Mex.	1,702	30	57
Tepeapulco, Hgo.	298	nd	nd	García, NL.	1,466	26	56
Apodaca, NL.	284	nd	nd	Carmen, NL.	1,440	18	80
Delegación Miguel Hidalgo	277	nd	nd	Sabinas, Coa.	1,274	24	53
Teziutlan, Pue.	268	nd	nd	Buenaventura, Chi	1,116	15	74
Ixtaczoquitlan, Ver.	249	nd	nd	Tetla, Tla.	1,099	10	110
San Pedro Cholula, Pue.	205	nd	nd	Jocotitlan, Mex.	1,037	14	74
General Zuazua, NL.	202	nd	nd	Capulhuac, Mex.	993	9	110
Delegación Venustiano Carranza	199	nd	nd	Jilotepec, Mex.	895	15	60
Irapuato, Gto.	187	5	37	Teolocholco, Tla.	802	6	134
Coacalco, Mex.	171	nd	nd	Pedro Escobedo, Qro.	749	15	50
Matamoros, Tam.	169	nd	nd	Papalotla De Xicohtencatl, Tla.	574	11	52
Teotihuacan, Mex.	160	nd	nd	Ascension, Chi	527	10	53
Ixtlahuacan De Los Membrillos, Jal.	148	nd	nd	Imuris, Son.	483	6	81
Saltillo, Coa.	144	nd	nd	Anahuac, NL.	408	7	58
Cadereyta Jimenez, NL.	135	nd	nd	Teoloyucan, Mex.	398	7	57

Source: INEGI, SAIC, México
1994

III. The Metal and Machine Industry in Mexico in the years 1995-1999.

What has happened on the manufacturing scene since the crisis which began in December 1994 and extended throughout 1995? *In what way have the main indicators of the metal and machine industry evolved?*

In the section where we describe the information in *Figure 1*, we saw that within the manufacturing structure, specifically since 1995, there have been some changes related to the generation of added value and the size of the shares of the nine divisions which make up the manufacturing industry.

For the divisions making up the metal and machine industry, in particular DIVISION VIII which includes metal products, machinery and equipment, we observed that beginning in 1995 its level of importance has been increasing to the extent that in the period 1995-98 its share grew by five percentage points, making it the most important complex of industrial manufacturing activities, as is shown in the upper part of the figure by an asynchronous movement with DIVISION I (food, beverages and tobacco), which passes to second position.

Observing its percentage growth rates in *Figure 2*, we can see that both the manufacturing industry as a whole and DIVISION VIII exhibit recovery and growth levels—after falls of –4.9% and –10.2% respectively—which in 1996 were already higher even than the highest levels of the 1980-94 period. This is especially true for machinery and equipment, which reached levels of above 20% in that year.

Now our examination of the Mexican economy for the period 1995-99, in particular the evolution of the MIM, will be based on information on employees, establishments, entities and districts obtained from the data bases published by the Secretariat of Commerce and Industry (SECOFI) and the Mexican System of Entrepreneurial Information (SIEM)[12].

Thus, in *Table 5* we have a compendium of the recent behavior of personnel and establishments in the manufacturing industry and a selection which includes four manufacturing divisions. According to these data, we can see that in the first year, 1995, *there were 3,066,356 employees in the manufacturing industry working in 114,807 establishments*.

It is important to stress that although the Secofi-Siem series cannot be taken as a form of monitoring of census procedures to derive information, we can nevertheless appreciate that with regard to the data of the 1994 industrial census, in 1995 there was a fall in the number of establishments of slightly more than 150 thousand[13] and in the case of employment there was a

[12] Where the records of employees per size of enterprise come essentially from the monthly reports which the enterprise administrations make to the Mexican Institute of Social Insurance (IMSS) and in which, for Mexican data processing, are the most important records for determining the evolution of employment.

[13] The Secofi-Siem series which we use here is not exactly comparable to the data from the 1994 industrial census. The methodology of obtaining information is different, and the census uses survey systems while the Seofi-Siem source uses records prepared under social security regulations.

decline of about 200,000 jobs, a figure which represents a rate of –4.4%[14] compared to the 1994 census.

Starting in 1995 the employment and establishment series in manufacturing show substantial increases. In 1999, the records indicate that there were 4,247,282 employees and 126,814 establishments (slightly below the figures for 1997), i.e. from 1995 to 1999 employment grew by 38.5% and the number of establishments by 10.4%[15].

A summary analysis of a sample of four manufacturing divisions—taking as a reference the number of employees and establishments—may be given as follows:

All four divisions show growth in employment and establishments for the period 1995-99[16], and within that behavior DIVISION VIII shows the most significant variations in employment, since the difference of 1999 over 1995 is 516,364 new jobs, a figure indicating impressive growth: 50.9%.

For DIVISION VII, the difference in jobs, while positive, is much more modest, with an increase of 18,371 jobs; however, that means a quite respectable growth rate of 26.3% for the period.

Thus, we can state that within the behavior of employment and establishments, DIVISION VIII has confirmed its preeminence in Mexican manufacturing as a generator of a large amount of added value and jobs.

In light of the foregoing we may note that of the four divisions shown in *Table 5*, DIVISION VIII is the only one which increased its share of employees in proportion to total manufacturing employment. In 1995 it accounted for 33% of jobs in the sector, and in 1999 that figure had risen to 36%, a level more than twice that of DIVISION I, which consists of establishments producing Food, Beverages and Tobacco.

The other three divisions, while exhibiting increases in personnel in absolute terms, show a decline in their share of employment for the period 1995-99: DIVISION VII falls from 2.28% to 2.07%, DIVISION I from 18.18% to 16.25% and DIVISION V from 11.87% to 10.88%.

[14] Using the Secofi-Siem records for 1994, the fall in employment for 1995 was –2.4%. An important element to consider here is that when a worker loses his job, the records remain in the IMSS for a period of six months.

[15] Although the increase in the number of manufacturing establishments was large, it was still well behind the increases indicated in the 1994 census.

[16] But in comparison to the data of the 1994 census they show a reduction in establishments. In terms of employment, the two divisions of the metal and machine industry show positive variation in 1994 and 1995. In DIVISION VII the number of employees rose from 59,4888 to 69,760 in 1995 according to the Secofi-Siem report and in DIVISION VIII from 955.267 employees to 1,012,528 for 1995.

Table 5 Evolution of Employees and Establishments in National Manufacturing and Selected Divisions 1995-1999						
		1995	**1996**	**1997**	**1998**	**1999***
National Manufacturing Industry						
Number of Establishments		114,807	117,587	121,055	126,946	126,814
Employees**		3,066,356	3,439,740	3,772,061	4,116,043	4,247,282
Division VII, Basic Metal Industry						
Number of Establishments		1,148	1,163	1,228	1,285	1,286
Employees**		69,760	75,395	80,082	87,166	88,131
Division VII as % of Manufacturing Industry						
Number of Establishments		1.00	0.99	1.01	1.01	1.01
Employees**		2.28	2.19	2.12	2.12	2.07
Division VIII, Machinery and Equipment						
Number of Establishments		27,783	28,104	28,808	30,714	30,751
Employees**		1,012,528	1,147,342	1,272,862	1,383,566	1,528,892
Division VIII as % of Manufacturing Industry						
Number of Establishments		24.20	23.90	23.80	24.19	24.25
Employees**		33.02	33.36	33.74	33.61	36.00
Division I, Food, Beverages and Tobacco						
Number of Establishments		28,927	29,975	30,345	31,202	31,083
Employees**		557,475	582,896	636,838	672,213	690,224
Division I as % of Manufacturing Industry						
Number of Establishments		25.20	25.49	25.07	24.58	24.51
Employees**		18.18	16.95	16.88	16.33	16.25
Division V, Chemicals						
Number of Establishments		8,171	8,323	8,620	9,125	9,112
Employees**		363,979	394,370	418,078	451,695	462,026
Division V as % of Manufacturing Industry						
Number of Establishments		7.12	7.08	7.12	7.19	7.19
Employees**		11.87	11.47	11.08	10.97	10.88

** Refers to data for the first four months of this year*
*** Includes blue- and white-collar workers, permanent and temporary personnel*
Source: Secofi-Siem-Imss

III.1 The Metal and Machine Industry, Employees and their Distribution in Establishments by Size.

With a view to studying the behavior of the MIM in recent years in greater detail, in this section we will consider the distribution of employees and establishments taking into account the size of plants. This classification of establishments is the one used in the SECOFI-IMSS (1999) records and refers to the sizes of establishments in terms of levels of employment[17]: MICRO up to 30 employees, SMALL between 31 and 100, MEDIUM between 101 and 500, and LARGE with more than 500 employees.

[17] A classification which has been in use since 1999 and which replaces the one which considered establishments as micro up to 15 employees and large with more than 250 employees.

On the basis of these references and with the data from *Table 6*, we can see that the structure of establishments in DIVISION VII consists mainly of MICRO sized establishments. In recent years this type of establishments has averaged 64.4% (e.g. 845 establishments of a total of 1,286 in 1999). On the other hand, the share of SMALL establishments averaged 25.5%, that of MEDIUM ones 5.4%, while LARGE establishments represented only 4.7%.

But when we observe the distribution of employees in DIVISION VII, we see that the majority are employed in the LARGE establishments. For that group the average share in the period 1995-99 was 66.7% of employees working in large enterprises (e.g. in 1999 there were 56,159 employees in that type of enterprise, out of a total of 88,131 for the Division as a whole). For their part, the medium enterprises averaged 13.6% of employment in the Division, small enterprises 14.5% and Micro enterprises only 5.2% (e.g. in the last category there were only 5,096 employees in 1999).

On the other hand, DIVISION VIII shows a more complex panorama. Although MICRO enterprises represent a high percentage (averaging 79.8% and LARGE enterprises only 3%, the distribution of employment follows the opposite trend. About 79% of the workers are employed in LARGE enterprises, 10% in MEDIUM, 12.4% in SMALL and 7.9% in MICRO enterprises.

As an illustration, in the year with the largest number of employees (1999), of the 1,528,892 employees in the Division as a whole, 1,056,668 were employed in LARGE enterprises while only 111,166 worked in MICRO enterprises.

In addition, if we observe the dynamics of the growth in the number of employees, we see that employment in the LARGE enterprises has been growing at a spectacular rate, which explains, *inter alia*, the tremendous variation in the totals for the DIVISION (highlighted in the previous section). If we observe this column more carefully, we can see that in 1995 there were 677,816 employees, a figure which rose from year to year to reach 1,056,668 employees in 1999. This indicates that the LARGE enterprises over the last five years have been accumulating no less than 378,852 new jobs to yield a growth in the period equal to 55.8%. An increase which, as we will see below, lies in the increase in personnel in the country's assembly plant structure related to metal and machine activities.

The variations in the MEDIUM enterprise segment, although in absolute terms not as great as that of the previous case, nevertheless does show a high rate of growth. In Medium enterprises employment rose from 107,894 workers in 1995 to 177,970 in 1999, an increase of 70,076 workers representing growth in the period on the order of 64.9%, one of the highest rates in Mexican manufacturing.

Tables 5 and 6 show a general panorama of the behavior of the metal and machine industry based on the recent evolution of its two main components. It emerges that both divisions have a high impact in the manufacturing context, especially because their growth in terms of employment and establishments (and as we have seen, in the formation of added value), will have repercussions on the national social and economic context. Based on the foregoing considerations, we will try to deepen our analysis by resorting to the processing of information on the regional scale.

Table 6 Establishments and Employees of Division VII and Division VIII By Size of Enterprise (1995-1999)						
Division VII. Basic Metal Industry						
Total establishments in Division VII						
Micro	765	743	782	796	845	
Small	280	314	322	344	297	
Medium	54	55	61	79	84	
Large	49	51	63	66	60	
Total	**1,148**	**1,163**	**1,228**	**1,285**	**1,286**	
% of establishments in Division VII						
Micro	66.6	63.9	63.7	61.9	65.7	64.4
Small	24.4	27.0	26.2	26.8	23.1	25.5
Medium	4.7	4.7	5.0	6.1	6.5	5.4
Large	4.3	4.4	5.1	5.1	4.6	4.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Employees in Division VII						
Micro	3,847	3,876	3,996	4,062	5,096	
Small	9,575	12,018	12,000	12,737	11,727	
Medium	8,230	9,648	9,660	12,412	15,150	
Large	48,108	49,853	54,426	57,955	56,159	
Total	**69,760**	**75,395**	**80,082**	**87,166**	**88,131**	
% of employees in Division VII						
Micro	5.5	5.1	5.0	4.7	5.8	5.2
Small	13.7	15.9	15.0	14.6	13.3	14.5
Medium	11.8	12.8	12.1	14.2	17.2	13.6
Large	69.0	66.1	68.0	66.5	63.7	66.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Division VIII, Machinery and Equipment						
Total establishments in Division VIII						
Micro	22,608	22,489	22,776	24,207	24,525	
Small	3,742	3,977	4,279	4,641	4,292	
Medium	693	789	838	874	972	
Large	740	849	915	992	962	
Total	**27,783**	**28,104**	**28,808**	**30,714**	**30,751**	
% of establishments in Division VIII						
Micro	81.4	80.0	79.1	78.8	79.8	79.8
Small	13.5	14.2	14.9	15.1	14.0	14.3
Medium	2.5	2.8	2.9	2.8	3.2	2.8
Large	2.7	3.0	3.2	3.2	3.1	3.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Employees in Division VIII						
Micro	90,273	93,344	96,132	102,333	111,166	
Small	136,545	145,911	157,758	169,236	167,801	
Medium	107,894	122,074	130,458	136,613	177,970	
Large	677,816	786,013	888,514	975,384	1,056,668	
Total	**1,012,528**	**1,147,342**	**1,272,862**	**1,383,566**	**1,528,892**	
% of employees in Division VIII						
Micro	8.9	8.1	7.6	7.4	7.3	7.9
Small	13.5	12.7	12.4	12.2	11.0	12.4
Medium	10.7	10.6	10.2	9.9	11.6	10.6
Large	66.9	68.5	69.8	70.5	69.1	69.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

III.2. The Metal and Machine Industry in Federal Entities in the Period 1995-1999.

The evolution of indicators of the MIM for the years 1995-99 observed in the previous section will be submitted to a process of statistical disaggregation by region, once the main federal entities where the metal and machine industry is most important have been identified—from the point of view of added value, see *Figures 4 and 5*, and in terms of their importance in the concentration of labor, see *Map 5*. The procedure for this analysis will be within the procedure used in Diagram 1, i.e. observing each of the divisions of the MIM based on their composition by BRANCH, INDUSTRIAL CLASSES and PRODUCT GROUPS.

III.2.1. The State of Mexico.

The State of Mexico is one of the federal entities with the highest level of industrialization in the country. As we have seen from chapter 1 (Figure 3), its presence on the national manufacturing scene has been important since the 1960s and it may be stated that its high content of industrial activities is directly related to its participation in the production of the basic metal industries and in machinery and equipment, where its contribution to national added value in recent years has been above 15% in DIVISION VII and more than 22% in DIVISION VIII.

Recent data[18] on the evolution of the Basic metal industries Industry, DIVISION VII in this state (Table 7), have shown growth both in establishments and in the number of employees. In 1998 there were 255 establishments (243 in 1995) employing 14,644 persons (10,394 in 1995) of which 9,152 were employed in 12 large establishments. From the annual series on establishments and jobs we can immediately see that the variations are essentially due to the presence of BRANCH 47, Non-Ferrous Metal Industries. As can be seen, that industrial branch last year employed 11,809 workers (80.6% of the DIVISION) distributed among 11 large enterprises. Thus, if we speak of the metal industries in this state, we now know that the predominant factor is its branch producing non-ferrous metal products, i.e. the production of products based on *copper, lead, aluminum, zinc, etc. On the other hand, Branch 46 has for only a marginal presence in this state.*

With reference to the dynamics of DIVISION VIII, in *Table 7a* we can observe growth in the number of establishments and jobs. Establishments increased from 3,278 in 1995 to 3,610 in 1999. As for employees, they increased during the same period from 116,215 to 154,229[19], i.e. an increase of 32.7% in the number of jobs.

The distribution of establishments and jobs for 1998 may be observed through the three big groups of products in DIVISION VIII[20]. GROUP I, the *Automobile and Transport Industries*, in 1998 employed 44,123 workers in 285 locations. The distribution by employment and plant size indicates that 78.1% of employees (in absolute terms, 34,480 employees) were working in large enterprises.

[18] For the State of Mexico the series of data corresponds to the period 1995-1998.
[19] As in DIVISION VII, the census data for 1994 are higher than the 1998 figures.
[20] See Diagram 1.

Table 7 State of Mexico. Configuration of Division VII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VII Basic Metal Industry					
Establishments in Division VII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	162	61	12	8	243
1996	157	65	11	9	242
1997	154	64	14	12	244
1998	153	78	12	12	255
Employees in Division VII					
1995	862	2,211	1,977	5,344	10,394
1996	862	2,211	1,977	5,344	10,394
1997	881	2,164	2,017	6,945	12,007
1998	846	2,720	1,926	7,152	12,644
Establishments in the Non-Ferrous Metal Industry					
1995	160	61	12	8	241
1996	150	65	11	9	235
1997	139	63	14	12	228
1998	136	72	12	11	231
Employees in the Non-Ferrous Metal Industry					
1995	860	2,211	1,977	5,344	10,392
1996	869	2,414	1,962	6,420	11,665
1997	789	2,134	2,017	6,945	11,885
1998	753	2,587	1,926	6,543	11,809

Source: Secofi-Siem-Imss

GROUP II, *Metal Products and Furniture*, in 1998 employed 57,075 workers in 2,326 establishments. Unlike the distribution of GROUP I, only 38% of the personnel was employed in large enterprises (43 establishments), the rest being distributed as follows: 20.2% in medium enterprises (80 establishments), 27.9% in small enterprises (427 establishments) and 13.6% in micro enterprises (1,776 establishments).

GROUP III, *Machinery, Equipment and Non-Electric, Electric and Electronic Products,* dominates DIVISION VIII; in 1998 it employed 53,031 workers (a figure which is the result of continuous annual growth in employment representing, in 1999, 34.4% of total employment for the Division) in 8,937 establishments, of which most employees worked in 38 large establishments.

This profile of the State of Mexico indicates that the regional metal and machine industry is dominated by three main types of products: *non-ferrous mineral products; automobiles; machinery, equipment and electric and electronic products.*

Table 7a State of Mexico. Configuration of Division VIII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	2,465	586	134	93	3,278
1996	2,306	605	153	108	3,172
1997	2,401	657	160	115	3,333
1998	2,620	700	166	124	3,610
Employees in Division VIII					
1995	10,553	22,500	20,919	62,243	116,215
1996	10,136	23,402	23,890	73,638	131,066
1997	10,756	26,060	24,865	82,776	144,457
1998	11,634	26,946	25,587	90,062	154,229
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	146	60	31	30	267
1996	125	58	32	36	251
1997	132	63	35	39	269
1998	139	71	33	42	285
Employees in Group I					
1995	648	2,624	5,290	24,719	33,281
1996	618	2,668	5,243	28,280	36,809
1997	628	2,846	5,691	30,988	40,153
1998	701	3,306	5,636	34,480	44,123
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	1630	356	60	27	2073
1996	1529	369	70	36	2004
1997	1605	401	70	42	2118
1998	1776	427	80	43	2326
Employees in Group II					
1995	6,973	13,752	9,590	11,704	42,019
1996	6,712	14,026	10,768	18,195	49,701
1997	7,184	15,696	10,507	21,418	54,805
1998	7,805	15,930	11,549	21,791	57,075
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	689	170	43	36	938
1996	652	178	51	36	917
1997	664	193	55	34	946
1998	683	198	54	38	973
Employees in Group III					
1995	2,932	6,124	6,039	25,820	40,915
1996	2,806	6,708	7,879	27,163	44,556
1997	2,944	7,518	8,667	30,370	49,499
1998	3,128	7,710	8,402	33,791	53,031

Source: Secofi-Siem-Imss

Going into greater detail at the level of the CLASS OF ACTIVITY, we observe that, according to the data for the first four months of 1999, the most representative classes of the product groups identified for this entity are:

GROUP I

- The MANUFACTURE AND ASSEMBLY OF AUTOMOBILES employ 12,868 workers in 9 establishments, of which 12,529 workers are employed in 5 large establishments.
- MANUFACTURE AND ASSEMBLY OF BODYWORK with 5,973 workers in 91 establishments. 3,293 are employed in 7 large enterprises.
- MANUFACTURE AND ASSEMBLY OF ENGINES FOR AUTOMOBILES, BUSES AND TRUCKS. It employs 3,854 workers of whom 3,668 are in large enterprise. This heading includes five establishments, of which two are large.

GROUP II

- MANUFACTURE AND/OR ASSEMBLY OF ELECTRIC OR ELECTRONIC APPLIANCES. Employs 22,897 workers and has 110 establishments. Most of the workers (19,107) are in large enterprises (14).
- MANUFACTURE OF MACHINERY AND EQUIPMENT. Employs 15,394 workers in 682 establishments. In this class the distribution of personnel has distinct features, since only 3,679 are in seven large establishments, the rest being distributed as follows: 5,139 workers in 29 medium establishments, 4,140 in 106 small enterprises, and 2,436 in MICRO establishments.

III.2.2. Federal District.

Together with the State of Mexico, the Federal District is the symbol of the old period of industrialization known as the *import substitution* period, and also of the long process of centralization of national industrial activity. As we saw in *Figures 3, 4 and 5*, although in the late 1980s and the 1990s its importance declined due to he weight of other states undergoing industrialization processes, the Federal District remains an area of great importance in manufacturing, especially in the metal and machine industry.

A breakdown at the level of the two manufacturing divisions of the MIM yields the following picture:

In the first four months of 1999 the Federal District had 3,627 persons employed in DIVISION VII (BASIC METAL INDUSTRIES). The number of establishments recorded was 124. Of the latter, three were large establishments employing 1,639 workers, see *Table 8*.

In that total, the iron and steel industries (branch 46) dominate the Division. In these activities in 1999 there were recorded 2,568 workers and 113 establishments, accounting for 70.8% of the workers of DIVISION VII and 91.1% of establishments. It should be noted that 1998 and 1999 saw a fall in employment in this BRANCH: in 1997 there were 2,719 employees registered, which figure fell to 2,529 in 1998 and 2,568 in 1999. These cutbacks particularly affected large and small enterprises whose records, in the case of large enterprises, are slightly higher than in 1995, while for small enterprises the 1999 figures are below those of 1995.

Table 8 Federal District. Configuration of Division VII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VII Basic Metal Industry					
Establishments in Division VII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	97	19	3	3	122
1996	88	24	4	2	118
1997	93	25	3	3	124
1998	93	25	4	3	125
1999*	97	20	5	3	124
Employees in Division VII					
1995	499	629	315	1,030	2,473
1996	519	563	405	1,316	2,803
1997	453	696	494	1,133	2,776
1998	461	929	502	1,715	3,607
1999*	539	739	711	1,639	3,627
Establishments in the Iron and Steel Industry					
1995	97	20	2	2	121
1996	91	18	3	3	115
1997	82	22	4	2	110
1998	84	23	3	3	113
1999*	87	19	5	3	113
Employees in the Iron and Steel Industry					
1995	487	608	315	1,030	2,440
1996	485	542	405	1,316	2,748
1997	438	654	494	1,133	2,719
1998	433	879	502	1,715	3,529
1999*	505	713	711	1,639	3,568

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

Table 8a shows the configuration of DIVISION VIII (*Machinery and Equipment*) in the Federal District. In 1999 there wee 108,919 employees registered for the whole Division and 4,790 establishments[21]. The distribution by plant size indicates that although 40,341 workers were employed in large establishments, the numbers for other classes are also high: 20,811 workers in medium enterprises (128 establishments), 27,231 workers in small enterprises (735 establishments) and 20,536 workers in micro enterprises (3,863 establishments).

Disaggregation by groups shows that GROUP I, AUTOMOBILE AND TRANSPORT INDUSTRIES, employed 12,413 workers in 238 establishments, GROUP II, METALLIC FURNITURE AND PRODUCTS, employed 58,790 workers in 3,065 establishments, while GROUP III had 37,716 workers and 1,488 establishments.

Thus, the dominant activities are those of GROUP II, i.e. the more traditional metal and machine manufacturing and the most useful in the big cities of Mexico: metal structures, forging, etc. An indicator which reveals the content of this industry is that only 30% of the workers are employed in large enterprises (30 units), the rest being distributed among medium (72) and small (457) enterprises, with a particularly large number of them in micro enterprises (2,505).

[21] Figures lower than the 1994 census.

Table 8a Federal District. Configuration of Division VIII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	4,063	785	106	63	5,017
1996	3,842	811	110	66	4,829
1997	3,768	853	112	70	4,803
1998	3,760	855	115	76	4,806
1999*	3,863	735	128	65	4,790
Employees in Division VIII					
1995	18,191	27,240	16,130	36,232	97,793
1996	18,156	28,337	16,811	37,133	100,437
1997	17,656	29,707	16,696	41,716	105,775
1998	18,157	30,041	17,343	43,680	109,221
1999*	20,536	27,231	20,811	40,341	108,919
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	182	33	11	11	237
1996	171	33	11	10	225
1997	170	43	9	11	233
1998	171	45	10	11	237
1999*	178	39	12	10	238
Employees in Group I					
1995	860	1,381	1,714	8,510	12,465
1996	838	1,226	1,677	7,345	11,086
1997	790	1,578	1,375	7,968	11,711
1998	858	1,780	1,556	8,341	12,535
1999*	956	1,614	1,992	7,851	12,413
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	2,583	489	60	28	3,160
1996	2,457	514	57	31	3,059
1997	2,441	533	62	33	3,069
1998	2,446	533	67	36	3,082
1999*	2,505	457	72	30	3,065
Employees in Group II					
1995	11,500	16,995	9,110	15,304	52,909
1996	11,547	18,141	8,769	16,679	55,136
1997	11,252	18,388	9,112	18,826	57,578
1998	11,610	18,463	9,886	19,086	59,045
1999*	13,122	16,843	11,636	17,189	58,790
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	1,298	263	35	24	1,620
1996	1,214	264	42	25	1,545
1997	1,157	277	41	26	1,501
1998	1,143	277	38	29	1,487
1999*	1,180	239	44	25	1,488
Employees in Group III					
1995	5,831	8,864	5,306	12,418	32,419
1996	5,771	8,970	6,365	13,109	34,215
1997	5,614	9,741	6,209	14,922	36,486
1998	5,689	9,798	5,901	16,253	37,641
1999*	6,458	8,775	7,183	15,301	37,716

** Refers to the first four months of this year*
Source: Secofi-Siem

The activities most closely related to the process concentrating personnel in large enterprises are in GROUP I, and show that of the total personnel in the group, 7,851 workers (63.2%) are employed in 10 large enterprises.

With data from the first four months of 1999, disaggregation of the groups yields the following results:

GROUP I

- Manufacture and assembly of automobiles and trucks employs 3,622 workers in 4 establishments. The distribution by establishments indicates that 3,617 workers are employed in two large enterprises.
- Manufacture of bodywork for vehicles. Employs 1,383 workers distributed as follows: 226 in one large enterprise, 389 workers in two medium enterprises, 423 in 12 small enterprises and 346 in 63 micro establishments.
- Parts and accessories for automobiles, motorcycles and bicycles. 4,184 workers distributed as follows: 2,205 in four large establishments, 889 in six medium enterprises, 762 in 17 small enterprises and 329 in 61 micro enterprises.

III.2.3. Nuevo León

As the location of the majority of the big industrial groups in Mexico, Nuevo León is one of the centers of development which has emerged with great dynamism in the second half of this century in a context where the dominant trend has been toward centralization of the economy in the Valley of Mexico.

Thus, in recent decades Nuevo León has occupied an important position in the industrial infrastructure of the country, averaging 10% in the national manufacturing GDP, which is in turn the result of its inclusion in the generation of added value in the divisions of the metal and machine industry. Now, in this section, we will observe the variations in personnel and establishments of the two divisions making up the metal and machine industry for the years 1995-99.

In *Figure 4* we have already seen that Nuevo León is the state with the biggest share in the production of the basic metal industries, although that share is tending to decrease—in the 1960s it generated more than a quarter of the total value for DIVISION VII—in the 1990s it has accounted for slightly more than 20% of the GDP in this DIVISION.

While according to census data in 1994 (*Table 3*) 8,445 workers were employed in 51 establishments in the state, more recently, in our SECOFI-SIEM series (*Table 9*) we can observe rising values for both variables: thus, establishments rose from 131 in 1995 to 161 in 1999, while the number of employees increased from 9,439 to 11,734 during the same period.

In DIVISION VII (Basic Metal Industries), the distribution of employment by size of establishment indicates that 50.1% of employees work in six large enterprises and 30% in 20 medium enterprises, i.e. 5,984 workers in the first case and 3,575 in medium enterprises.

In Nuevo León the most important activity in DIVISION VII is that corresponding to BRANCH 46, Iron and Steel Industries. For 1999 as well, there were 7,914 workers recorded and 155 establishments in this field. The distribution shows that the most important segment, taking employment as a reference, is the group of medium enterprises—20 units—which employ 3,575

workers (45.1% of the total for the branch), followed by the 4 large establishments employing 2,118 persons (26.7%).

Table 9 Nuevo León. Configuration of Division VII Total and Groups of Products by Size of Establishments and Distribution of Employment

Division VII Basic Metal Industry					
Establishments in Division VII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	74	41	12	4	131
1996	70	48	12	3	133
1997	85	50	14	4	153
1998	85	51	18	7	161
1999*	92	43	20	6	161
Employees in Division VII					
1995	436	1,568	1,806	5,629	9,439
1996	428	1,890	1,879	3,978	8,175
1997	477	1,934	2,183	4,256	8,850
1998	453	1,843	2,807	6,213	11,316
1999*	611	1,565	3,575	5,984	11,734
Establishments in the Iron and Steel Industry					
1995	74	41	12	3	130
1996	69	48	12	2	131
1997	85	50	14	3	152
1998	84	51	18	5	158
1999*	88	43	20	4	155
Employees in the Iron and Steel Industry					
1995	436	1,568	1,806	2,223	6,033
1996	426	1,890	1,879	748	4,943
1997	477	1,934	2,183	1,094	5,688
1998	449	1,843	2,807	2,209	7,308
1999*	587	1,635	3,575	2,118	7,914

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

With regard to DIVISION VIII, and using as a reference the census data, in this state there has been a continuous process of expansion of personnel employed in the establishments. The census indicates that in 1994 there were 97,911 employees and processing our SECOFI-SIEM base indicates that in 1995 the Division of Metal Products, Machinery and Equipment had 101,385 employees, while by 1999 that figure had risen to 159,503 employees.

As regards establishments, if we compare the census data and those of the SECOFI-SIEM base, we can observe that the 3,071 establishments recorded in 1994 had increased to 3,546 in 1999.

As for distribution of employees in the establishments, we can see that in the last year of our series most of the jobs, 96,033 employees, were in the 103 large enterprises, i.e. 60.2% of the personnel concentrated at this level.

We can identify three groups of industrial branches with the following features:

The automobile industry[22] in the state employs 35,784 workers, 22.4% of employment in the Division. The distribution of employees by plant size shows that 20 large plants employ 29,739 workers, i.e. 83.1% of the population of the group.

METAL FURNITURE AND PRODUCTS had 55,448 employees, which means that 34.7% of employment in DIVISION VIII in the state was concentrated in manufacturing this type of product. The distribution of employment by enterprise size, as can be seen in *Table 9a*, shows levels of a certain homogeneity: 29.7% of workers (16,474) were employed in 29 large establishments, 23.7% (13,145) in 76 medium-sized enterprises, 27.8% (15,444) in 414 small establishments, and 18.7% worked in 1,907 micro enterprises.

The GROUP OF EQUIPMENT, MACHINERY AND ELECTRIC AND ELECTRONIC PRODUCTS, is the most important group in terms of employment. In 1999 it accounted for 43.6% of total employment for the Division, corresponding to 69,660 workers. The distribution of employment, unlike that of the METAL FURNITURE group, tends toward the large enterprises, in this case 31 establishments employing 45,502 workers (65.3%).

A selection of the most important classes of GROUP III indicates that Nuevo León is on of the few places in Mexico where there is Manufacture of Equipment and Machinery—capital goods in the strict sense—in addition to the traditional electronic products, which will be shown below.

MANUFACTURE AND/OR ASSEMBLY OF ELECTRONIC OR ELECTRIC APPLIANCES AND ACCESSORIES. In 1999 this class employed 18,134 workers in 55 enterprises, of which 11 are large and employ 15,881, i.e. 87.5% of the total for this industrial class.

MANUFACTURE AND/OR ASSEMBLY OF AGRICULTURAL EQUIPMENT. This activity employed 3,809 workers in 19 establishments, of which two were classified as large and employed 91.4% of the total personnel, i.e. 3,484 workers.

MANUFACTURE AND/OR ASSEMBLY OF MACHINERY AND EQUIPMENT IN GENERAL AND ELECTRIC POWER TRANSMISSION EQUIPMENT. This important industrial class comes under capital goods, and in 1999 employed 3,630 workers in 39 enterprises. There were three large enterprises employing 2,454 persons and three medium enterprises employing 546 workers.

MANUFACTURE AND/OR ASSEMBLY OF RADIO, TV AND COMMUNICATIONS APPLIANCES AND EQUIPMENT. This activity accounted for 3,028 workers distributed among 14 enterprises. Two large enterprises employed 2,278 workers, i.e. 75.2% of the total personnel for the class.

[22] Here the generic heading “automobiles” refers to buses, trucks and tractor-trucks.

Table 9a Nuevo León. Configuration of Division VIII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	2,398	519	85	81	3,083
1996	2,401	578	119	93	3,191
1997	2,422	617	117	105	3,261
1998	2,581	684	125	111	3,501
1999*	2,692	609	143	103	3,546
Employees in Division VIII					
1995	11,101	19,374	12,668	58,242	101,385
1996	11,519	21,508	17,634	73,630	124,291
1997	11,990	23,077	18,655	84,784	138,506
1998	12,468	25,026	19,650	95,277	152,421
1999*	14,635	23,597	25,238	96,033	159,503
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	99	56	12	16	183
1996	102	50	15	21	188
1997	105	56	17	26	204
1998	120	59	16	29	224
1999*	142	37	28	20	227
Employees in Group I					
1995	528	2,524	1,988	16,372	21,412
1996	525	2,245	2,412	19,947	25,129
1997	637	2,427	3,007	23,165	29,236
1998	695	2,573	2,578	28,735	34,581
1999*	662	2,476	2,907	29,739	35,784
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	1,670	342	45	26	2,083
1996	1,686	390	67	31	2,174
1997	1,703	412	63	35	2,213
1998	1,818	471	69	32	2,390
1999*	1,907	414	76	29	2,425
Employees in Group II					
1995	7,629	11,807	6,908	11,789	38,133
1996	8,001	13,969	9,938	15,387	47,295
1997	8,306	14,723	9,675	18,070	50,774
1998	8,754	16,286	10,946	17,056	53,042
1999*	10,385	15,444	13,145	16,474	55,448
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	629	121	28	39	817
1996	613	138	37	41	829
1997	614	149	37	44	844
1998	643	154	40	50	887
1999*	724	86	64	31	905
Employees in Group III					
1995	2,944	5,043	3,772	30,081	41,840
1996	2,993	5,294	5,284	38,296	51,867
1997	3,047	5,927	5,973	43,549	58,496
1998	3,019	6,167	6,126	49,486	64,798
1999*	4,657	4,590	14,911	45,502	69,660

** Refers to the first four months of this year*
Source: Secofi-Siem

III.2.4. Chihuahua.

The industrial development of the state of Chihuahua is associated with the arrival of investments of the maquiladoras in the 1980s. Cities and municipalities such as Juárez, Nuevo Casas Grandes, Delicias, Guadalupe and Chihuahua became well known for their ability to absorb the workforce in new plants operating from the beginning with new systems of task assignment and pay.

The 1994 census indicated that Chihuahua had a working population in manufacturing of 222,559 persons (*Table 2*) of whom 141,601 were in DIVISION VIII, Machinery and Equipment (*Table 2*). In the classification of the most important industrial districts in terms of employment, the most important is Chihuahua; according to the census, in DIVISION VIII Ciudad Juárez had 97,781 workers (*Table 4*).

The employment series for the period 1995-99 (in *Table 10*) indicates that the activities of DIVISION VIII in 1995 accounted for 201,186 workers, and that figure rose to 276,256 in the first four months of 1999.

Two features of the new industrial agglomerations are reflected here: the importance of the large enterprises in the concentration of personnel, and the type of products manufactured.

First, according to the records, in Chihuahua the large establishments (1,288) at the level of the Division as a whole employ 256,530 workers, i.e. 92.8% of total employment.

Second, classification by groups shows that in this federal entity GROUP III, Electric and Electronic Products, employs 237,805 workers of whom 228,413 are distributed among 132 large establishments.

Considering criteria of density, we can see that in DIVISION VIII the average is 1,653 workers per plant while in GROUP III it is 1,730. Here we certainly have one of the most representative examples of the new industrial integration closely associated with large industrial agglomerations, high levels of job generation, high density in the concentration of labor and, particularly, the *maquiladora* work regime which has been established for more than a decade in the northern part of the country.

The most important class of GROUP III is the MANUFACTURE AND/OR ASSEMBLY OF ELECTRIC AND ELECTRONIC APPLIANCES AND ACCESSORIES. For 1999 it employed 162,293 workers in 146 enterprises. Significantly, 97.4% of the total personnel, i.e. 158.210 workers, were employed in 88 large enterprises.

In second place is the class MANUFACTURE AND ASSEMBLY OF RADIO, TV AND COMMUNICATIONS EQUIPMENT AND APPLIANCES, which rose from 33,300 workers in 31 enterprises in 1995 to 52,356 workers in 48 enterprises in 1999. In those years (1995 and 1999) the large enterprises showed a clear trend toward concentration; 15 large establishments had 97.7% of the workers in 1995 (32,603) and in 1999 that percentage rose to 98.1%, with 51,269 workers.

MANUFACTURE AND/OR ASSEMBLY OF HOUSEHOLD ELECTRIC APPLIANCES AND PARTS. A class which in 1995 accounted for 10,332 workers employed in 16 establishments of which nine were large enterprises employing 10,002 workers. By 1999 this activity employed 12,162 workers in 16 establishments. Nine of the latter were large enterprises providing employment to 11,925 persons, representing 98% of total employment.

Table 10 Chihuahua. Configuration of Division VIII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Metal Products, Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	733	134	37	127	1,031
1996	782	130	44	142	1,098
1997	828	154	44	149	1,175
1998	926	167	43	158	1,294
1999*	929	154	48	158	1,288
Employees in Division VIII					
1995	2,735	5,073	5,992	187,386	201,186
1996	3,288	4,791	6,999	207,236	222,314
1997	3,433	5,955	7,063	216,395	232,846
1998	3,833	6,436	7,335	240,606	258,210
1999*	4,194	6,154	9,379	256,530	276,256
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	6	7	6	15	34
1996	11	6	5	18	40
1997	10	9	3	19	41
1998	17	9	4	21	51
1999*	17	9	6	20	52
Employees in Group I					
1995	50	367	913	18,143	19,473
1996	46	299	707	19,488	20,540
1997	25	538	567	18,067	19,197
1998	77	501	649	20,644	21,871
1999*	81	471	1,187	22,843	24,582
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	548	69	8	3	628
1996	577	69	17	3	666
1997	620	84	16	5	725
1998	693	92	14	6	805
1999*	695	87	15	6	803
Employees in Group II					
1995	1,926	2,373	1,133	1,330	6,762
1996	2,398	2,225	2,530	1,480	8,633
1997	2,517	2,800	2,306	2,234	9,857
1998	2,812	3,134	2,185	4,832	12,963
1999*	3,065	3,112	2,419	5,274	13,870
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	179	58	23	109	369
1996	192	58	23	109	382
1997	198	61	25	125	409
1998	216	66	25	131	438
1999*	218	58	26	132	433
Employees in Group III					
1995	759	2,333	3,946	167,913	174,951
1996	844	2,267	3,762	186,268	193,141
1997	891	2,617	4,190	196,094	203,792
1998	944	2,801	4,501	215,130	223,376
1999*	1,049	2,570	5,772	228,413	237,805

** Refers to the first four months of this year*
Source: Secofi-Siem

III.2.5. Puebla

The state of Puebla belongs to the group of states the origin of whose industrialization goes back to the 1960s as part of a process of the establishment and development of large enterprises. This process took on regional importance beginning with the presence of the VW plant and the HYLSA metallurgical complex.

Analysis of the data indicates that DIVISION VII Basic Metal Industries, which in 1995 accounted for 1,337 workers in 39 establishments[23], by 1999 had 1,741 workers in 43 establishments (Table 11).

Table 11 Puebla. Configuration of Division VII Total and Groups of Products by Size of Establishments and Distribution of Employment

Division VII Basic Metal Industry					
Establishments in Division VII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	28	9	1	1	39
1996	27	10	1	1	39
1997	25	15	N.D	2	42
1998	27	13	3	2	45
1999*	29	11	3	1	43
Employees in Division VII					
1995	137	249	238	713	1,337
1996	136	333	226	531	1,226
1997	114	583	N.D	803	1,500
1998	174	540	464	781	1,959
1999*	192	468	567	514	1,741
Establishments in the Iron and Steel Industry					
1995	27	9	1	N.D	37
1996	26	9	1	N.D	36
1997	23	14	N.D	1	38
1998	27	13	2	1	43
1999*	29	11	1	1	41
Employees in the Iron and Steel Industry					
1995	136	249	238	N.D	623
1996	135	290	226	N.D	651
1997	111	493	N.D	289	893
1998	174	540	278	277	1,269
1999*	192	468	230	139	1,028

** Refers to the first four months of this year*
Source: Secofi-Siem

The distribution of workers by size of enterprise is fairly homogeneous at the levels of large, medium and small enterprises, being respectively 29.5%, 32.5% and 26.8% of the total personnel for DIVISION VII.

The BRANCH of IRON AND STEEL is the most important, employing 1,028 workers, i.e. 60% of the total.

[23] In terms of number of employees the data indicate a major loss of employment, since for 1994 2,162 workers were recorded, which is a higher number than that recorded for 1999. As for establishments, the census recorded only 12 (Table 3).

DIVISION VIII exhibited the following features: establishments rose from 921 to 1,017 between 1995 and 1999[24]. The number of employees rose from 26,314 in 1995 to 39,718 in 1999. In that last year 26,675 employees were distributed among 18 large enterprises, representing a rate of 67% of total employment at this level.

The most important group is that of the Automobile and Transport Industry. In the last year it had 25,089 employees in 83 establishments. The large establishments (10) employed 23,078 workers, which indicates a level of concentration in the large enterprises equal to 91.0% of employment of the group (as we will see below, it is quite clear that this employment and these establishments are accounted for by the VW plant and its part suppliers).

Secondly, we have GROUP II, Metallic Furniture and Products, which like that of the Federal District is characterized by a distribution in which small and micro enterprises predominate. In 1999 of a total of 8,894 workers in 700 establishments, 2,636 workers were employed 605 micro establishments and 2,818 in 80 small establishments. In other words, 5,454 workers (61l.3% of the total) were employed in entrepreneurial units classified as small and micro.

In 1999 GROUP III—which produces non-electric, electric and electronic machinery, equipment and other products—employed 5,736 workers in 234 establishments. Employment was distributed at three levels of enterprise size: five large enterprises employed 2,076; eight medium enterprises employed 1,576 and 31 small enterprises employed 1,175.

Disaggregating GROUPS I, II and III, we can highlight the following results:

- AUTOMOBILE MANUFACTURE AND ASSEMBLY employed 16,865 workers in 12 establishments. But of those, 16,382 workers were employed in one large enterprise (which is practically the exact figure for employees at the VW plant in Mexico).
- Bodywork assembly employed 11,841 workers of whom 1,577 were employed in two large enterprises (of a total of 39).
- Automobile parts and accessories accounted for 5,888 workers of whom 5,119 were in seven large enterprises, of a total of 23 establishments.

[24] The 1994 census recorded 2,599 establishments in this Division and 32,378 workers for Puebla (see *Table 2*).

Table 11a Puebla. Configuration of Division VIII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Metal Products, Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	806	90	10	15	921
1996	783	105	15	16	919
1997	772	129	21	16	938
1998	834	145	23	20	1,022
1999*	845	128	26	18	1,017
Employees in Division VIII					
1995	2,985	3,279	1,432	18,618	26,314
1996	3,012	4,050	2,347	20,915	30,324
1997	3,100	4,855	3,431	25,330	36,716
1998	3,366	5,015	3,583	27,432	39,396
1999*	3,750	4,808	4,485	26,675	39,718
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	48	11	3	6	68
1996	47	10	4	7	68
1997	46	12	7	7	72
1998	51	16	7	9	83
1999*	51	17	6	10	83
Employees in Group I					
1995	131	462	443	15,051	16,087
1996	155	430	648	17,138	18,371
1997	173	496	1,121	20,212	22,002
1998	173	646	1,113	22,708	24,640
1999*	205	815	991	23,078	25,089
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	577	54	5	4	640
1996	564	63	6	4	637
1997	564	84	7	4	659
1998	597	96	10	4	707
1999*	605	80	12	3	700
Employees in Group II					
1995	2,130	1,784	705	1,544	6,163
1996	2,172	2,332	963	1,684	7,151
1997	2,209	3,130	1,206	1,688	8,233
1998	2,395	3,201	1,478	1,848	8,922
1999*	2,636	2,818	1,919	1,522	8,894
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	181	25	2	5	213
1996	172	32	5	5	214
1997	162	33	7	5	207
1998	186	33	6	7	232
1999*	189	31	8	5	234
Employees in Group III					
1995	724	1,033	284	2,023	4,064
1996	685	1,288	736	2,093	4,802
1997	718	1,229	1,104	3,430	6,481
1998	798	1,168	992	2,876	5,834
1999*	910	1,175	1,576	2,076	5,736

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

III.2.6. Baja California

Baja California Norte is, like Chihuahua, one of the recently industrialized states. Districts of this entity such as Tijuana, Ensenada and Mexicali are famous as the locations of the new assembly plant industry which has been developing since the 1980s in the northern states of the country. In terms of generation of added manufacturing value it ranks in 11th place, while in terms of gdp of Division viii it occupies fourth place with a share of 7.3%.

Braking down the two divisions of the metal and machine industry for the years 1995-1999 gives the following results.

Table 12 Baja California Norte. Configuration of Division VII Total and Groups of Products by Size of Establishments and Distribution of Employment

Division VII Basic Metal Industry					
Establishments in Division VII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	26	17	1	2	46
1996	25	13	2	2	42
1997	31	14	1	2	48
1998	28	11	5	2	46
1999*	29	10	6	2	47
Employees in Division VII					
1995	119	666	109	953	1,847
1996	118	648	329	862	1,957
1997	149	760	131	754	1,794
1998	124	571	720	776	2,191
1999*	152	532	995	687	2,366
Establishments in the Iron and Steel Industry					
1995	26	17	1	2	46
1996	24	13	2	2	41
1997	29	14	1	2	46
1998	27	11	5	2	45
1999*	27	10	6	2	45
Employees in the Iron and Steel Industry					
1995	119	666	109	953	1,847
1996	117	648	329	862	1,956
1997	144	760	131	754	1,789
1998	123	571	720	776	2,190
1999*	142	532	995	687	2,355

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

Division VII maintained practically the same level in the period 1995-99 in terms of the number of establishments, while the number of employees rose from 1,847 in 1995 to 2,355 in 199925. The iron and steel industry accounted for the entire Division as can be seen in Table 12. The most important concentration of workers was presented by medium enterprises, which employed 995 out of a total of 2,355, or 42.2% of the total.

[25] The records of the 1994 census indicate that in that year there were 748 employees in DIVISION VII; there are no data for establishments.

Division viii is another case. Baja California is one of the states with the most employment based on personnel grouped together in the production of metal products, machinery and equipment. The number of employees rose from 95,661 in 199526 to 141,871 workers, which indicates an increase of 48.3% in the period. As for establishments, their number rose from 919 to 1,090 in 1999.

Distribution by size of plant shows that in Baja California Division viii has behaved like the new manufacturing agglomerations where large enterprises account for the majority of jobs. In the case in question, 110,648 workers were employed in 118 establishments, which means a density of 937 workers per enterprise.

In 1999, the predominant activities on this scene were those of Group iii, in this case electric and electronic products, employing 104,462 persons, i.e. 73.6% of the personnel of the Division. Large enterprises employed 87,341 in 93 establishments (yielding a density of 939 workers per establishment).

Disaggregation of activities in this Group confirms the characteristic of the new poles of manufacturing development in the 1990s, which in this state as well are dominated by maquiladora plants specializing in electric and electronic products. In confirmation of this, we observe two very important classes:

- Manufacture and/or assembly of radio, tv and communications appliances. In 1999 it employed 41,026 workers in 64 establishments. Most of the jobs were concentrated in large enterprises, with 38,128 workers in 28 establishments.

- Manufacture and/or assembly of electric or electronic appliances and accessories by connection. In the first four months of 1999, this industrial class 38,438 employed workers in 119 establishments. As in the Division in general, it is the large enterprises (39 establishments) which employed most of the workers, 31,522.

III.2.7. Jalisco

Among federal entities Jalisco occupies fourth place on the scale of industrialization in Mexico. Its shares of the manufacturing GDP in the years from 1970 to 1995 have averaged around 6% (see Figure 2). However, in recent years we have seen a recovery of manufacturing activity due to increased presence of the metal and machine industry, especially activities related to the electric and electronic industry.

Division VIII as a whole showed a recovery similar to that of the development poles with assembly plant industries. In 1995 there were 2,749 establishments with 45,995 jobs27, and by 1999 there were 80,556 workers distributed among 3,153 establishments. This means that employment increased in five years by 75.1% and establishments by 14.6%.

The large establishments (45 units) employed 50.8%, i.e. 40,946 workers.

A breakdown by groups of products shows that the most important activities were those related to electric and electronic products.

[26] The 1994 census recorded for DIVISION VIII 72,279 workers and 984 establishments in 1994.
[27] The 1994 census indicated 3,748 establishments and 47,262 employees.

Table 12a Baja California Norte. Configuration of Division VIII Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Metal Products, Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	549	193	78	99	919
1996	589	195	84	113	981
1997	647	199	92	119	1,057
1998	690	227	93	128	1,138
1999*	673	197	102	118	1,090
Employees in Division VIII					
1995	2,235	8,570	12,776	72,080	95,661
1996	2,590	8,395	13,991	87,011	111,987
1997	2,832	8,412	14,514	106,356	132,114
1998	2,952	9,709	15,061	113,172	140,894
1999*	3,360	8,740	19,125	110,648	141,871
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	48	22	7	5	82
1996	54	19	9	7	89
1997	51	18	11	7	87
1998	52	26	9	7	94
1999*	54	20	9	7	90
Employees in Group I					
1995	273	895	1,056	3,742	5,966
1996	315	803	1,532	4,378	7,028
1997	269	651	1,586	5,615	8,121
1998	293	1,166	1,640	6,692	9,791
1999*	330	914	1,604	6,945	9,792
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	351	91	14	18	474
1996	388	97	20	15	520
1997	440	102	18	20	580
1998	472	111	26	18	627
1999*	459	95	30	18	601
Employees in Group II					
1995	1,348	3,604	2,305	11,869	19,126
1996	1,599	3,827	3,584	14,009	23,019
1997	1,828	3,961	2,782	18,790	27,361
1998	1,911	4,150	4,406	16,745	27,212
1999*	2,222	3,625	5,410	16,361	27,618
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	150	80	57	76	363
1996	147	79	55	91	372
1997	156	79	63	92	390
1998	166	90	58	103	417
1999*	160	82	64	93	399
Employees in Group III					
1995	614	4,071	9,415	56,469	70,569
1996	676	3,765	8,875	68,624	81,940
1997	735	3,800	10,146	81,951	96,632
1998	748	4,393	9,015	89,735	103,891
1999*	808	4,201	12,111	87,341	104,462

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

In Group III there were 39,424 workers recorded (48.9% of the total), of whom 39,067 were employed in the large establishments (26 units), which yields one of the highest densities: 1,156 workers per establishment.

Group II in 1999 employed 33,641 workers, and their distribution is similar to the cases of Puebla and the Federal District for micro and small units producing metal furniture and products, i.e.: 2,058 micro enterprises employed 9,553 workers; 293 small enterprises employed 10,363 workers; 40 medium enterprises had 6,436 workers and 13 large enterprises employed 7,290 persons.

Group I is the smallest of the three with 7,491 workers of whom 3,590 were employed in six large enterprises (this certainly includes the Honda assembly plant in El Salto). In this group one important category is the scale of medium enterprises, which employed 6,436 workers in 40 establishments.

Breaking down Group III, electric and electronic products, we arrive at the following results:

- Manufacture and assembly of (dry) batteries, electric and electronic components. Employs 6,704 workers in eight establishments. The large enterprises (four units) employ 6,624 workers, yielding one of the highest densities in the country per group of products: 1,656 workers per establishment.

- Manufacture and/or assembly of electric or electronic appliances and accessories by connection. In 1999 there wee 58 establishments with 11,664 workers of whom 10,183 were employed in eight large establishments.

Table 13 Jalisco. Configuration of Division VIII. Total and Groups of Products by Size of Establishments and Distribution of Employment					
Division VIII Metal Products, Machinery and Equipment					
Establishments in Division VIII					
	Micro	**Small**	**Medium**	**Large**	**Total**
1995	2,304	374	48	23	2,749
1996	2,323	399	55	34	2,811
1997	2,388	446	63	39	2,936
1998	2,578	465	68	51	3,162
1999*	2,711	397	73	45	3,153
Employees in Division VIII					
1995	9,455	12,820	7,571	16,148	45,994
1996	10,078	14,126	7,927	24,353	56,484
1997	10,447	15,566	9,468	34,588	70,069
1998	11,283	15,393	10,400	43,216	80,292
1999*	12,806	14,093	12,711	40,946	80,556
Group I Automobile and Transport Industry					
Total establishments in Group I					
1995	121	38	2	4	165
1996	122	36	5	3	166
1997	113	34	9	6	162
1998	115	31	12	7	165
1999*	125	25	14	6	169
Employees in Group I					
1995	544	1,443	340	2,435	4,762
1996	542	1,408	672	1,401	4,023
1997	472	1,334	1,177	3,019	6,002
1998	509	1,101	1,573	3,750	6,933
1999*	635	979	2,288	3,590	7,491
Group II Metal Furniture and Products					
Total establishments in Group II					
1995	1,708	261	32	7	2,008
1996	1,728	276	38	13	2,055
1997	1,785	320	33	14	2,152
1998	1,950	343	38	15	2,346
1999*	2,058	293	40	13	2,330
Employees in Group II					
1995	6,833	8,829	4,968	3,491	24,121
1996	7,478	9,662	5,396	5,590	28,126
1997	7,761	11,058	4,763	6,495	30,077
1998	8,461	11,279	5,623	7,415	32,778
1999*	9,553	10,363	6,436	7,290	33,641
Group III Machinery, Equipment and Non-Electric, Electric & Electronic Products					
Total establishments in Group III					
1995	475	75	14	12	576
1996	473	87	12	18	590
1997	490	92	21	19	622
1998	513	91	18	29	651
1999*	528	80	20	26	653
Employees in Group III					
1995	2,078	2,548	2,263	10,222	17,111
1996	2,058	3,056	1,859	17,362	24,335
1997	2,214	3,174	3,528	25,074	33,990
1998	2,313	3,013	3,204	32,051	40,581
1999*	2,619	2,752	3,988	30,067	39,424

** Refers to the first four months of this year*
Source: Secofi-Siem-Imss

MAP 5

III.3. The Most Important Industrial Districts in the Metal and Machine Industry in Mexico (1999)

As an epilog to this chapter, we can identify the geographic location of the 12 most important states where the metal and machine industry has its most important establishments and the most numerous concentrations of workers. Map 5 shows the position of the entity and the number of workers for each division.

For a more detailed observation, Map 6 shows the complex of the most important industrial districts which, in terms of their number of employees, level of density, share in iron and steel production or their importance in the manufacture of products of GROUP I (automobiles and auto parts) and GROUP III (machinery, equipment, electric and electronic products)—and in accordance with our initial organigram—may be visualized in accordance with their position.

This complex of locations by federal entities and industrial districts concentrates the processing of information which we have analyzed throughout this *Profile of the Metal and Machine Industry in Mexico*.

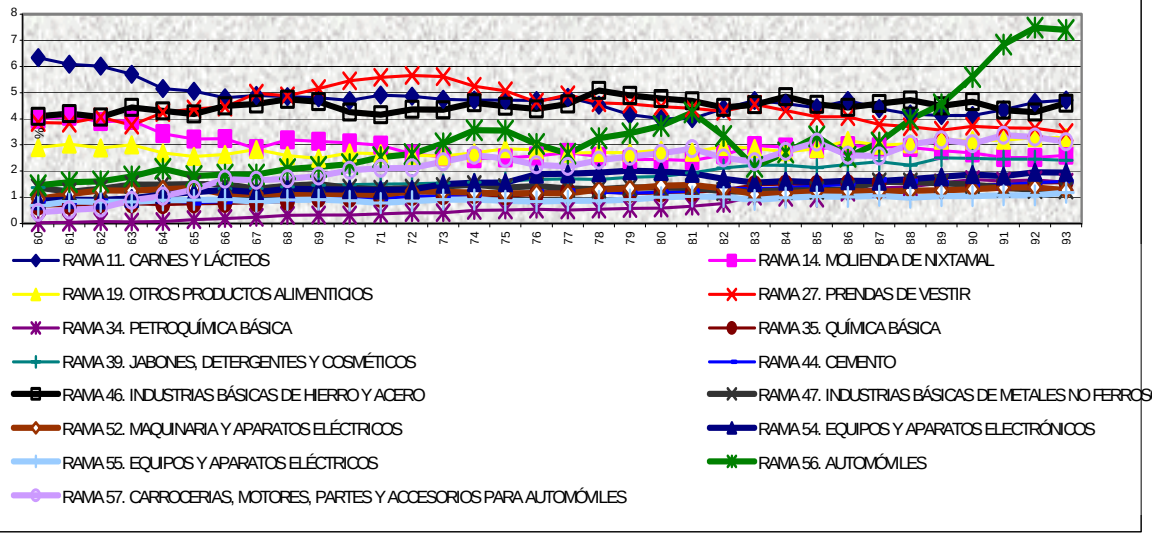
MAP 6

MAP 7

IV. Profile of the Automobile Industry in Mexico

The automobile industry in Mexico (AIM), consisting of Branches 56 (automobiles) and 57 (auto parts) in the System of National Accounts (SNA), the is the most important manufacturing industry in Mexico in terms of formation of added value. *Figure 6*, which is based on a selection of the most important industrial branches, illustrates how in the period from 1960 to 1993 the automobile industry (rama 56) has soared in the 1990s.

Figure 6
Manufacturing Industry.
Selection of Industrial Branches. Shares in %
1960-1993



Source: Ibid.

The modern history of this industry in Mexico goes back to the 1980s, when the restructuring of plants was linked to the restructuring of the large international automotive consortia with the result that Mexico became a platform oriented toward supplementing quotas for the major markets. That strategy has taken over virtually all of Mexican production due to the fact that the domestic market has experienced constant fluctuations, and since the 1994 crisis has maintained a very low consumption profile.

Originally, the restructuring of production was associated with the production of engines and parts, and in the late 1980s with the production of finished units.

In the early ’90s the production of auto parts began to gain in importance, displacing engines in terms of value, so that by the middle of the decade the Mexican automotive industry had consolidated its position as the most important in manufacturing.

A summary review of the macro indicators of its behavior in recent years can shed light on the foregoing:

a) In the last five years (1994-1998), the AIM has had a total figure of foreign direct investment above 10 billion dollars. This is a substantial amount in comparison to the values of total and manufacturing FDI. As can be seen in *Table 14*, its annual percentage as a share of investments in manufacturing as a whole places it as a fundamental industry for the purposes of budgeting the present industrial plan, having received some 40% of total FDI over the last five years. Within this behavior, it may be noted that in that period the auto parts segment began to exhibit levels of annual investment somewhat higher than the total for the finished unit industry, which indicates the presence of new components in the production locations.

Table 14 Foreign Direct Investment.
Total, Manufacturing and Automotive
Millions of Dollars

	Total in Mexico	Manufacturing Industry	Finished Automotive Industry	Auto Parts Industry	Total Automotive	Automotive as part of Manufacturing Industry
1994	10,493.1	6,063.7	1,363	869	2,232	36.8
1995	8,077.1	4,672.4	597	1,047	1,644	35.2
1996	7,396.4	4,508.8	852	1,123	1,975	43.8
1997	10,795.6	6,695.5	1,072	1,195	2,267	33.9
1998	4,470.6	3,530.0	1,123	1,200	2,323	65.8
Total	41,232.8	25,470.4	5,007	5,434	10,441	41.0

Note 1. 1998 for Total in Mexico and for Manufacturing Industry are preliminary.
Note: Investment in auto parts for 1998 is estimated on the basis of newspaper reports.
Sources: Secofi, Dirección General de Inversión extranjera y BDINEGI.

b) Export statistics are another reflection of this importance. In recent years, within manufacturing exports with monthly averages of 8.5 billion dollars, the automotive industry has been exporting more than 20 billion dollars. The annualized figures (*Table 15*) indicate that within the upward trend of manufacturing exports in the 1990s—which rose from 14.9 in 1990 to 106.4 billion dollars in 1998—the AIM has been exporting slightly more than 20% of the total value (in this context, it should be borne in mind that in the face of recent problems of disequilibrium in manufacturing balances, the AIM was able to maintain positive balances).

Table 15 Manufacturing and Automotive Exports
Billions of Dollars

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Manufacturing exports	14.8	32.3	36.1	42.5	51.0	67.3	81.0	95.5	106.4
Total automobile exports	4.8	5.7	6.0	8.6	10.5	14.6	19.1	20.4	22.1
% IA in manufacturing exports	32.3	17.7	16.7	20.4	20.6	21.7	23.7	21.4	20.8
Engines	1.4	1.1	1.2	1.3	1.7	2.1	2.2	2.2	2.1
Auto parts	0.6	0.7	0.8	2.4	3.6	3.1	3.6	4.2	5.3
Automobiles	2.6	3.8	3.9	4.9	5.0	9.3	13.2	13.8	14.7

Sources: Secofi, Dirección General de Inversión extranjera, BDINEGI y AMIA. 1999.

c) The levels of physical production indicate that from the early 1990s Mexican production was based on producing complete units for export. This aspect must be evaluated in the context of the recent processes of regionalization of production, i.e. the production strategies followed by the big auto corporations in Mexico are essentially predominant for the scene of competition in the American and Canadian markets; thus, Mexican operations must refer in one way or another to this context. *Table 16* provides data on production in the region, and

shows that Mexican production already accounts for 8% of production, equivalent to 1,427,270 units (1998), of which 978,758 were for export.

Table 16 Automobile Production in North America and World Production. Units and Proportions

	1989	1990	1991	1992	1993	1994	1995	1996	1997
United States	10,874,032	9,782,997	8,810,521	9,701,934	10,897,665	12,262,737	11,985,457	11,798,905	12,149,493
Canada	2,001,680	1,920,565	1,888,293	1,961,193	2,248,418	2,320,603	2,407,999	2,396,756	2,577,998
Mexico	641,275	820,558	989,373	1,080,863	1,080,802	1,112,700	935,017	1,219,424	1,336,284
North America	13,516,987	12,524,120	11,688,187	12,743,990	14,226,885	15,696,040	15,328,473	15,415,085	16,063,775
% of Mexico in North America.	4.7	6.6	8.5	8.5	7.6	7.1	6.1	7.9	8.3
World Production	49,247,810	*48,553,969*	*46,928,417*	*48,088,050*	*46,785,380*	*49,785,380*	*49,982,819*	*51,331,965*	55,133,963
% of North-America in World Product.	27.4	25.8	24.9	26.5	30.4	31.5	30.7	30.0	29.1

Sources: World Motor Vehicle Data, 1998 Edition y Ward's Automotive Yearbook, 1998

Table 16a Automobile Production in Mexico. Units

Production	1990	1991	1992	1993	1994	1995	1996	1997	1998
Domestic	525,133	595,529	660,129	562,027	522,350	152,500	240,423	345,846	448,832
Export	278,558	365,354	391,050	493,194	575,031	778,678	970,874	984,430	978,758
Total*	803,691	960,883	1,051,179	1,055,221	1,097,381	931,178	1,211,297	1,330,276	1,427,590

**Total production does not include buses and trucks.*
Source: Asociación Mexicana de la Industria Automotriz (AMIA). Boletines 1990-1999

These data, and especially exports (in units and values) may suggest that for the regionalization of production to function, it has been necessary to approve productive policies and develop synchronies for the production of models of cars and trucks for the most important market in the world.

Thus, in this context the signing of the free trade agreement (FTA) in 1994 had a direct effect on that integration to the extent that as of its start-up, it has defined the general framework of regionalization of production and market access, the community of interests in the countries involved in legal and labor terms and, in particular, the Rules of Origin, which stipulate degrees of regional and national integration to be reached, as well as the regulatory procedures for European and Japanese competitors with projects for establishing their own plants in Mexico to catapult production toward the American market[28].

[28] For example, for the case of rules in Mexico, see these excerpts from the part entitled ***Rules of Origin***:
Industry of auto parts, national suppliers and independent assembly plants
1. Mexico may not require that an enterprise obtain a level of national added value higher than 20 percent of its total sales as one of the conditions for obtaining registration as a national supplier or enterprise of the auto parts industry.

Tables 17, 18 and 19 provide a better view of the structure of the automotive industry in North America and the general features of the producing plants in Mexico; in them we can appreciate the levels of complementarity achieved around enterprises, plants, models and, in Table 20, the levels of labor costs in the finished product plants in Mexico.

This information seems to indicate that the automotive structure of North America is moving toward strategies characterized by setting production quotas based on continental platforms, where the interaction of plants has already advanced on the basis of what is known as twin plants, e.g.: for the Escort, Wayne—Hermosillo; for the Cavalier, Ramos Arizpe—Lordtown; for the Stratus, Toluca—Sterling Hights; for the Sentra, Aguascalientes—Smyrna; etc., see Table 18.

Within this trend the Flint-GM strike of 1998 and its spectacular impact on all of its plants in North America drew attention as regards management strategies to the vulnerability of supply systems (many of them just-in-time) in that integration with suppliers still maintains highly vertical and distant structures.

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2. Only for the purposes of paragraph 2, in calculating national added value, Mexico may require that a national supplier or enterprise of the auto parts industry include customs duties in the value of imports incorporated in the auto parts produced by said supplier or enterprise.

3. Mexico shall consider as a national supplier an independent assembly plant which so requests and which fulfills the corresponding requirements established in the prevailing Automotive Decree, as amended in accordance with paragraphs 2 and 3. Mexico shall continue to grant all independent assembly plants which request recognition as national suppliers all the prevailing rights and privileges granted to independent assembly plants in accordance with the prevailing Decree for the Promotion and Operation of the Assembly Plant Industry (22 December 1989)(Maquiladora Decree).

National Added Value

4. Mexico shall establish that the national added value of suppliers (NAVs) required from an industry of the finished product industry shall be calculated as a percentage of greater of the following two values: (a) the reference value of the enterprise of the finished products industry as defined in paragraph 8; or (b) the total national added value (NAVt) of the enterprise of the finished product industry, except that Mexico shall provide that an enterprise of the finished product industry which has begun production of automotive vehicles in Mexico after the model year 1991 shall calculate its national added value of suppliers (NAVs) required as a percentage of its total national added value (NAVt).

5. Mexico shall not require that the percentage referred to in paragraph 5 be higher than: (a) 34 percent in each of the first five years, beginning on 1 January 1994; (b) 33 percent in 1999. (FTA Automotive Annex; 1994).

Table 17 Automobile Industry. List of Plants in North America					
Enterprise	**Location/ Plant/Line**	**Enterprise**	**Location/ Plant/Line**	**Enterprise**	**Location/ Plant/Line**
Autoalliance US	Flat Rock	Ford/US/Car	Atlanta Chicago	*GM/US/Light Truck*	Flint 1 (Light) Flint 1 (Medium)
BMW	Toluca/Mexico Spartanburg/US		Dearborn Kansas City Wayne		Fort Wayne Janesville (Light) Janesville (Medium)
CAMI/Canada	Ingersoll (autos) Ingersoll (light truck)	Ford/US/Light Truck	Wixom Avon Lake Edison		Linden Moraine Pontiac East
Chyrsler/Canada/ Car	Bramalea		Kansas City Kentucky Truck (Light)		Shreveport Wentzville
Chyrsler/Canada/ Lt.Truck	Pillette Rd. Windsor		Kentucky Truck (Medium) Lorain Louisville	Honda/Canada	Alliston (Car) Alliston (Truck)
Chrysler Mexico/ Autos	Toluca		Michigan Truck Norfolk	Honda/Mexico/Autos Honda/US/Car	El Salto, Jalisco East Liberty
Chrysler Mexico/ Trucks	Lago Alberto. Light Lago Alberto Medium	GM/Canada/Car	St. Louis Twin Cities Oshawa 1	Mercedes/Mexico/autos Mercedes/ Mexico/trucks	Marysville Santiago T. St. of Mexico Santiago T. St. of Mexico
Chrysler/US/ Car	Belvedere Conner Sterling Heights	GM/Canada/Lt. Truck GM/Mexico/Autos	Oshawa 2 Ste. Therese Oshawa Truck Light Ramos Arizpe, Coahuila	Mercedes/USA/Cars and LT Truck Mitsubishi/USA/Cars-LT Truck Nissan/Mexico/Autos	Vance Normal Cuernavaca Aguascalientes
Chrysler/US/ Lt. Truck	Dodge City-Warren Jefferson North Newark St. Louis South St. Louis South Toledo	GM/Mexico/ Trucks GM/US/Car	Ramos Arizpe. Light Silao. Light Toluca. Light Bowling Green Buick City (Flint) Craft Center (Lansing) Fairfax	Nissan/Mexico/light trucks Nissan/USA/Car- Lt Trucks NUMMI/USACar-Lt Trucks Subaru-Isuzu/USA/ Cars-Lt Truck	Cuernavaca Smyrna Fremont Lafayette
Ford/Canada/Car	St. Thomas		Hamtramck Lansing M	Toyota Canada Car	Cambridge
Ford/Canada/ Lt. Truck	Oakville Ontario Truck		Lansing C Lordstown Oklahoma City	Toyota/USA/Cars-Lt Truck Volkswagen/ Mexico/ Autos	Georgetown
Ford/Mexico/ Autos	Cuautitlán. St. of Mexico Hermosillo, Sonora		Orion Spring Hill Wimington	Volvo/Canada/Cars	Puebla Halifax
Ford/Mexico/ Trucks	Cuautitlán.Light Cuautitlán. Medium	GM/US/Light Truck	Arlington Baltimore Detroit, Doraville	Volvo/USA/ Heavy Truck	Dublin

Source: Based on Ward's Automotive Reports

Table 18 Twin Plants for Assembly in North America 1996, 1997, 1998		
Enterprise and Model	**Mexico**	**United States and Canada**
Chrysler	Toluca	Belvedere
Neon (SC)	Toluca	Sterling Heights
Cirrus/Stratus/Ply Breeze (S)	Toluca	Bloomington
Sebrin/Avenger (S)	Saltillo	St. Louis # 2
Dodge Ram (P)	Lago Alberto	Warren
General Motors	Ramos Arizpe	Lordstown
Chevy Corsa/Monza	Ramos Arizpe	Lordstown
Cavalier/Sunbird/Toyota Cav. (SC)	Silao	Lansing
Suburban/Silverado/Tahoe	Silao	Janesville
Yukon		Arlington
Ford	Hermosillo	Wayne
Escort/Tracer (SC)	Cuautitlán	Kansas City
Contour/Mystique (C)	Cuautitlán	Kansas City
Ford F-series (P)		Kentucky Truck
		Ontario
		Michigan Truck
		Norfolk
Nissan	Aguascalientes	Smyrna
Hikary-Tsuru/Sentra/Tsubame/Lucino (SC)	Cuernavaca	Smyrna
Nissan Pickup		

Note: C= compacts; SC= subcompacts; S= sports; P= pickup
Source: Labor Studies Center, WSU. With data from Automotive Industries; Autofacts, division of Price Waterhouse Coopers Consulting

Table 19 Finished Product Enterprises in Mexico

Enterprise	Product or Process	Location	Installed Capacity	Models
BMW	Automobile Assembly	Amomolulco, State of Mexico	3 000 vehicles	323/A, 328iA, 528/A & 540/A
CHRYSLER	Trucks Vans Engines Autos, 8 cl engines, transmissions, stamped parts and engine supports	Mexico FD Saltillo, Coahuila Ramos Arizpe, Coahuila Toluca, State of Mexico	413 000 vehicles * 954 400 engines *	Neon, Cinrus, Stratus, Chrysler RT, C 200, C-230, C230K, C-260, E320, Ram Charger, Ram 1500, Ram 2500, Ram 3500 & Ram 6500
FORD	Assembly Engines Stamping and assembly	Cuautitlán, State of Mexico Chihuahua, Chihuahua Hermosillo, Sonora	154 800 vehicles 435 000 engines 168 000 vehicles	Escort CT120, C170E, C170N & C212, Escort Coupe ZX2-CT 120 & C212; Tracer, Contour, Mystique, Mondeo; F/150, 250, 350, 450, 550 & 700/800, M450; B700/800
GENERAL MOTORS	Engines, assembly and stamping Engines, casting and assembly Assembly	Ramos Arizpe, Coahuila Toluca, State of Mexico, Silao, Guanajuato	317 000 vehicles* 900 000 engines*	Chevy Swing, Joy Monza & Pick Up; Cavalier, Pontiac, Sunfire, Suburban, Silverado, C-3500, P-30 & P-70
HONDA	Automobile assembly	El Salto, Jalisco	13 000 vehicles	4 Cylinders
VOLVO	Automobile assembly	Tultitlán, State of Mexico	250 vehicles	S40/V40 & S18
NISSAN	Assembly of autos and trucks Engines	Jiutepec, Morelos Aguascalientes, Aguascalientes Lerma, State of Mexico	300 000 vehicles* 785 800 engines*	Tsubame, Tsuru, Sentra, Chassis, Cab & Pick Up.
VOLKS-WAGEN	Automobile assembly. Engines	Cuautlancingo, Puebla	428 800 vehicles 621 000 engines	Sedan, Golf 2 & 4 doors, Jetta, Cabrio & New Beetle

** For each plant*
Source: Secofi. 1999

All indications are that the solution which is emerging is the formation of platforms whose relations are based on twin productions, which are complementary in the final part and with options of flexibilization (i.e., expansion, in the case of strikes, work stoppages or problems in the other plants of the platform) to cover demand. For example, for GM, the Ramos Arizpe and Silao plants are crucial in the new GMT800 project based on the production of high value vehicles and a complex chain of suppliers which for example in Silao has been recently consolidating just-in-time delivery mechanisms and subassemblies within the terminal enterprise (see Table 18 which indicates existing projects).

Table 20 Summary of pay of worker and technical personnel in the Mexican automobile industry

Plant	Jobs	Average daily pay	Pay plus direct & indirect benefits
Chrysler-Assembly Toluca	3,041	$138.12	$265.43
Chrysler-Engines-Toluca	861	$152.83	$293.58
Chrysler-Engines-Saltillo	605	$94.00	$185.19
Chrysler-Autom. trans.	89	$159.46	$265.97
Chrysler-Trucks-Saltillo	2,204	$79.90	$144.99
Chrysler- Trucks L-Albert	2,077	$179.54	$349.39
Chrysler	**8,877**	**$131.99**	**$252.44**
Mercedes Benz P. Norte	112	$84.50	$106.24
Mercedes Benz P. Toluca	847	$103.82	$146.88
Mercedes Benz	**959**	**$101.56**	**$142.13**
Kenwort	1,112	$134.78	$200.22
MASA	1,958	$75.22	$89.53
Ford Chihuahua	782	$124.75	$281.50
Ford Hermosillo	2,134	$145.05	$314.65
Ford Cuautitlán	3,414	$148.32	$250.30
Ford	**6,330**	**$144.31**	**$275.85**
VW	12,812	$121.24	$241.40
BMW	63	$122.57	$135.02
Nissan Aguascalientes.Comp.	1,631	$92.57	$141.43
Nissan Aguascalientes-Vehí	1,180	$89.87	$137.07
Nissan CIVAC	1,882	$156.63	$273.67
Nissan Lerma	758	$95.94	$154.22
Nissan Toluca	65	$85.39	$139.46
Nissan	**5,516**	**$114.23**	**$187.35**
GM Toluca	2,299	$113.09	$218.58
GM Ramos Arizpe Engines	2,095	$116.20	$237.71
GM Ramos Arizpe Assembly	2,830	$105.65	$208.41
GM Silao	2,468	$100.01	$202.74
GM S.P.O.	73	$78.40	$136.89
GM	**9,765**	**$108.03**	**$215.12**
Dina Trucks	573	$96.68	$167.91
Dina Autobuses	472	$102.18	$175.65
Dina Plastics	125	$88.97	nd
Dina Composites	292	$42.86	nd
Autopartes Hidalguenses	157	$44.19	nd
Dina	**1,619**	**$82.89**	**$171.41**
Weighted industry Average	***49,038***	***$119.54***	***$223.07***

Sources: Program of Studies of the Automotive Industry. FE-BUAP (11/XII/98) and VW de Mexico. Administration and Payroll Department. (1/X/98)

In this context, it is important to observe that GM, FORD and CHRYSLER statements to the effect that in Mexico they follow guidelines of the modular factory similar to VW, would seem to be involved in a sort of third restructuring[29] with supply agents. Mexican assembly plants (*Tables 19*

[29] In this idea of dividing restructuring of the auto industry in Mexico, the first restructuring took place in the 1980s when the plants were built in northern Mexico to produce engines and parts for export. The second restructuring was in the years 1982-1992 when the production of complete units was promoted both in new factories such as Hermosillo, Aguascalientes, Ramos Arizpe and in existing ones such as Toluca and Puebla.

and *20*, and Map 7) in the period 1994-1999 have continually been increasingly surrounded by auto parts plants within the general trends associated with the modular factory projects.

The strengthening of this trend for the immediate future gives the impression that they (the Mexican assembly plants) will constitute the support to supplement production quotas of Canadian and American plants at the same time as developing a mechanism for the transition in North America to automobiles without internal combustion engines in the next century.

Finally, as far as Mexico is concerned, there is no need to stress what is already well known about the general framework of economic policy which has served to justify government support for the automobile conglomerates: first, setting Mexico's economic policy to encourage *economies of agglomeration* with its core enterprises and subsidiaries as a resource for the industrialization of new regions[30]; second, the sensitive issue of the labor plan applied to maintain the low value of Mexican labor (*Table 20*); the direct interference in the workers' organizational structures to encourage the atomization of unions and public resources used to generate processes of regional training (e.g. the Labor Market Modernization Projects I and II applied in 1995-99), to encourage an increase in levels of productivity, quality and efficiency of labor performance required by the automotive corporations.

These quality and productivity standards had already been reached as of the late 1980s for Mexican workers in the auto industry, and are the best guarantee for management that the future of the Mexican plants will be consistent with the strategic project of generating platforms in North America.

Thus, on this basis it is possible to recognize the other part of the scenario, the relocation of the auto parts industry and its implications for the Mexican regions.

[30] Where transnational corporations have enjoy a special place, if we consider the principles of Mexican industrial policy in the '80s and '90s.

MAP 8

V. Profile of the Auto Parts Industry

Map 8 shows an initial approximation of the profile which the agglomeration of the auto parts industry is assuming in Mexico. Based on the information provided by our data base on the auto parts industry and in view of the process underway for some 500 medium and large enterprises in Mexico, we propose an initial view based on a ranking of enterprise agglomerations in various districts of Mexico.

The difficulty is substantial, since we must not just prepare a specialized directory of auto parts enterprises[31], but must also understand how within this spatial distribution the supply networks are being consolidated and, of course, whether this can be explained within the pattern of *just-in-time/kanban* systems and within the new concepts related to the modular factory.

We may distinguish two types of groupings: those formed around assembly factories and those which exist in regions far away from them. In the first case we have as an example, Puebla—VW; State of MEXICO—CHRYSLER, GM, FORD; Coahuila—GM, CHRYSLER; Aguascalientes—NISSAN. In the second case consists of enterprises in places such as Reynosa, Ensenada, Ciudad Juárez, etc., where the *maquiladoras* have prospered since the 1980s.

It is fairly clear that the first type of agglomeration is constituted on the Cluster principle, while the second corresponds to the export/*maquiladora* model. The integration and mergers among these two forms in the 1990s have complicated matters as regards arriving at an accurate analysis of the present state of the networks.

Thus, we have proceeded in the identification of enterprises based on their location (municipality and/or locality), then identifying the type of product and the end use of its products[32]. In *Annex 1* we provide a sample of states and municipalities with parts producing enterprises[33] of the types referred to, e.g. in Baja California Norte we observe that the supply industry which has emerged according to the assembly for export principle is concentrated in two municipalities, Mexicali and Tijuana, and the biggest family of products is that of polishing wheels, centers, plugs, piston rings. It may be seen that in general this complex of enterprises is oriented toward low-tech accessories.

In the case of Chihuahua the situation is more complex. The districts of Ciudad Juárez and Chihuahua have the majority of enterprises and in terms of types of production we can see that they offer an interesting variety of products ranging from trim and harnesses to hi-tech products (solenoids, electronic circuits, etc.).

In the State of Chihuahua subsidiaries of GM and FORD predominate (FORD has installed its engine plant there), and much of the production of the assembly plants—e.g. DELPHI GM of Ciudad Juárez—have diversified their markets by supplying plants of the *Ramos Arizpe* complex.

[31] Preparing a directory is a major task in this process of investigation. For example, the business group known as the National Auto Parts Industry has updated registers of enterprises for products and suppliers but which only cover a fraction of enterprises, most of them with high national content. The SECOFI records, which ought to be the most complete, are not public, and finally the records of management associations generally do not include the enterprises of transnationals recently established in the country.

[32] Our data base already has a directory of 1,165 auto parts enterprises with information on the type of product, value of production, added value, assets, employment, investments, etc.

[33] The annexes to this profile are drawn from our database of 2,047 enterprises of the MIM.

Examples of industrial locations near the Cluster agglomerations are Coahuila, the State of Mexico and Puebla. In the first case—whose main towns with large populations are Saltillo, Ramos Arizpe, Candela, Piedras Negras, Torreón—has become a focus absorbing a range of products of a large number of enterprises intended for the GM and CHRYSLER assembly lines. Thus suppliers offer hi-tech products ranging from engine parts (injectors, pistons, camshafts, etc.) to electronic systems and components, and also including electric harnesses, trim, exhausts, etc.

The State of Mexico has the highest industrial concentration and thus the greatest diversity of products, which are virtually all intended for Mexican assembly plants, although those which have finished product plants are of particular importance: GM, CHRYSLER, FORD, BMW, MEXICANA DE AUTOBUSES, VOLVO, DAIMLER BENZ, NISSAN (engine plant).

Industrial plants in the State of Mexico are an example of the hybridization which led to the restructuring of the 1980s and the association among the big supply enterprises of Mexican origin with the transnationals in the 1990s: Taloymex, Tepeyac, Nacional de Autopartes, Tebo. Although they have locations in many cities, in fact they are essentially active in two main areas: one extending from the north of the Federal District (Naucalpan, Cuautilán) and one which lies west of the Federal District around the Lerma—Toluca complex.

In the case of Puebla we can see the Cluster principle in the location of market diversification projects and the importance of national suppliers in relation to supplier exporting to the Puebla plant. We thus find that some enterprises such as Benteler (suspensions, chassis), Luk (clutches), Rassini (brake systems), Krupp (crankshafts, connecting rods, etc.), Siemens (harnesses), aside from their primary function as supplier to VW, have also been selling surpluses to other enterprises. The Puebla auto parts industry is already finding its place in the Mexican supply network, although not in the same way as in the State of Mexico.

Three Models of Integration

We may use our information on enterprises, products, clients, investments, etc. to get identify the operating principles of the plants in Mexico surrounding the business projects of the *Platform* and the *Modular Factory*. We have been able to identify three types of behavior based on their general characteristics.

1. Ford assembly plants in Mexico (Cuautitlán and Hermosillo) operate essentially based on imports, i.e. their levels of supply with enterprises operating in Mexico are advancing slowly. Most purchases in Mexico are made for the assembly plants of Cuautitlán and Chihuahua (engines), while the levels of Mexican supply in Hermosillo are just beginning to emerge and most needs are satisfied with imports.

   According to our survey, in 1996 Ford de Mexico imported 86.5 percent of its materials and products for assembly, in 1997 that proportion fell to 77.3 percent, and in 1998. The foregoing means that more than three quarters of intermediate consumption value come from American plants or from Ford's Japanese partners. This proportion is even greater if we consider that in 1998 purchases of assembly materials and other materials for finished product plants was close to 2.4 billion dollars. (SHyCP, 1997-1998).

2. Starting with the opening of he Silao plant (at the same time as it closed its old plant in the Federal District), GM has been consolidating its strategy of diversification of finished products (Chevies, Suburban, Trucks). For that purpose GM already had on the northern border one of the largest networks in Mexico of engine and parts production for export. If we observe in *Annex 2* the column which refers to the start-up year, the whole structure has

been in operation for an average of more than 15 years. If we consider that some of these enterprises have been generating technologies (e.g. DELPHI, Ciudad Juárez, Carrillo-Hualde, 1998), the GM supply structure has become one of the most sophisticated, especially counting the agglomeration of suppliers of the Ramos Arizpe and Toluca complexes.

This configuration of mexicanizing part of the export production, formation of clusters in Toluca, Ramos and Silao (see Table, Annex 1) and resorting to imports from plants in Michigan, has generated the bases for designing the strategy of *production platforms*.

As is well known, GM is the world leader in production, the main competitor in the American market, and has been operating with autonomous production divisions for many years. This would seem to indicate that GM is in a position to integrate manufacturing in the coming years in both aspects indicated above: on the one hand, a project to standardize processes (MVT800 Platform) in all its plants in the three countries of North America and as a fundamental complement, and on the other hand, to develop integration with suppliers along the lines of the modular factory (restructuring in Silao[34]).

3. In the last seven months VW de Mexico has consolidated its position as the most important export enterprise in Mexico. In 1998 it produced 338,959 units for export, a figure very close to that of Chrysler, which was the leader in this segment (359,442 units), but in the first half of 1999 vw turned out 168,018 units (of which 119,906 were for the American market), while Chrysler exported 114,317 units; GM 96,444 and Ford 95,804 (AMIA, 99).

   Most of the production of VW's Puebla plant is for export (average of 73% in 1998 and 86.3% from January to June 1999), its use of capacity is at the highest point in its history, this year more than 32,000 units on the average are being produced, and there has already been one month with a record-breaking output of 39,638 units.

The modular factory project has not advanced substantially since 1997-98 due to resistance on the part of the unions, whose efforts to enable workers from supplier enterprises to gain free access to the plant remain the main obstacle to progress with that project. Nevertheless, organization of the Cluster is moving ahead as regards external integration to supply complete modules, and on the production lines one can already see, as in Silao, a large number of workers of diverse origins to put the finishing touches or to establish the "guarantees" that just-in-time deliveries are synchronized with the daily production quality and schedule.

VW de Mexico is supplied from three sources: the FINSA cluster and adjacent parks, suppliers from other regions, and imports. We have processed information on suppliers and products from other parts of Mexico[35] as well as on subsidiaries and partners of the VW consortium which carry out imports; *Annex 1* (in the part on Puebla) and *Annex 3* deal with enterprises located in Mexico which help in the process of supplying VW. Adding the approximately 70 enterprises in Puebla (first and second rank suppliers) to the 182 enterprises located in other states (figure for 1996 and refers to enterprises which can be classified as second and third rank), the number of enterprises and

[34] In the summer of 1999 the Silao plant was in the process of complete restructuring. Designed to be expanded, it was constructed in the form of an angle so that the production processes would not be affected. In the first years, 1995-97, production was maintained with imports and parts produced by plants in Mexico (Toluca and Ramos). Recently, encouraged by the effects of a tri-national work stoppage due to the Flint, Michigan, strike, an industrial corridor has been formed which already has some 20 enterprises practicing just-in-time supply and which will begin to experiment in the coming months with supplying more integrated products and, in some cases, in-plant subassembly in the manner of the modular factory.

[35] In *Annex 3* on VW suppliers in other states for reasons of space we have not added the type of product.

plants is higher[36]. However, if we consult their importance in the general scheme of purchases of parts and raw materials for VW, the dimension is somewhat different.

The composition of operations continued to give increasing importance to imports. Over the last four years, purchases in Mexico have not been more than 50% of the total. According to available information, in 1995 45% of purchases were within Mexico while exports amounted to 55%. Three years later, the proportion has not changed significantly.

Table 21 Composition of parts purchases for assembly of products Raw and auxiliary materials of VW de Mexico

	1995	1996	1997	1998
National purchases	45.0	48.6	49.2	48.5
Imports	55.0	51.4	50.8	51.5
Total purchases	100.0	100.0	100.0	100.0

Source: Program "Efecto de los sistemas Just in Time para regiones en desarrollo. Huberto Juarez. CIEPE-FE-BUAP 1999

To consider the impact of these operations on the regional level, we may add that in 1998 the value of total purchases was slightly more than 3 billion dollars. In the case of "national purchases", company officials estimate that about 75% are with enterprises near the factory, i.e. with first and second rank suppliers.

The foreign enterprises from whom imports are obtained are usually VW enterprises in Germany, Brazil and Spain, or are in the *global sourcing* category in the United States, Japan, Canada and other countries. Among the important enterprises we may mention, *VW-AG, VW do Brasil, SEAT-VW España, Lucas Automotive Gmbh, Allied Signal Bendix, Automotive Body Systems-Rockwell Inc., Benteler Industries Fabricated, Cambridge Industries, Inc, Delphi Metal España, Delphi Sagilaw Steering Systems, Krupp Metalurgica Campo Limpo Ltda, Ks-Automobil Sicherheitstechnik Gmbh, Metzeler Gimetall AG, Metzeler Gmbh, Rockell International Of Canada, Rsl Espana, TRW Repa Ges M.B.H., Inc.Barrie Oper, etc.*

This implies that the trade underlying production of the New Beetle, Jetta A4 and Golf Cabrio (the models most sold in the US) is essentially intra-corporate industrial trade.

VI. Profile of Mining, Metallurgy and the Iron and Steel Industry in Mexico

The economic activities which we could consider "traditional" for the metal and machine industry have had a limited development in the growth of Mexican capitalism. On the one hand we have the mining and metallurgical segment, i.e. the complex of extractive activities involving the obtention of metallic minerals for industrial use which historically has been displaced by mining of precious metals, and in this century, by oil and gas extraction.

In addition, the iron and steel manufacturing, for many years under state control—the history of which includes the construction of the big Mexican steel mills, in the 1940s the Altos Hornos de

[36] As we have already indicated in the 1998 summary, the requirements for becoming a VW supplier are very strict in terms of quality control and delivery time. ISO 9002 certificates, QS and compliance with the consortium's own standards are required to obtain certification as a VW supplier.

Mexico complex in Monclova, Coahuila (AHMSA), and later, in the 1970s the Lázaro Cárdenas Iron and Steel Complex, "Las Truchas", in the state of Michoacán (SICARTSA)— has since the '50s presented two structural problems: production levels lower than national consumption37 and the fact that its products were low-tech and of limited diversity, which to a great extent hindered its ability to supply the construction industry and hence its products were displaced—especially in the 1980s—from the markets for intermediate capital goods by imports of more elaborate products better suited to the needs of new production processes requiring a new range of rolled steel products with new alloys for greater resistance and flexibility, etc. In addition, many of the new processes and products which used ferrous metals as raw materials—e.g. the automobile and electronic industries—have been developing alternative materials to steel (plastics, resins, ceramics) which are cheaper, more flexible and have new properties.

With a view to filling in the details on our profile of the Metal and Machine Industry in Mexico, what follows is a summary of the general situation of mining and the iron and steel producing branch.

VI.1. Mining

As we noted in the main body of our profile, over the last 20 years mining in Mexico has maintained a low profile in terms of its share of industrial gdp, averaging 5%. The extremes of the series indicate that in 1980 of an industrial product—measured in 1993 values—equivalent to 240,512.3 million pesos, mining contributed 12,264.3 (5.1%) and in 1998 of a total of 384,038.1 million pesos mining accounted for 18,964.5 (4.9%).

According to data of the System of National Accounts, Table 22, mining—consisting of: extraction of metallic minerals (ferrous, non-ferrous, precious metals), non-metallic minerals (sand, gravel, clay) and extraction of crude oil and natural gas—in 1990 employed 178,871 persons, of whom the mining and metallurgical segment breaks down as follows: 12,818 persons in Extraction and Processing of Coal and Graphite, 6,278 in Extraction and Processing of Iron Ore and 35,040 in Extraction and Processing of Non-Ferrous Metal Ores (including precious metals).

Table 22 Mining. Paid Employees. 1990-1996

	Total Mining	Extraction and processing of coal and graphite	Extraction of crude oil and natural gas	Extraction and processing of iron ore	Extraction and processing of non-ferrous metal ores	Operation of quarries and extraction of sand and clay	Extraction and processing of other non-metallic minerals
1990	178,871	12,818	56,299	6,278	35,040	51,065	17,371
1991	176,296	11,629	61,886	6,123	29,583	51,188	15,887
1992	149,255	10,001	40,146	5,182	28,260	51,663	14,003
1993	131,420	10,291	31,011	4,421	26,086	51,014	8,597
1994	125,462	10,970	26,634	4,204	24,795	50,601	8,258
1995	124,098	10,784	28,951	4,175	23,589	48,723	7,876
1996	124,112	11,183	31,491	4,363	21,471	47,717	7,887
Variation 90-96	-30.6	-12.8	-44.1	-30.5	-38.7	-6.6	-54.6

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[37] For example, in 1949 production was 370,700 tons and consumption 654,000. In 1960 production was 1,555,000 tons and domestic consumption 1,925,000. In 1980 production was 7,156,000 and consumption 11,411,600 (Canacero, 1999).

It can be seen that most of the personnel was employed in Oil and Gas (56,299 employees) and non-metallic minerals (68,436 employees).

For 1996, according to that source, all series showed a decline. The total number of employees fell by –30%, coal and graphite by –12%, iron ore by –30%, non-ferrous metal ores by –38%, oil and gas by –44.1% and non-metallic minerals averaged a decline of –18.7%.

If we observe the composition of the metallurgical sector (coal, graphite, iron and non-ferrous metals), at the end of 1996 there were slightly more than 37,017 persons employed.

To update our data, we consider the Secofi-Siem series which does not include the operation of quarries and extraction of sand and clay, or oil and gas extraction (but it does include processing thereof), the result is that the mining sector in June 1999 had 70,183 employees of whom 32,174 were in extraction and processing of metal ore.

The last figures break down as follows: 16,118 persons employed in extraction and processing of metal ores in underground mines; 6,945 in extraction and processing of metal ores in open cast mines and 9,111 in processing of metal ores (Secofi-Siem).

The data on the production volume of metallurgic minerals indicate that in 1999 Mexico produced:

- Iron. Approximately 500,000 tons. The main producing states are Coahuila (200,000 tons), Colima (190,000 tons and Michoacán (92,819 tons).
- Coke. 189,170 tons. Producing states: Coahuila 144,589 tons and Michoacán 44,572 tons.
- Coal. 821,017 tons. Main producing states Coahuila, Jalisco and Michoacán[38].
- Copper. 19,145 tons. Chihuahua produces 14,880 and Sonora 2,352.
- Zinc. 34,707 tons. Chihuahua, 13,020 tons, Zacatecas 8,866 tons and San Luis Potosí 4,860.

The data for precious metals are: Gold, in 1998 2,115 kilograms were produced in Mexico, the main contributing federal entities being Durango (429), Guanajuato (225) and Chihuahua (112). Silver: national production is 222,692 kilograms. Main producing states: Zacatecas (90,321), Chihuahua (30,110), Durango (28,236), Guanajuato (13,195) and Hidalgo (10,120).

Concentrating our data on production, employment and location, we can see that the states where the big mines—open cast and underground—which produce metallurgic minerals are located are Coahuila, Colima and Michoacán.

Based on our analysis of the Secofi-Siem series, we may summarize employment and distribution by establishment as follows:

1. Coahuila. In 199939 mining employed 12,485 workers in 249 establishments. Of that total 6,407 were in 6 large establishments and 3,026 in small establishments.

    - We find that of this total, 10,290 worked in extraction and processing of coal and graphite in 233 establishments, of which 4,463 in 5 large establishments.

[38] We have no reliable data for tons per state.
[39] Data for the month of June.

- Extraction and processing of metal ores employed 2,172 workers in 10 establishments, of which 1,944 in one large establishment.

2. Jalisco. Personnel employed in mining in this state totaled 1,873 of whom 1,149 in extraction and processing of coal. There were 75 establishments for mining as a whole and 22 for extraction and processing of coal40.

3. In Colima, the location of one of the big open cast mines, there were 2,084 workers and 35 establishments. 640 workers were in one large enterprise producing iron ore and 1,043 workers were employed in six medium enterprises.

4. Michoacán. The location of the Lázaro Cárdenas Iron and Steel Complex. In this state mining employed 645 persons in 42 establishments. Most of them (463 workers) are in extraction and processing of metal ores, 357 of them working in one large enterprise.

VI.2. The Iron and Steel Industry.

In 1998 steel production in Mexico was 14.241 million tons, which indicates that it holds second place in Latin America after Brazil (15.8 million tons), and 16th place in the international context42.

The position of the Basic Metal Industries for indicators such as generation of added manufacturing value, employees, establishments, assets, location by federal entity and by industrial district has been detailed in the first chapters of our text. From that we may conclude that its contribution to manufacturing GDP (Figure 1) has not varied substantially over the last 20 years, i.e. it has maintained an average of 5%; the number of employees in the division has not exceeded 60,000 on the national scale, according to the 1994 census; its locations is associated with places of extraction and processing of metals or with positions related to the communications structure and, finally, its industrial districts are characterized by high density.

Observing this panorama in greater detail, we can see that within the internal composition of the Basic Metal Industries—consisting of the Branches of Iron and Steel, 46, and Non-Ferrous Metals, 47—the dominant position is occupied by branch 46.

According to the series in Table 23, the share of the Iron and Steel Industries in the generation of added value in Division vii has remained constant; over a period of 34 years it has accounted for slightly more than three fourths of the total value for the division.

The new profile of this industrial complex, constructed based on the standards of efficiency applied by governments in recent years, is associated with the processes of privatization of public enterprises in the late 1980s when the main iron and steel complexes began to be ceded to private capital43.

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[40] The data for distribution in the published series are not reliable.
[41] Various company sources indicate that in 1999 production would be approximately 17 million tons.
[42] 1998 world steel production is estimated at 775.3 million tons. The main producer countries were: People's Republic of China (114.1), US (97.4), Japan (93.59), Germany (44.7), Russia (41.8) and South Korea (40).
[43] Until 1991 the parastate enterprises accounted for the better part of national steel production: 53.4% in 1989, 56% in 1990 and 51.6% in 1991, within national production levels of 7.8, 8.7 and 7.96 million tons respectively.

Table 23. Added Value of the Basic Metal Industries. 1960-1993 Thousands of 1980 pesos					
	TOTAL DIVISION VII	BRANCH 46. Basic iron and steel industries[44]	BRANCH 47. Basic non-ferrous metal industries	BRANCH 46 Percentage of total	BRANCH 47 Percentage of total
1960	13,936	10,436	3,500	74.9	25.1
1961	14,463	11,240	3,223	77.7	22.3
1962	15,005	11,309	3,696	75.4	24.6
1963	18,003	13,470	4,533	74.8	25.2
1964	20,522	15,240	5,282	74.3	25.7
1965	21,792	16,022	5,770	73.5	26.5
1966	24,673	18,481	6,192	74.9	25.1
1967	25,638	19,883	5,755	77.6	22.4
1968	29,017	22,251	6,766	76.7	23.3
1969	30,877	23,354	7,523	75.6	24.4
1970	30,263	22,987	7,276	76.0	24.0
1971	30,356	23,070	7,286	76.0	24.0
1972	34,454	26,275	8,179	76.3	23.7
1973	37,811	28,542	9,269	75.5	24.5
1974	42,056	31,817	10,239	75.7	24.3
1975	42,042	32,228	9,814	76.7	23.3
1976	43,526	32,797	10,729	75.4	24.6
1977	45,597	35,295	10,302	77.4	22.6
1978	54,251	43,127	11,124	79.5	20.5
1979	58,723	45,750	12,973	77.9	22.1
1980	60,795	47,241	13,554	77.7	22.3
1981	63,774	49,313	14,461	77.3	22.7
1982	57,855	45,409	12,446	78.5	21.5
1983	54,283	42,775	11,508	78.8	21.2
1984	60,577	47,993	12,584	79.2	20.8
1985	61,215	47,854	13,361	78.2	21.8
1986	57,055	44,203	12,852	77.5	22.5
1987	63,383	47,032	16,351	74.2	25.8
1988	66,701	49,876	16,825	74.8	25.2
1989	68,358	50,991	17,367	74.6	25.4
1990	73,927	56,061	17,866	75.8	24.2
1991	71,247	54,283	16,964	76.2	23.8
1992	71,230	54,621	16,609	76.7	23.3
1993	74,745	58,363	16,382	78.1	21.9

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Annual steel production toward the end of the last decade was between 7 and 8 million tons per year, but in 1994 it exceeded 10 million tons and in 1995, against the background of the general economic contraction, production exceeded national consumption45 and the surpluses began to be sold in foreign markets.

[44] In 1998 prices the value of production of the Iron and Steel Industries would be 40 billion pesos, equivalent of about 8% of the national manufacturing value (Canacero, 1999).

[45] In 1994 steel consumption was the highest in the country's history: 13.2 million tons. In 1995 consumption plunged to 7.6, i.e. a fall of –42.5%.

In this context new phenomena have appeared, such as diversification of products and the search for new markets in an international environment where world steel production has been depressed in the 1990s46, the result of processes of substitution of raw materials, oversupply of products and regional crises such as that of Asia in 1998, which have worsened the two major problems of these industries, the fall in international prices and overproduction.

VI.3. Employment in the Iron and Steel Industry.

If we examine the restructuring of the Mexican iron and steel complex in the 1990s in greater detail, we can identify two major elements: first, the adjustment in employment and the modernization of equipment related to the incorporation of new processes (with the appearance of foreign technological partners in many cases), and second, the expansion of business to other countries together with an increase in exports.

In the first case, employment, restructuring of the iron and steel industry clearly shows the results of policies combining adjustment, restructuring and opening up.

Table 24 Paid Employees in the Basic Metal Industries[47]. 1998-1996

	TOTAL DIVISION VII	46 BASIC IRON & STEEL INDUSTRIES	47 BASIC NON-FERROUS METAL INDUSTRIES
1988	103,516	81,731	21,785
1989	97,038	74,732	22,306
1990	88,467	63,909	24,558
1991	81,812	55,546	26,266
1992	70,279	45,265	25,014
1993	59,441	35,921	23,520
1994	56,143	34,103	22,040
1995	52,788	32,799	19,989
1996	55,947	34,182	21,765

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[46] For example, in 1989 world production was 786 million tons, in 1990—770.5, in 1992—719.7(the lowest point), in 1994—725.2, in 1996—750.5, and only in 1996 did production reach levels higher than in the 1980s with a production of 799 million tons, to fall again in 1998 to 775.3.

[47] The sources which group together employment levels in the division in the case of DIVISION VII show substantial differences. For example, in the Secofi-Siem series, *Table 5*, page 37 of this text, DIVISION VII in 1995 had 69,760 jobs and 75,395 in 1996. In the latter year the difference with the System of National Accounts is almost 20,000 workers. In the case of the 1994 censuses, the difference for that year is smaller. The census indicates 59,488 jobs while the SNA has 56,143. Nevertheless, disaggregation at the level of industrial branch would seem to indicate that the SNA figures for iron and steel are fairly close to reality, a matter which we subsequently try to corroborate at the enterprise level.

Table 24b Blue-collar Workers in the Basic Metal Industries. 1998-1996			
	TOTAL DIVISION VII	46 BASIC IRON AND STEEL INDUSTRIES	47 BASIC NON-FERROUS METAL INDUSTRIES
1988	73,791	59,312	14,479
1989	68,849	53,627	15,222
1990	62,509	45,817	16,692
1991	58,080	40,016	18,064
1992	49,381	31,835	17,546
1993	42,783	25,803	16,980
1994	40,331	24,442	15,889
1995	37,930	23,434	14,496
1996	40,152	24,447	15,705

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Our data in *Tables 24* and *24.b*. illustrate the impact of that adjustment for two groups, the total number of employees[48] and that of blue-collar workers.

In 1988 DIVISION VII employed 103,516 persons; for 1996 that total had fallen to 55,947, i.e. a loss of 46% of total personnel. In this avalanche of job elimination, the years 1992 and 1993 are particularly prominent, with annual losses of –14.1% and –15.4%.

Observing the composition of the division, it can be immediately seen that the adjustment of personnel is essentially accounted for by Branch 46, the iron and steel industry. It was precisely in that industry in the period 1988-96 that the number of employees fell from 81,731 to 34,182, i.e. loss of –58.2% in nine years. That adjustment was especially severe in the years 1990-1993 when the annual rate was –14.5%, –13.1 %, –18.5% and –20.6% respectively.

Table 24.b. shows a more precise dimension of the adjustment. It is the blue-collar workers who bore the brunt of the layoffs. The total number of employees in the division fell from 73,791 to 40,152, i.e. –45.6%, and it is the iron and steel workers who have the negative index (in contrast to the non-ferrous metal workers, whose level remained constant during the period). The number of workers fell from 59,312 in 1988 to 24,447 in 1996, a drop of -58.8%.

In the last case, the phase of deep adjustment extended through the first five years of the series in Table 26.b. with annual declines of: –9.6% in 1989, –14.6% in 1990, –12.7% in 1991, –20.4% in 1992 y –18.9% in 1993.

As an epilog to this section, we may consider the productivity indicators provided by management. In various publications and public statements on increased efficiency in private management systems, with regard to the immediate past when they administered parastate entities, it is generally affirmed that "there was an increase from 259 tons per worker in 1991 to 594 tons per worker in 1996 and 643 in 199749. The corollary is interesting: in the absence of statistics on the number of blue-collar workers employed for the last two years, if we take these statements into account and compare physical production for 1997 with the corresponding productivity indicator,

[48] Which, as we have said, includes administrative and supervisory employees as well as blue-collar workers, the last category usually referring to unionized workers.

[49] See, e.g.: the journal "*Acero*" of the Chamber of the Iron and Steel Industry, "Expansion", vol. XXIX and Position of the Mexican Iron and Steel Industry in the fact of the Challenges of 1998 (Canacero, 1998).

we arrive at the conclusion that for that year there were somewhat more than 22,000 direct workers employed in the Mexican iron and steel industry50.

VI.4. Investments, Exports, Imports.

This account of the reduction in personnel must be explained within the process of restructuring and privatization of the iron and steel industry.

An account of the levels of investment per enterprise and where they are allocated in various projects may be seen in Table 25.

The main state steel enterprises were privatized in the period 1989-94: Altos Hornos de Mexico (AHMSA) was sold to the Autrey/Ancira families in 1991; the Fundidora Monterrey-Flat Steel Plant APM was sold to the Industrias Monterrey Group (IMSA) in 1991; Sicartsa I was sold to the Villacero group in 1991 and Sicartsa II was also sold in 1991 to the ISPAT-IMEXA group. Investments totaling 2,478 billion dollars were recorded (Secofi-Canacero, 1999) during that period, concentrated in the five most important producing groups (to the foregoing list should be added HYLSAMEX owned by the ALFA group of Monterrey.

Investments in the first phase were allocated directly to new plants, modernization for diversification of products and expansion of capacity. Although we do not have figures disaggregated by year, all indications are that the investments were made just at the time when the government was finalizing the "divestment" projects for public enterprises in the branch, i.e. in 199151.

Investments for the yeas 1995 and the period 1996-99 show the orientation which the industry has taken in recent years: modernization and diversification of products and concentration of investments in the five big producing enterprises.

The combined effect of the reduction in personnel (with the reorganization of work systems in all plants) and the new investments starting in 1992 led to steel production as indicated in Table 26. Total national production in the period 1991-98 increased by approximately 80% and it is interesting to observe how in 1995, when national consumption collapsed, national production had its fastest growth. In this context, enterprises such as AHMSA, IMEXSA and TAMSA experienced growth rates above 20%.

[50] The same exercise for 1991 yields a similar quantity to that in Table 24.b. and less accurate for the datum of 1996 where the difference is 2,000 more blue-collar workers in the data of our table.

[51] Reports on enterprises in the journal "*Acero*" published by the National Chamber of the Iron and Steel Industry (Canacero) indicate that investments for modernization began just in the year that the enterprises passed to private ownership (September 1999). See also the special report on the Iron and Steel Industry in the journal *Expansión*, vol. XXIX, 1997.

Table 25 Iron and Steel Industry Investments. 1989-2000.		
	1989-1994	
Enterprise	**Total**	**Project**
HYLSA	**767**	New plant for flat steel
Altos Hornos de Mexico (AHMSA)	**736**	Increase in capacity and modernization of flat steel plant
Industrias Monterrey	**182**	Galvanized steel line and modernization of APM plant
Sidek Group	**160**	Baja California plant and modernization
Mexinox	**150**	Modernization and increase in capacity
Villacero Group	**148**	Galvanized steel plant and modernization of SICARTSA
San Luis Group	**90**	New plant
Talleres de Aceros	**70**	New plant (Orizaba)
Feldman Group	**60**	New rolling mill and modernization of Siderúrgica Tultitlán
Deacero	**50**	Modernization and expansion of capacity
Other enterprises	**65**	Modernization and repairs
TOTAL	**2,478**	
	1995	
Ispat Mexicana	**250**	Pelletizer and conveyor belt plant
Siderúrgica Lázaro Cárdenas, Las Truchas	**161**	New electric furnace, emissions control, etc.
Altos Hornos de Mexico (AHMSA)	**91**	Modernization of coking plant and construction of galvanized steel plant
Industrias Monterrey	**90**	Modernization of cold-rolled plant, new galvanized and stripping line
Feldman Group	**60**	Rolling, continuous casting and final sealing mill (Siderúrgica de Tultitlán)
Industrias Monterrey/Grupo PREMDOR	**15**	Door manufacturing plant
Compañía Minera Autlán	**10**	Miscellaneous projects
TOTAL	**677**	
	1996-2000	
Altos Hornos de Mexico (AHMSA)	**1,261**	Modernization, construction of galvanized steel plant, environment and improvements.
Ispat Mexicana	**865**	Pelletizing plant, conveyor belt, direct reduction, additions and improvements.
Villacero Group	**644**	Modernization of plants, construction of fourth furnace, expansion of capacity and investments to preserve the environment in SICARTSA and expansion of capacity and cutting line in Zincacero.
HYLSA	**610**	New direct reduction plant, modernization and expansion in flat, no-flat and galvanized products
Industrias Monterrey	**245**	Modernization of cold rolling, new galvanized and stripping line; machinery, equipment and rolling in APM, door manufacturing plant with the Prendor Group.
Deacero	**160**	Expansion, new steel mill-rolling mill.
Industrias CH.	**128**	Machinery, equipment and continuous casting.
Mexinox	**111**	Construction, expansion and installation of patching, stripping, polishing and cutting.
Aceros Corsa	**100**	New plant
Feldman Group	**73**	Rolling, continuous casting, final sealing, furnace, increase of reheating furnace in Siderúrgica de Tultitlán.
San Luis Group	**68**	Oxygen plant, expansion of steel mill and rolling mill.
Tubos de Acero de Mexico (TAMSA)	**63**	Steel mill, rolling, finishing..
Aceros Nacionales	**27**	Modernization and increase in capacity.
Compañía Minera Autlán	**10**	Miscellaneous projects
TOTAL	**4,365**	

Source: National Chamber of the Iron and Steel Industry. 1995. Secofi. 1999.

Table 26 Steel production and annual growth rates in %. 1989-2000. Thousands of tons														
	AHMSA	**GR %**	**HYLSA**	**GR %**	**IMEXSA**	**GR %**	**SICARTSA**	**GR %**	**TAMSA**	**GR %**	**OTHERS**	**GR %**	**ANNUAL TOTAL**	**GR %**
1989	**2,862**		**1,812**				**1,336**		**469**		**1,373**		**7,852**	
1990	**3,096**	8.2	**1,882**	3.9			**1,802**	34.9	**503**	7.2	**1,451**	5.7	**8,788**	11.9
1991	**2,659**	-14.1	**1,924**	2.2			**1,455**	-19.3	**517**	2.8	**1,409**	-2.9	**7,936**	-9.7
1992	**2,550**	-4.1	**1,938**	0.7	**954**		**1,194**	-17.9	**380**	-26.5	**1,443**	2.4	**8,411**	6.0
1993	**2,584**	1.3	**2,027**	4.6	**1,354**	41.9	**1,165**	-2.4	**391**	2.9	**1,678**	16.3	**9,247**	9.9
1994	**2,490**	-3.6	**2,181**	7.6	**1,761**	30.1	**1,345**	15.5	**427**	9.2	**2,056**	22.5	**10,319**	11.6
1995	**3,103**	24.6	**2,463**	12.9	**2,254**	28.0	**1,439**	7.0	**550**	28.8	**2,338**	13.7	**12,248**	18.7
1996	**3,393**	9.3	**2,722**	10.5	**2,426**	7.6	**1,337**	-7.1	**737**	34.0	**2,557**	9.4	**13,226**	8.0
1997	**3,505**	3.3	**3,060**	12.4	**2,867**	18.2	**1,459**	9.1	**746**	1.2	**2,581**	0.9	**14,262**	7.8
1998	**3,677**	4.9	**2,797**	-8.6	**3,123**	8.9	**1,283**	-12.1	**721**	-3.4	**2,612**	1.2	**14,203**	-0.4

Source: Canacero. 1999.

The foregoing shows the new profile of this industry, the increase in its export capacity. For that, in Table 27 we can observe two important facts, a growth in the segment of finished products, in which the most important products are flat rolled products and seamless tubes which rose from 1.01 million tons in 1990 to 3.5 million in 1998, and secondly, the increasing share of exports in total national production.

Table 27 Exports of iron and steel products. 1989-1998. Thousands of tons.				
	Raw materials and semi-finished products*	Finished and processed products**	Total exports	Exports as a percentage of total production
1989	343	1,035	1,378	17.5
1990	659	1,012	1,671	19.0
1991	496	933	1,429	18.0
1992	932	799	1,731	20.6
1993	1,357	799	2,156	23.3
1994	1,494	877	2,371	23.0
1995	2,143	4,134	6,277	51.2
1996	2,106	3,652	5,758	43.5
1997	2,343	3,652	5,995	42.0
1998	2,558	3,357	5,915	41.6

Source: Canacero. 1999.
** Includes: pig iron and sponge iron, ferro-alloys, semi-finished products.*
*** Includes: flat steel, non-flat, seamless tubes, seamed tubes and other products.*

As for physical volumes of production exported, from 1989-91 their share averaged 18%, but rose to more than 40% by the end of the 1990s, even reaching the level of 51.2% in 1995 when the domestic steel market contracted substantially.

Looking at the value of exports, we see in Table 28 that in 1989-1998 the value of exports rose from 816.2 million dollars to 3,899.5 million dollars. In this series it is clear that the turning point was 1995, when the value of exports grew by 150% over the corresponding figure for 1994, and from that point the value went as high as 3,899.5 million dollars in 1998.

Considering the composition of export value of iron and steel products, we can observe that finished products are the most important, in 1998, for example, representing 83% of total value52.

Table 28 Exports of iron and steel products. 1989-1998. Thousands of Dollars

	Raw materials and semi-finished products	Finished and processed products	Total exported
1989	133,354	682,897	816,251
1990	188,926	651,484	840,410
1991	208,231	800,659	1,008,890
1992	353,500	688,480	1,041,980
1993	322,287	572,441	894,728
1994	404,974	683,065	1,088,039
1995	622,486	2,094,129	2,716,615
1996	565,898	2,147,095	2,712,993
1997	663,992	2,546,116	3,210,108
1998	665,114	3,234,413	3,899,527

Source: Canacero 1999. Based on: Dirección de servicios al Comercio exterior. Secofi. 1989-1992.
Bancomex. 1993-1994
SHyCP 1995-1998

However, within the upward trends of exports, we must bear in mind the problem underlying the national industrial context. Until 1994 the inability of iron and steel production to satisfy domestic demand, and thus the dependence on imports—especially for hi-tech products such as certain varieties of flat steel products for some types of production, e.g. the auto industry—together with the negative trade balance for the iron and steel industry, was resolved by a drastic contraction in steel consumption on the domestic market with the 1995 crisis when consumption fell by –42.5%) from 13.2 million tons in 1994 to 7.6 million tons in 1995). Imports faithfully reflect the problem. In Table 29, especially in the column for physical production, we can see that in 1994 imports exceeded three million tons (with a value of 2,236.9 million dollars), and one year later the level had fallen to 972,000 tons (950.2 million dollars), i.e. a contraction of –68%.

Table 29 Imports of metallurgic products. 1989-1990

	Thousands of tons	Thousands of Dollars
1989	893	752,223
1990	1,207	964,085
1991	2,514	1,807,355
1992	3,038	2,236,878
1993	1,763	1,614,355
1994	3,013	2,733,225
1995	972	950,202
1996	1,111	1,228,013
1997	1,705	1,577,444
1998	2,429	1,926,532

Source: Ibid.

[52] To illustrate this structure of exports, of these finished products, the two most important families of products were *flat products* with a value of 696.4 million dollars and *seamless tubes* with 357 million dollars.

Although in recent years there has been an increase in the volume of domestic consumption of iron and steel products (1996: 10.6 million tons, 1997: 12.6 million tons, 1998: 12.8 million tons), it has certainly not regained the level of 13.2 million tons of 1994. Imports faithfully reflect the trend, having risen to 2.4 million, but the have been falling since 1994.

This comparison of exports and imports as a function of national demand indicates that much of the success of export promotion policies is based on a contraction of national consumption of those products. A sign of the times, the iron and steel industry, recently privatized and modernized, has also not escaped the logic of "outward growth" nor avoided the fate of national productive chains.

VI.5. A closer look at the main enterprises:

There are five enterprises in Branch 46 which are the most important (AHMSA, IMEXSA, HYLSA, SICARTSA and TAMSA); as Table 26 indicates, they control just over 80% of total national production. The most important features of the big companies of the Mexican iron and steel industry may be summarized as follows:

- Tubos de Acero de Mexico (TAMSA). Owned by the SIDERCA group of Argentina. In 1996 the Italian group Dalmine also acquired holdings and formed the group DST. Located in the Bruno Pagliat industrial city of Veracruz, TAMSA is the main national producer of seamless steel tubes. In 1998 it exported 70% of its production and its sales reached 620.6 million dollars. Its employees number 2,553 (Secofi-Siem, 1999).

- Siderúrgica Lázaro Cárdenas "Las Truchas" (SICARTSA). Founded in 1976, it was part of the iron and steel complex most representative of state intervention in the last years of the period of "stabilizing development". It was privatized in 1991, and now belongs to the VILLACERO Group. Sicartsa is the most important plant in the iron and steel division of that group. Its main products are corrugated rods, wire rods and billets. It presently employs 2,445 blue- and white-collar workers. The Villacero group also has other plants in Mexico: SIMISA in Nuevo León (corrugated rods), CAMSA in Mexico City (corrugated rods) and the SIBASA plant in Guanajuato recently began operating. It also has investments outside of Mexico, and owns the Border Steel plant in El Paso, Texas, and has holdings in Aceros de Centroamérica, San Salvador.

- Hierro y Hojalata (HYLSAMEX). Generic name for the iron and steel holdings of the ALFA group of Monterrey and consisting of nine steel producing and processing plants. The ALFA group, certainly one of the most representative groups of national private capital, has a range of enterprises in the most diverse areas: food (Sigma), petrochemicals (Nylon de Mexico, Tereftelatos Mexicanos), electricity (Pegi, Coenergy), mining (Peña Colorada), communications (Alestra), transport (Express Anáhuac), consulting firms (Técnica Industrial), etc.

  In Mexico we can identify in first place Hylsa, founded in 1943, with plants in Monterrey and Puebla. The most important of the plants is located in the town of San Nicolás de los Garza, and produces mainly tubing and cold- and hot-rolled sheets (the latter, for export, is a special sheet less than 1.5 millimeters thick). Its sales in 1998 were on the order of 1.2 billion dollars. In 1999 it employed 8,083 persons (of whom some 650 at the plant in San Miguel Xoxtla, Puebla).

HYLSABECK. A plant located in Tultitlán, State of Mexico. Specializes in wire, needles and nails. 481 employees.

GALVAK. Plant specializing in galvanized and painted steel sheets, structural and undulated profiles and metal floor structures. 982 employees.

- IMEXSA. Until 1991 this was the SICARTSA II plant; as of 1992 it has been owned by the Indian consortium ISPAT with plants in Canada, Germany, France, Indonesia, Ireland, the United Kingdom and the United States.

  The Mexican plants of Ispat-Imexsa (Ispat Mexicana, Mexican producer of tubing and Peña Colorada) are the number two steel producer in Mexico. In 1999 they produced approximately 3.6 million tons, exporting 70%, equal to 22% of national production.

  The main product of Ispat Mexicana in Lázaro Cárdenas, Michoacán, is steel plate for export. Its main markets are North America (57%), Mexico (28%), Asia (10%) and Europe (5%). It employs 1,050 persons.

  The enterprise Productora Mexicana de Tubería, also in Lázaro Cárdenas, produces seamed tubing for the national and international markets. 250 employees.

- Altos Hornos de Mexico (AHMSA). The main producing enterprise in the branch. Et began operations in June 1942, and, under state administration until December 1991, was the flagship of the Mexican iron and steel complex. With the process of privatization it came to be owned by the Autrey/Ancira families, who paid 145 million dollars for it. Since 1995 it has been one of the enterprises controlled by the Grupo Acerero del Norte (GAN). In the late 1980s it accounted for more than a third of national steel production, but in the '90s, with the increase in the share of new enterprises (especially IMEXSA), its share fell to around 25%.

  Observing our report on investments in iron and steel (Table 25), we see that the highest figures correspond to the modernization of this enterprise. It can also be seen that the orientation of investments is toward modernization and expansion of its plants making flat steel and galvanized sheet, hot- and cold-rolled sheets and rods. In 1999 it produced 40% of the country's flat steel products.

  But the results of modernization are representative of accelerated growth of assets under government coverage of facilities for access to credit[53]. By 1998 signs of heavy indebtedness associated with liquidity problems began to appear. The fall in steel prices on the international market encouraged by overproduction, and in this case also by the impact of the Asian crisis leading to an oversupply of steel[54], were elements which exacerbated the enterprise's financial problems. In May 1999 AHMSA declared a moratorium on payments and marked the beginning of a critical phase for the iron and steel industry.

[53] AHMSA received unguaranteed loans from the following banks: Citibank, Bancomer, ABN, Inverlat, West Merchant Bank, Banobras, Promex and Banamex. The debts owed to these banks amounts to 565 million dollars. There is another group of banks lending with guarantees which are owed 773 million dollars: Bancomex, JP Morgan, Chase Manhattan Bank, Santander, Bilbao Viscaya, and the Deutsche Bank (El Financiero, 2 June 1999).

[54] There has also been talk of unfair practices by producers in Eastern Europe and South East Asia.

It was announced that the company's debt amounted to 1,900 million dollars[55] and in the summer of 1999 the creditor banks led by the Bank of America and JP Morgan began to exert pressure to obtain greater guarantees by adjusting the Law on Bankruptcy and Suspension of Payments. In this context the company management has always talked of financial difficulties but not of operational difficulties, i.e. production levels would not be affected by cash flow problems.

In the autumn of 1999, creditors and bidders demanded a new restructuring. Based on the GAN scenario, this would involve a new capitalization, restructuring of liabilities and "deductions" in total debt, but control would remain in the hands of the group. From the point of view of the bidders, Hylsamex, Villacero and IMSA the matter depended on obtaining total control of the enterprise. In July 1999 IMSA and AHMSA signed a temporary agreement to explore a strategic alliance with a view to forming a new iron and steel group.

The results of pressure for a new restructuring in the labor field did not take long to appear: by the autumn of 1999, 2,000 white-collar[56] and 1,500 blue-collar workers had been laid off.

[55] According to a report of the Expansión group, "The 500 Most Important Enterprises in Mexico", by 1998 AHMSA's liabilities totaled 24,669.9 million pesos. Of those liabilities, financial debts to foreign and Mexican banks was estimated for June 1999 at 1,900 million dollars (El Financiero, 29 June 1999).

[56] "The gentlemen who get paid a lot and who produce little" as José Domene, the Director General of the company, put it.

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