Chapter 6

Raw Materials

Chapter 6 Raw Materials

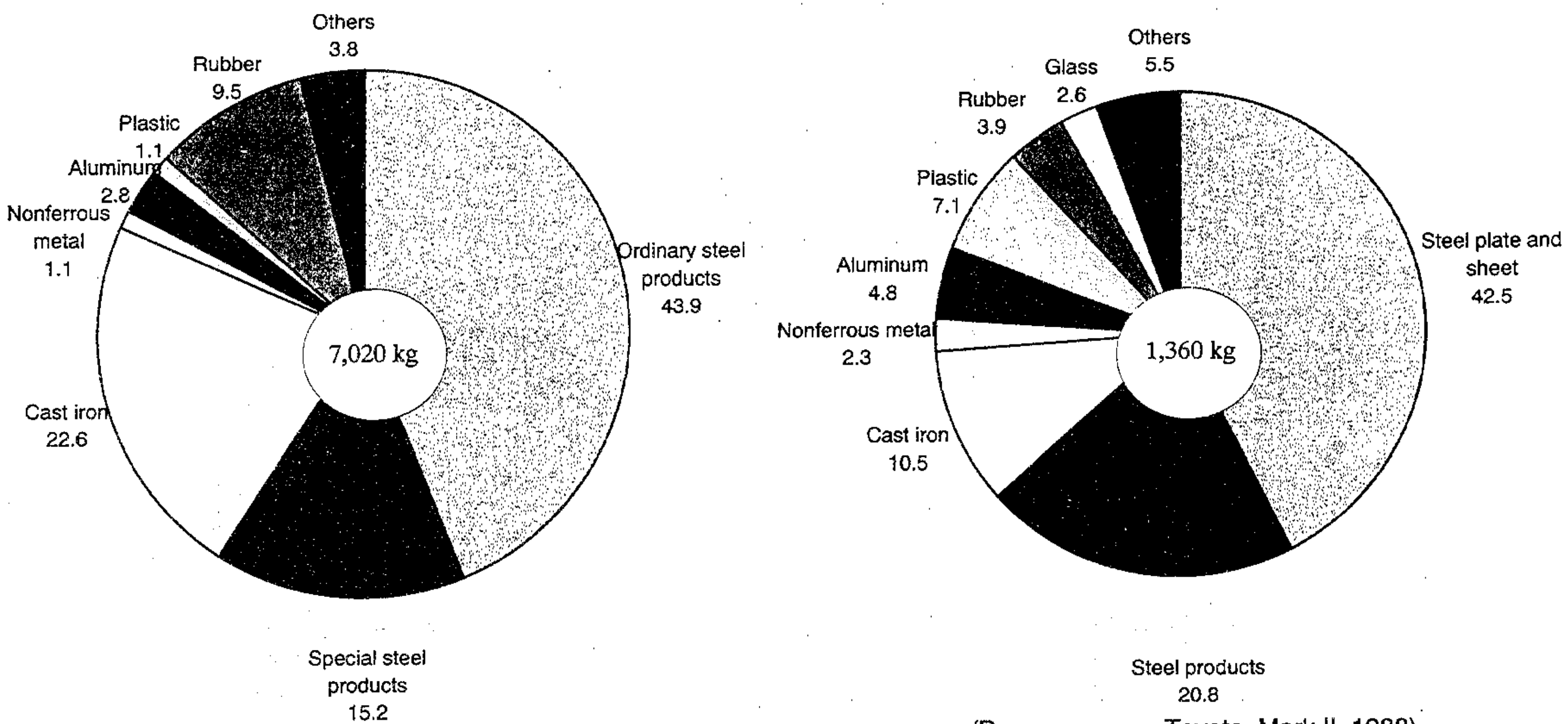
6.1 Raw Materials Used in the Parts Industry

In a broad sense, an industry which supplies raw materials to the parts industry can be considered as a kind of supporting industry. With this in mind, we shall take a look at the demand and supply of raw materials that are frequently used in the Mexican automotive and electrical/electronic industries and the problems which they are facing shall be discussed here.

Figure 6.1-1 shows the composition of materials used in passenger car and big truck, respectively. Table 6.1-1 portrays the composition of raw materials used in a 2,000cc passenger car in different years. It is indicating that the share of steel products have been declining, whereas that of nonferrous metals (especially aluminum) and plastics have been rapidly growing. Plastics have become increasingly popular because they are much easier to design and mold compared to steel plates and sheets; on the other hand, the increasing use of aluminum, etc. is the result of efforts to reduce the weight of wheels. Despite this trend, steel products still account for more than 70% of wheels in terms of weight.

It is difficult to illustrate the composition of raw materials used in electrical and electronic industries in a bloc, as there is a wide range of electrical and electronic products. It should be noted, however, that plastics and steel products are the main raw materials.

In this chapter, steel products and plastic shall be focused as the principal raw materials used for automotive and electrical/electronic industries.



(Big truck: Excl. platform 1988)

(Passenger car: Toyota, Mark II, 1988)

Unit: % in weight
kg: weight of an automobile

Source: Automobile Industries, Vol. 25

Figure 6.1-1 Composition of Materials Used for Automobile

Table 6.1-1 Changes in Composition of Materials Used for a 2,000cc Car

(Unit: %)

		1973	1977	1980	1983	1986	1989	1992
Pig iron	Pig iron	3.2	3.2	2.8	2.2	1.7	1.7	2.1
Ordinary Steel Products	Bar	1.2	1.0	1.0	0.9	0.9	0.8	0.8
	Hot-rolled sheets (~ 8mm)	6.9	7.1	6.9	7.6	7.1	6.3	8.5
	Hot-rolled plates (3mm ~ 6mm)	7.5	7.2	5.9	5.7	4.7	4.8	3.6
	Hot-rolled plates (6mm ~)	0.2	0.5	0.8	0.6	0.4	0.4	0.3
	Cold-rolled sheets	38.9	37.9	33.8	29.4	26.0	22.5	15.0
	High tensile strength steel sheets	-	0.5	1.4	4.1	7.3	6.4	3.9
	Galvanized sheets		3.8	5.7	5.5	5.4	10.0	14.8
	Other coated sheets	1.6	0.6	1.5	2.3	2.8	2.9	5.4
	Steel pipes	2.3	2.2	2.3	2.3	2.7	2.4	2.0
	Others	1.8	0.8	1.2	1.1	0.4	0.4	0.6
	Total	60.4	61.6	60.5	59.5	57.7	56.9	54.9
Special Steel Products	Carbon steel	7.9	6.8	6.1	6.0	6.1	6.0	5.8
	Alloy steel	5.6	4.6	3.8	3.6	3.4	3.5	3.7
	Free cutting steel	-	0.7	1.0	1.0	1.4	1.9	2.1
	Stainless sheet-resistant steel	0.4	0.9	0.9	0.9	1.0	1.0	1.4
	Spring steel	2.2	2.0	1.5	1.5	1.5	1.4	1.3
	Bearing steel	-	0.9	0.9	0.9	0.9	0.7	0.6
	Others	1.4	0.2	0.5	0.4	0.7	0.6	0.4
	Total	17.5	16.1	14.7	14.3	15.0	15.1	15.3
Nonferrous Metal	Electrolytic cathode copper	1.0	0.9	0.8	0.9	1.0	1.3	1.0
	Pb ingot	0.6	0.6	0.8	0.6	0.6	0.6	0.5
	Zn ingot	0.5	0.5	0.3	0.4	0.4	0.4	0.3
	Al ingot	2.8	2.6	3.3	3.5	3.9	4.9	6.0
	Others	0.1	0.1	0.4	0.2	0.2	0.2	0.2
	Total	5.0	4.7	5.6	5.6	6.1	7.4	8.0
Plastics Synthetic Resin	Phenol	0.1	0.1	0.1	0.2	0.1	0.1	0.1
	Polyurethane (PU)	0.5	0.5	0.8	0.9	1.2	1.0	1.1
	Polyvinyl chloride (PVC)	0.9	1.1	1.4	1.7	1.7	1.6	1.1
	Polyethylene (PE)	0.2	0.2	0.3	0.4	0.5	0.4	0.3
	Polypropylene (PP)	0.5	0.5	0.9	1.2	2.0	2.4	2.5
	ABS resin	0.4	0.7	0.5	0.5	0.7	0.8	0.7
	Others	0.3	0.4	0.7	0.6	0.4	0.3	0.4
	Engineering plastic	-	-	-	0.2	0.7	0.9	1.1
	Total	2.9	3.5	4.7	5.7	7.3	7.5	7.3
Other Non-metal	Paints	2.1	1.6	1.8	1.7	1.7	1.4	1.5
	Rubber	4.8	4.3	3.7	3.5	3.0	2.7	3.1
	Glass	2.8	2.7	3.1	3.2	3.3	3.0	2.8
	Fiber	-	0.7	1.2	1.3	1.4	1.2	1.2
	Wood	-	-	0.2	0.3	0.5	0.4	0.4
	Others	1.3	1.6	1.7	2.7	2.3	2.7	3.4
	Total	11.0	10.9	11.7	12.7	12.2	11.4	12.4
	Grand total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Automotive Industry, Vol.26

6.2 Steel Products

The following products are listed in the order of manufacturing process of steel products. The manufacturing process can be broadly divided into three, namely, the production of pig iron, the steel making, and rolling. In addition, machining process will be added partially.

(1) Pig Iron

This is an intermediate product made by extracting iron from reduced iron ore. Those which are used for the cast goods become the final product at this stage.

Note 1: "Pig iron" usually refers to the product acquired from a blast furnace. Those obtained by the direct reduction of iron ore with the use of natural gas, etc. are either called "sponge iron" or "directly reduced iron" instead of "pig iron".

(2) Crude Steel

This is a generic term for ingot, bloom, slab, billet, etc., continuous cast blooms and cast steel made of pig iron and iron scraps.

(3) Steel Products

This refers to steel plates/sheets, shapes, bars and pipes made of crude steel.

6.2.1 Crude Steel

The amount of production and consumption of crude steel is normally considered as an index of a nation's steel industry. Statistics on the export/import of steel products are totaled after multiplying the figures for each product by the crude-steel coefficient (>1), and apparent consumption is calculated by the equation "production + import - export".

Tables 6.2-1 and 6.2-2 illustrate the export/import of crude steel and steel products. Table 6.2-3 shows the production and apparent consumption of crude steel, the latter being calculated by the aforementioned method.

Table 6.2-3 Production and Apparent Consumption of Crude Steel

(Unit : Thousand Ton)

	1991	1992	1993	1994	1995
Production	7,964	8,459	9,199	10,260	12,128
Apparent Consumption	10,256	11,208	10,053	13,196	7,280

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

Table 6.2-1 Export of Steel Products

(Unit : Thousand Ton)

Product	1991	%	1992	%	1993	%	1994	%	1995	%
Crude Steel	**430.9**	**100.0**	**872.8**	**100.0**	**1,301.8**	**100.0**	**1,438.1**	**100.0**	**2,137.2**	**100.0**
Flat Products	**27.1**	**100.0**	**116.3**	**100.0**	**149.0**	**100.0**	**55.9**	**100.0**	**1,491.6**	**100.0**
Plate	17.1	63.1	61.6	53.0	15.4	10.3	20.9	37.4	383.7	25.7
H.R. sheet	1.5	5.5	26.4	22.7	27.8	18.7	12.7	22.7	884.7	59.3
C.R. sheet	6.1	22.5	27.6	23.7	104.5	70.1	17.8	31.8	200.1	13.4
Tin plate	2.4	8.9	0.7	0.6	1.3	0.9	4.5	8.1	23.1	1.5
Alloyed and Surface Treated Flat Products	**117.8**	**100.0**	**180.9**	**100.0**	**153.3**	**100.0**	**182.7**	**100.0**	**368.9**	**100.0**
Magnetic sheet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stainless sheet	49.4	41.9	59.1	32.7	80.4	52.4	90.8	49.7	81.3	22.0
Surface treated sheet	65.4	55.5	119.8	66.2	71.4	46.6	89.5	49.0	285.2	77.3
Chromate treated sheet	0.8	0.7	0.3	0.2	0.2	0.1	0.4	0.2	0.8	0.2
Alloyed sheet	0.3	0.3	0.2	0.1	0.0	0.0	0.2	0.1	0.3	0.1
Steel strip	1.9	1.6	1.5	0.8	1.3	0.8	1.8	1.0	1.3	0.4
Non-flat Products	**132.1**	**100.0**	**65.1**	**100.0**	**116.9**	**100.0**	**116.9**	**100.0**	**1,397.8**	**100.0**
Wire rod	89.7	67.9	51.3	78.8	77.7	66.5	21.3	18.2	649.5	46.5
Deformed bar	21.6	16.4	0.0	0.0	15.0	12.8	19.7	16.9	368.0	26.3
Commercial Shapes	2.9	2.2	2.7	4.1	8.6	7.4	40.2	34.4	173.3	12.4
Structural shapes	13.1	9.9	6.7	10.3	11.6	9.9	27.2	23.3	82.3	5.9
Bars	4.8	3.6	4.4	6.8	4.0	3.4	8.5	7.3	124.7	8.9
Non-flat Alloyed Products	**27.2**	**100.0**	**6.3**	**100.0**	**13.7**	**100.0**	**16.0**	**100.0**	**58.7**	**100.0**
Wire	0.2	0.7	0.0	0.0	0.0	0.0	0.1	0.6	13.8	23.5
Bars	1.7	6.3	1.6	25.4	0.3	2.2	0.2	1.3	3.2	5.5
Shapes	25.3	93.0	4.7	74.6	13.4	97.8	15.7	98.1	41.7	71.0
Rails	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Product	**374.3**	**100.0**	**208.9**	**100.0**	**320.7**	**100.0**	**456.6**	**100.0**	**605.0**	**100.0**
Seamless pipe	281.5	75.2	167.5	80.2	249.8	77.9	303.6	66.5	420.8	69.6
Welded pipe	92.7	24.8	41.1	19.7	70.0	21.8	151.3	33.1	181.7	30.0
Other pipe	0.1	0.0	0.3	0.1	0.9	0.3	1.7	0.4	2.5	0.4
Wire	**13.2**	**100.0**	**11.1**	**100.0**	**2.8**	**100.0**	**5.5**	**100.0**	**67.3**	**100.0**
Secondary Wire Products	**29.4**	**100.0**	**26.0**	**100.0**	**9.9**	**100.0**	**19.0**	**100.0**	**81.0**	**100.0**

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

Table 6.2-2 Import of Steel Products

(Unit : Thousand Ton)

Product	1991	%	1992	%	1993	%	1994	%	1995	%
Crude Steel	**144.1**	**100.0**	**150.1**	**100.0**	**93.6**	**100.0**	**72.1**	**100.0**	**24.7**	**100.0**
Flat Products	**879.3**	**100.0**	**964.0**	**100.0**	**552.6**	**100.0**	**1,225.8**	**100.0**	**284.3**	**100.0**
Plate	188.6	21.4	235.2	24.4	92.5	16.7	286.9	23.4	36.5	12.8
H.R. sheet	283.8	32.3	277.3	28.8	103.1	18.7	347.9	28.4	53.1	18.7
C.R. sheet	246.1	28.0	304.7	31.6	233.7	42.3	375.3	30.6	70.0	24.6
Tin plate	160.8	18.3	146.8	15.2	123.3	22.3	215.7	17.6	124.7	43.9
Alloyed and Surface Treated Flat Products	**345.1**	**100.0**	**420.8**	**100.0**	**270.5**	**100.0**	**457.5**	**100.0**	**210.5**	**100.0**
Magnetic sheet	29.5	8.5	21.3	5.1	20.7	7.7	42.8	9.4	20.0	9.5
Stainless sheet	87.0	25.2	115.2	27.4	12.3	4.5	17.6	3.8	17.1	8.1
Surface treated sheet	75.6	21.9	125.5	29.8	73.7	27.2	123.4	27.0	43.5	20.7
Chromate treated sheet	115.2	33.4	110.3	26.2	130.0	48.1	217.0	47.4	96.9	46.0
Alloyed sheet	19.2	5.6	32.7	7.8	26.8	9.9	41.5	9.1	26.6	12.6
Steel strip	18.6	5.4	15.8	3.8	7.0	2.6	15.2	3.3	6.4	3.0
Non-flat Products	**394.9**	**100.0**	**450.4**	**100.0**	**359.4**	**100.0**	**454.3**	**100.0**	**105.3**	**100.0**
Wire rod	105.6	26.7	95.5	21.2	79.5	22.1	36.1	7.9	13.9	13.2
Deformed bar	137.0	34.7	183.6	40.8	126.7	35.3	106.6	23.5	13.3	12.6
Commercial Shapes	31.2	7.9	21.4	4.8	20.5	5.7	30.2	6.6	8.9	8.5
Structural shapes	52.7	13.3	57.2	12.7	64.2	17.9	174.6	38.4	40.1	38.1
Bars	68.4	17.3	92.7	20.6	68.5	19.1	106.8	23.5	29.1	27.6
Non-flat Alloyed Products	**167.8**	**100.0**	**208.0**	**100.0**	**190.3**	**100.0**	**247.1**	**100.0**	**83.3**	**100.0**
Wire	3.7	2.2	6.4	3.1	3.5	1.8	5.6	2.3	0.8	1.0
Bars	73.6	43.9	130.6	62.8	66.7	35.0	105.0	42.5	30.7	36.9
Shapes	68.9	41.1	66.2	31.8	70.9	37.3	100.6	40.7	29.9	35.9
Rails	21.6	12.9	4.8	2.3	49.2	25.9	35.9	14.5	21.9	26.3
Pipe Product	**119.1**	**100.0**	**82.5**	**100.0**	**110.4**	**100.0**	**197.5**	**100.0**	**72.5**	**100.0**
Seamless pipe	58.9	49.5	38.0	46.1	60.8	55.1	82.9	42.0	39.9	55.0
Welded pipe	51.8	43.5	30.2	36.6	35.0	31.7	98.4	49.8	28.0	38.6
Other pipe	8.4	7.1	14.3	17.3	14.6	13.2	16.2	8.2	4.6	6.3
Wire	**28.3**	**100.0**	**32.4**	**100.0**	**26.6**	**100.0**	**55.2**	**100.0**	**17.0**	**100.0**
Secondary Wire Products	**17.5**	**100.0**	**23.8**	**100.0**	**20.7**	**100.0**	**41.0**	**100.0**	**14.0**	**100.0**

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

On average, production increased by more than 11% per year between 1991 and 1995, from 7.946 million tons to 12.128 million tons. Nonetheless, it can be said that Mexico is a steel importer, as apparent consumption continued to exceed production up until 1994. Production increased in 1995 as a result of growing exports, while apparent consumption substantially decreased due to sluggish domestic demand following the currency crisis.

6.2.2 Steel Mills in Mexico

SICARTSA, the state-run steel mill, was privatized in 1991; SICARTSA I became SICARTSA, and SICARTSA II became IMEXA with India's investment. It is worth noting that SICARTSA's crude steel production accounted for 52% of total domestic production as of 1991, when the firm was managed by the government. According to CANACERO (Cámara Nacional de la Industria del Hierro y del Acero), an organization representing the Mexican steel industry, the following six mills are currently making crude steel. The figures in Table 6.2-4 represent the share of each mill in the domestic market on and after 1992.

AHMSA is an integrated steel mill with blast furnaces, which undertakes integrated production of pig iron and steel, upto rolling; the firm produces slabs by continuous casting. HYLSA, which owns a direct-reduction-of-iron (DRI) plant, produces slabs by two electric furnaces and continuous casting, and produces a whole set of steel products including steel plates/sheets. IMEXSA, at present, merely produces up to slabs with a DRI plant. SICARTSA, an integrated steel mill with blast furnaces, neither produces any steel plates nor sheets; it only produces bars. TAMSA is a steel mill with an electric furnace. ACERIAS is a statistical term for a group of small and medium steel mills.

Table 6.2-4 Steel Production Share by Maker

(Unit : %)

	1992	1993	1994	1995
AHMSA	30.15	28.09	24.27	25.59
HYLSA	22.91	22.04	21.26	20.34
IMEXSA	11.28	14.72	17.16	18.59
SICARTSA	14.12	12.66	13.1	11.87
TAMSA	4.49	4.25	4.16	4.54
ACERIAS	17.06	18.24	20.04	19.07
Total	100.00	100.00	100.00	100.00

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

The details of the top two steel mills, AHMSA and HYLSA, is as follows.

(1) AHMSA (Altos Hornos de México)

1) Place of business: Monclova, Coahuila
2) Principal facilities:
   Five blast furnaces (capacity to make crude steel = 3.1 million tons)
   In-house production of slabs by continuous casting
   H.R. mill (1.1 million tons/year)
   C.R. mill (0.78 million tons/year)
3) Raw materials:
   Essential raw materials as iron ore, coke, etc. are all procured domestically.
4) Technological cooperation:
   Grupo Acero del Norte (which owns AHMSA) and the Dutch Hoogovens concluded a comprehensive technological-cooperation agreement to modernize AHMSA.
5) Modernization plan:
   Improvement of No.5 Blast Furnace, modernization of No.1 Converter, No.2 BOF, C.C., etc. between 1994 and 1997.
   The firm is also planning to modernize No. 2 Coke Furnace, establish a new oxygen-supplier plant, improve No. 4 Blast Furnace, repair Plate Mill, etc. obtained ISO-9000 certificate in March, 1995.
6) Products:
   Thick plates/sheets, H.R./C.R. coil/cut plates, wire-rods, profiles

(2) HYLSA

1) Place of business: Monterrey, Nuevo León
2) Principal facilities:
   Two blast furnaces (capacity to make crude steel = 2.1 million tons per year)
   No.1 H.R. Mill (Ingot-casting method)
   No.2 H.R. Mill (Directly to H.R. Mill from thin-slab C.C.)
   H.R. Mill (Total: 1.7 million tons/year)
   C.R. Mill, 1 unit (0.6 million tons/year)
3) Raw materials: Scrap (domestic/import), in-house production by DRI
4) Products: H.R./C.R. coil

6.2.3 Production of Steel Products

Tables 6.2-1 and 6.2-2 describe the import/export of crude steel and other steel products, while Tables 6.2-5 and 6.2-6 illustrate the domestic production and consumption of steel products. The table below (Table 6.2-7) portrays the domestic production and consumption of H.R. sheet/coil and C.R. sheet/coil, for which the demand happens to be the largest, not only in the automotive industry but also in the electrical/electronic industries, among various types of steel products stated in Tables 6.2-5 and 6.2-6.

Table 6.2-7 Production/Consumption of H.R. and C.R. Sheets

(Unit : Thousand Ton)

		1991	1992	1993	1994	1995
H.R. sheet/coil	Production	914.0	1,042.0	1,173.7	1,248.9	2,205.9
	Consumption	1,196.3	1,292.9	1,249.0	1,584.1	1,374.3
C.R. sheet/coil	Production	1,038.6	1,074.0	947.5	988.7	988.9
	Consumption	1,278.6	1,351.1	1,076.7	1,346.2	858.8

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

Consumption of H.R. sheet/coil and C.R. sheet/coil both exceeded production up until 1994. The situation reversed in 1995. H.R. sheet/coil production increased dramatically (76%) as a result of plant investment by mills (AHMSA, HYLSA) and the favorable export environment based on the devaluation of the peso.

Table 6.2-5 Production of Steel Products

(Unit : Thousand Ton)

Product	1991	%	1992	%	1993	%	1994	%	1995	%
Crude Steel	**532.5**	**100.0**	**916.4**	**100.0**	**1,296.8**	**100.0**	**1,706.0**	**100.0**	**2,189.1**	**100.0**
Flat Products	**2,551.1**	**100.0**	**2,643.9**	**100.0**	**2,649.6**	**100.0**	**2,822.0**	**100.0**	**3,822.1**	**100.0**
Plate	488.2	19.1	481.4	18.2	464.2	17.5	523.7	18.6	557.2	14.6
H.R. sheet	914.0	35.8	1,042.0	39.4	1,173.7	44.3	1,248.9	44.3	2,205.9	57.7
C.R. sheet	1,038.6	40.7	1,074.0	40.6	947.5	35.8	988.7	35.0	988.9	25.9
Tin plate	110.3	4.3	46.5	1.8	64.2	2.4	60.7	2.2	70.1	1.8
Non-flat Products	**3,101.7**	**100.0**	**3,302.0**	**100.0**	**3,673.6**	**100.0**	**4,233.7**	**100.0**	**4,298.4**	**100.0**
Wire rod	1,610.0	51.9	1,794.2	54.3	2,045.4	55.7	2,258.6	53.3	2,174.2	50.6
Deformed bar	824.9	26.6	828.3	25.1	874.5	23.8	1,126.2	26.6	1,273.8	29.6
Commercial Shapes	194.2	6.3	197.6	6.0	230.2	6.3	247.7	5.9	250.1	5.8
Structural shapes	235.8	7.6	269.1	8.1	295.1	8.0	314.9	7.4	339.5	7.9
Bars	236.8	7.6	212.8	6.4	228.4	6.2	286.3	6.8	260.8	6.1
Seamless pipe	**400.4**	**100.0**	**289.7**	**100.0**	**322.3**	**100.0**	**358.0**	**100.0**	**448.9**	**100.0**
Welded pipe	**427.0**	**100.0**	**427.1**	**100.0**	**398.0**	**100.0**	**483.9**	**100.0**	**327.9**	**100.0**

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

Table 6.2-6 Consumption of Steel Products

(Unit : Thousand Ton)

Product	1991	%	1992	%	1993	%	1994	%	1995	%
Flat Products	**3,403.3**	**100.0**	**3,491.6**	**100.0**	**3,053.2**	**100.0**	**3,991.9**	**100.0**	**2,614.8**	**100.0**
Plate	659.7	19.4	655.0	18.8	541.3	17.7	789.7	19.8	210.0	8.0
H.R. sheet	1,196.3	35.2	1,292.9	37.0	1,249.0	40.9	1,584.1	39.7	1,374.3	52.6
C.R. sheet	1,278.6	37.6	1,351.1	38.7	1,076.7	35.3	1,346.2	33.7	858.8	32.8
Tin plate	268.7	7.9	192.6	5.5	186.2	6.1	271.9	6.8	171.7	6.6
Non-flat Products	**3,364.5**	**100.0**	**3,687.3**	**100.0**	**3,916.1**	**100.0**	**4,571.1**	**100.0**	**3,130.6**	**100.0**
Wire rod	1,625.9	48.3	1,838.4	49.9	2,047.2	52.3	2,273.4	49.7	1,538.6	49.1
Deformed bar	940.3	27.9	1,011.9	27.4	986.2	25.2	1,213.1	26.5	919.1	29.4
Commercial Shapes	222.5	6.6	216.3	5.9	242.1	6.2	237.7	5.2	85.7	2.7
Structural shapes	275.4	8.2	319.6	8.7	347.7	8.9	462.3	10.1	297.3	9.5
Bars	300.4	8.9	301.1	8.2	292.9	7.5	384.6	8.4	289.9	9.3
Seamless pipe	**177.8**	**100.0**	**160.2**	**100.0**	**133.3**	**100.0**	**137.3**	**100.0**	**68.0**	**100.0**

Source : Cámara Nacional de la Industria del Hierro y del Acero (CANACERO)

There are only three manufacturers of H.R. sheet/coil and C.R. sheet/coil in Mexico. Their production capacity of H.R. sheet/coil and C.R. sheet/coil totals 3.5 million tons and 1.63 million tons, respectively. Considering that the production of H.R. sheet/coil and C.R. sheet/coil in 1995 amounted to 2.206 million tons and 0.989 million tons respectively, the operation rates are merely 63% and 61%. In terms of volume, Mexico has the production capacity to satisfy the domestic demand for steel sheets.

It should be remembered that APM (Acero Plano de Monterrey), the rolled sheet/coil manufacturer, is using purchased slabs.

Table 6.2-8 Capacity of Sheet Steel Plants by Maker

(Unit : Thousand Ton)

	AHMSA	HYLSA	APM	Total
H.R. sheet/coil	1,100	1,700	700	3,500
C.R. sheet/coil	780	600	250	1,630

There are three galvanized-steel-sheet manufactures in Mexico, namely, AHMSA, GALVAK (using steel sheets from HYLSA) and IMSA (using steel sheets from APM).

6.2.4 Supply/Demand Situation and Problems of Steel Products in the Automotive and Electrical/Electronic Industries

(1) There are hardly any data on the consumption of steel products in the automotive and electrical/electronic industries; the only one available is the 1986 survey conducted by a private firm, commissioned by CANACERO. According to this 10-year-old survey, steel consumption in the automotive industry (including assembling/parts industries concerning passenger cars, trucks and buses) accounted for 9.2 % of total steel consumption, while that in the electrical/electronic industries (including the entire assembling/parts industries, such as heavy electric) amounted to 3.2%. In the U.S. and Japan, steel consumption in the automotive industry accounts for 8-10% of total domestic steel consumption. In Mexico, total consumption of H.R. sheet/coil and C.R. sheet/coil happened to be 13.0% in the automotive industry and 3.8% in the electrical/electronic industries, according to the said survey.

Using these ratios, and the figures representing domestic consumption in 1994 stated in Table 6.2-6, it may be estimated that total consumption of H.R. sheet/coil and C.R. sheet/coil in the Mexican automotive industry was 381,000 tons, while that in the electrical/electronic industries was 111,000 tons.

(2) Steel-sheet supplies required by automotive and electrical/electronic industries have the following features in terms of type and quality.

a) Type: In automobiles, high-tensile steel sheets are frequently used to reduce the weight of the body, while surface-treated steel sheets are commonly utilized to improve the anti-corrosiveness of the body. In the electrical/electronic sector, steels with anti-corrosive specifications and those with special specifications to upgrade the performance of the products are often used.

b) Quality: There are strict requirements for uniform quality, since advanced product designs need high workability, and the accuracy of sheet-thickness is vital to the smooth operation of automated production-lines.

(3) The supply and demand situation and the problems regarding steel products (especially steel sheets) in the Mexican automotive and electrical/electronic industries may be summarized as follows, taking interviews by the Team into account.

a) Mexico has the production capacity to satisfy the demand for H.R. sheet/coil, C.R. sheet/coil and other major steel products in the two industries.

b) Nonetheless, it is estimated that the assemblers in the two industries are currently relying as much as 100% on imports to meet the demand for galvanized steel sheet and other special steel sheets, and nearly 50% for H.R. sheet/coil and C.R. sheet/coil. Assemblers often directly import steel without the involvement of coil centers; they either import steel sheets in coil-form and cut them by themselves as they require, or purchase them in cut-plate form.

c) The heavy reliance on imports may be due to the following reasons.

1. There are problems in the quality of domestic materials, especially in terms of rolling accuracy and the stability of quality. This particularly applies to high-grade steel sheets which are used for parts requiring high workability. As high-grade steel sheets serve as the base metal for surface-treated steel sheets and anti-corrosive steel sheets, their poor quality is affecting the production of special steel sheets in Mexico.
2. Mexico still lacks the ability to produce some special steel sheets.
3. Products geared to exports are normally subject to strict quality standards. Yet, domestic manufacturers lack the flexibility to comply with different specifications even though they often depend on the recipient country.
4. The automotive and electrical/electronic industries are distinctive in that the diversification of product specifications and the increasing volume of products necessitate the automation of production processes. This means that it becomes increasingly important to receive parts on schedule. With regard to parts processing, there is an increasing demand for uniform quality of steel products and reliable delivery schedules, in the interests of efficient production especially at stamping shops. Domestic manufacturers, however, have problems keeping delivery dates, making it difficult for many firms to switch from imports to domestic material.

d) Meanwhile, secondary and tertiary parts mills are purchasing domestic materials mainly through coil centers. In general, this is because the majority of parts ordered to them are of low workability and the types specified are hardly special.

e) Steel products produced and shipped by steel mills are generally standard-sized and coiled. The coil center either cuts coils to adjust the width or to make them into plate-forms according to the user's request, and delivers them by the specified date. Coil centers are sometimes called "steel centers" or "steel service centers", and are equipped with slitter lines, blanking lines, levellers, and shears.

There are a large number of coil centers across Mexico, ranging from large ones to small ones. For the time being, they are sufficient both qualitatively and quantitatively. Nonetheless, the users (i.e. autoparts manufacturers and electrical/electronic parts manufacturers) appear to be extremely unsatisfied with frequent delivery delays by coil centers, among all the services they offer.

6.2.5 Major Issues Related to the Steel Industry for Localization of Steel Materials for Parts Industries

Steel sheet is one of the steel products consumed in large quantities by automotive and electrical/electronic industries. Steel sheets are mainly classified into ordinary sheet used for interior parts, and high-grade sheet used for external panels including surface treated sheet. In Mexico, most of high-grade sheet used by the both industries, and large portions of ordinary sheet are imported from U.S., Japan and other countries, although domestic production capacities are available. To increase the share of domestic sheet, priority should be given to the localization of ordinary sheet for the reasons stated below.

First of all, high-grade sheet used in automobiles and electrical/electronic products requires high levels of quality which warrant workability for deep-draw and accurate thickness according to the specifications, which is the prerequisite to be fulfilled before meeting price and delivery requirements. Production of high-grade sheet, therefore, requires all the key technologies (steelmaking, rolling, and surface treatment) to be at advanced levels. Although the Japanese steel industry provided technical assistance for the ailing U.S. industry in the 1980s, including equity participation, and contributed greatly to its regeneration, the Japanese steel industry is still the technological leader in the world. Likewise, to advance itself to such technology levels, the Mexican steel industry must import advanced technology from Japan or other countries and make massive capital investment. While such investment may be feasible in the long run as Latin America is considered as a potential market, it is premature for the country to choose the course at this moment, so long as there is no market to justify the investment. For this reason, the use of imported high-grade sheet will be appropriate for the time being. In fact, even major automobile producing countries in the world import high-grade sheet for external panel mainly from Japan.

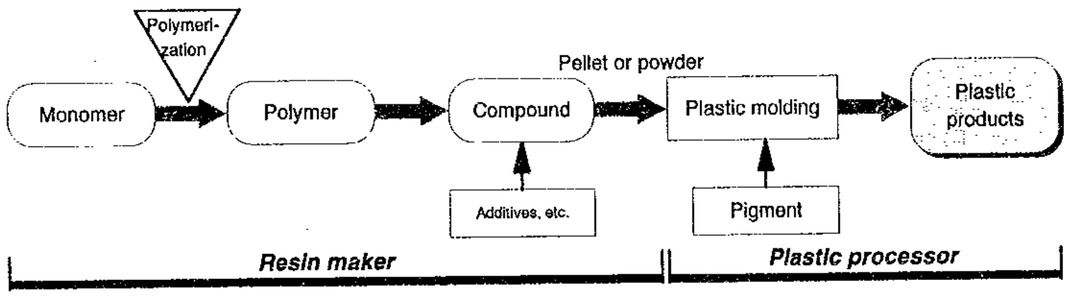
On the other hand, ordinary sheet is mainly used for construction materials, containers, packaging materials, and general merchandise, which do not require strict quality levels in terms of workability, external appearance and other factors, which are demanded for high-grade sheet. Nevertheless, assemblers in Mexico heavily rely on imported ordinary sheet, setting aside that secondary and tertiary subcontractors use local products, as discussed in 6.2.4. During the Team's interview, delivery was most frequently cited as an obstacle to the use of local products, followed by price, while quality problems were not raised by many respondents. If a relatively high in-land transportation cost from the U.S. (a major import source) is taken into account, the lack of price competitiveness of local products against imported ones should be attributed to the lack of efforts of local manufacturers. Local steel mills are in the course of modernization by introducing foreign technology and capital, and their immediate target is the domestic market for ordinary steel sheet. The market can be penetrated by improving production management and quality control and thereby overcoming delivery and price problems, for which steel mills have to take appropriate measures, together with the coil centers for streamlining distribution.

It should be noted automotive and electrical/electronic parts industries are not major markets for the steel industry and represent only a small portion of the steel market (generally 10% or less). Thus, it is difficult to make recommendations for the steel industry solely from the interest of the parts industries.

6.3 Plastics

By specification, plastics can broadly be divided into two groups, namely, thermoplastic resin and thermosetting resin. They can also be divided into such groups as general-purpose resin and engineering plastic, according to its demand and purpose.

The production process of plastic products is as follows.



Plastic-parts manufacturers in the automotive and electrical/electronic industries purchase pellets from the resin maker and produce plastic goods, serving as plastic processor thereby. As a matter of course, assemblers which produce plastic parts in their own plants are also categorized as plastic processors.

There are various types of resin makers. PEMEX produces resin materials from monomers, sometimes even compounds depending on the resin. Some makers purchase monomers, and even undertake polymerization to produce compounds. There are also firms which mix additives with the purchased compounds to sell them to plastic processors; they are also included in resin makers.

6.3.1 Production and Consumption of Resin in Mexico

Table 6.3-1 shows the production, import, export and consumption (= production + import - export) of resin in Mexico in 1994 and 1995.

Table 6.3-1 Production, Import/Export and Consumption of Resins

(Unit : Thousand Ton)

	1994	1995
Production	1,680	1,770
Import	611	638
Export	297	340
Consumption	2,000	2,065
Plant capacity	2,260	2,310

Source : Instituto Mexicano del Plástico Industrial (IMPI)

Contrary to steel products mentioned in section 6.2., of which domestic consumption substantially decreased between 1994 and 1995, domestic demand for resin increased by 3.3% during the same period. Table 6.3-2 illustrates the production and domestic consumption of resin by class, as of 1995.

6.3.2 Resin Makers

Mexico's petrochemical sector is based on ethylene production by PEMEX's (Petróleos Mexicanos) gas processing. Production of ethylene amounted to 1.5 million tons in 1995. PEMEX, which sells monomers to other resin makers, is the sole compound maker of LDPE and HDPE in Mexico; thus, Mexican resin makers purchase raw materials from PEMEX and cover the shortage by imports.

Figure 6.3-1 shows how 1.5 million tons of ethylene by PEMEX are converted into various resin. The amount produced by each maker was estimated considering their production capacities.

6.3.3 Plastics, and the Automotive and Electrical/Electronic Industries

Figure 6.3-2 represents the domestic consumption of plastic by sector.

Consumption in the transportation manufacturing industry (including passenger cars and trucks) and the electrical/electronic equipment manufacturing industry (including heavy electric) account for 2.4% and 4.8% of total consumption, respectively. It is common to all countries that the largest portion is consumed for packaging purposes; in industrialized countries, this accounts for roughly 30%.

Table 6.3-2 Production/Consumption of Resins by Class for 1995

(Unit : Thousand Ton)

		Production	(%)	Consumption	(%)
Thermoplastics	LDPE	307	17.3	342	16.6
	HDPE	190	10.7	305	14.8
	LLDPE	0	0.0	100	4.8
	PP	218	12.3	272	13.2
	PVC	380	21.5	245	11.9
	PS	120	6.8	150	7.3
	PET	145	8.2	135	6.5
Thermosets	PUR	305 (PUR–Other)	17.2 (PUR–Other)	52	2.5
	EP			5	0.2
	UP			43	2.1
	PF			11	0.5
	MF			256 (MF–SI)	12.4 (MF–SI)
	UF				
	SI				
	Other				
Engineering Plastics	ABS	21	1.2	19	0.9
	PA	7	0.4	5	0.2
	Other	77	4.4	125	6.1
	Total	1,770	100.0	2,065	100.0

Source : Instituto Mexicano del Plástico Industrial (IMPI)

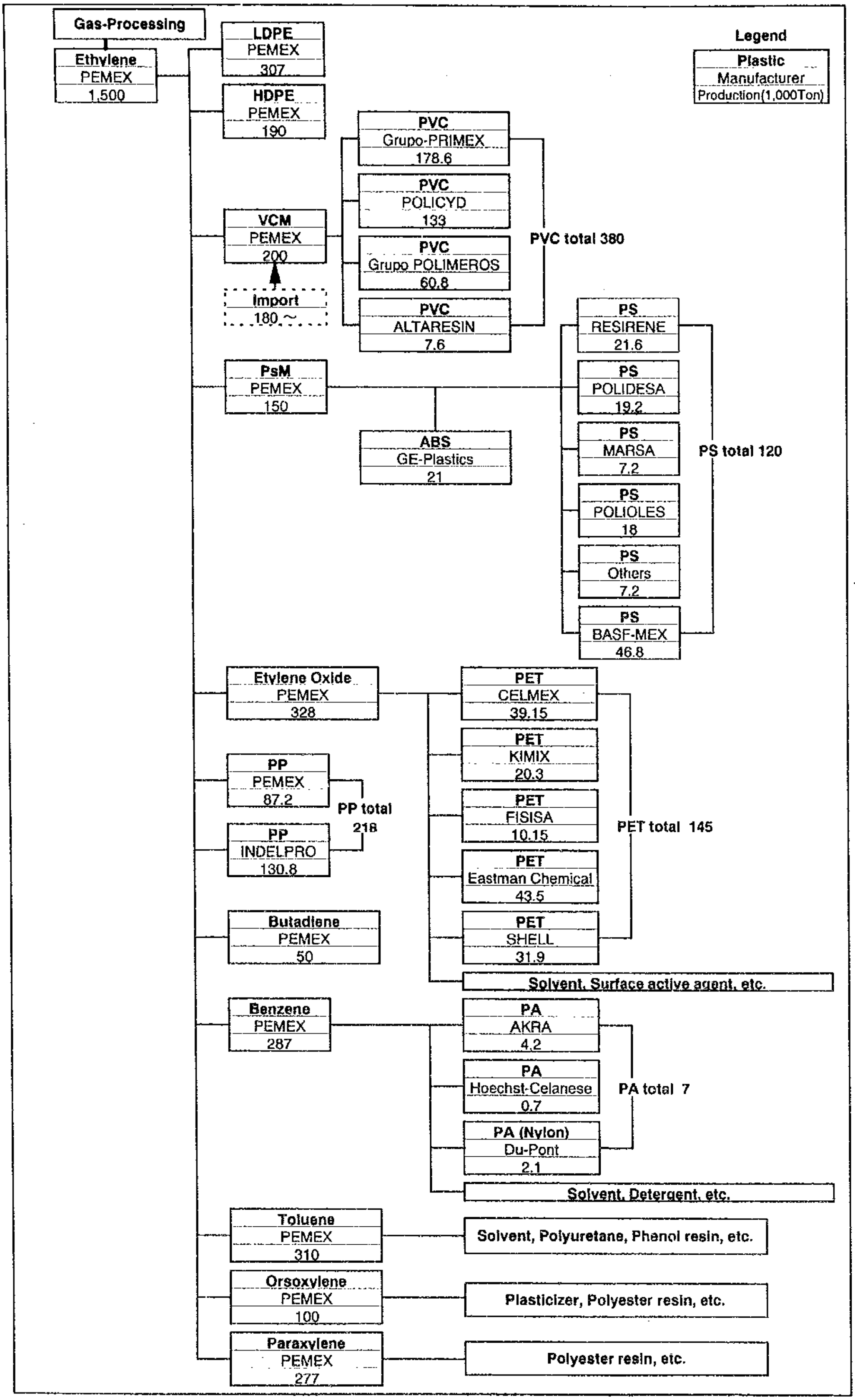
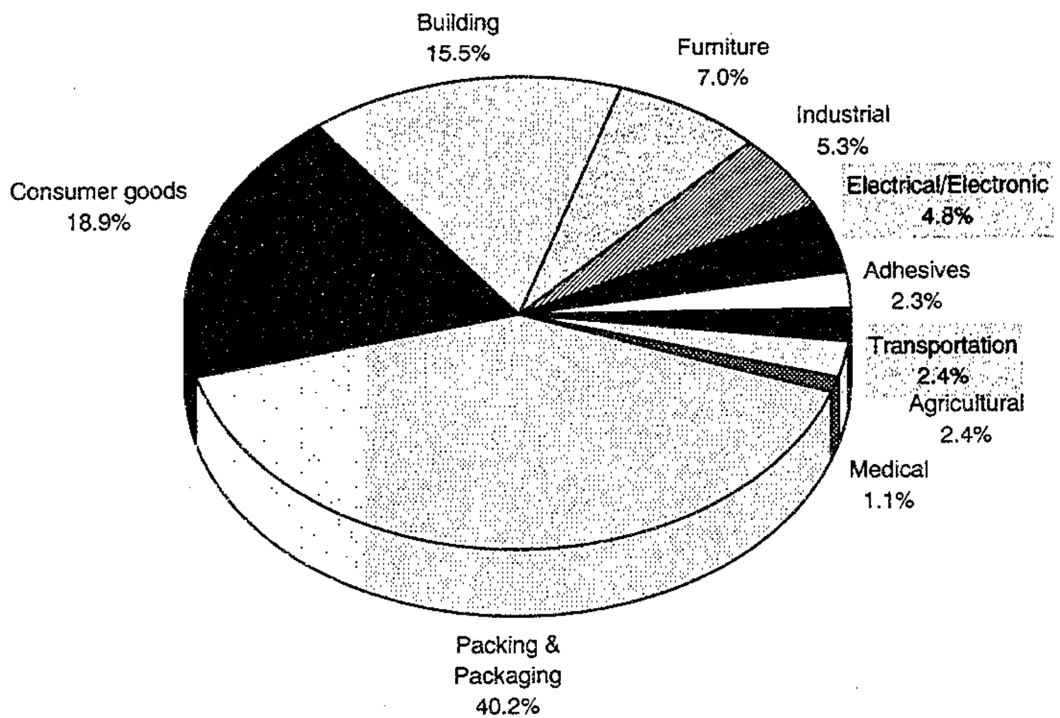


Figure 6.3-1 Resin Industry in Mexico for 1995



Market	(Unit 1,000Ton)
Packing & Packaging	830
Consumer goods	390
Building	320
Furniture	145
Industrial	110
Electrical/Electronic	100
Adhesives	48
Transportation	50
Agricultural	50
Medical	22
Total	2,065

Source : Instituto Mexicano del Plástico Industrial (IMPI)

Figure 6.3-2 Market Segments of Plastics, Mexico 1995

The composition of consumption in the transportation manufacturing industry and the electrical/electronic equipment manufacturing industry (2.4% and 4.8% respectively) by plastic type is shown in Figures 6.3-3 and 6.3-4. According to these Figures, the transportation and electrical/electronic equipment manufacturing industries most commonly use the following plastics.

Transportation manufacturing industry: PUR, PP, ABS
Electrical/electronic equipment manufacturing industry; PVC, LDPE, HDPE, PS, PP

The amount of plastics used in automobiles account for 7-10%, generally 8%, of the total weight, whereas those in household electric appliances amount to roughly 30-45%.

The supply and demand situation of the aforementioned 6 plastics (excluding PUR) in Mexico is as follows.

Table 6.3-3 Production, Import/Export, Consumption of Major Plastics for Transportation/Electrical-Electronic Equipment Manufacturing Industries for 1995

(Unit : Thousand Ton)

	LDPE	HDPE	PP	PVC	PS	ABS
Production	307	190	18	380	120	21
Import	50	160	99	5	55	7
Export	15	45	45	140	25	9
Consumption	342	305	272	245	150	19
Plant Capacity	310	200	300	425	310	22

Source : Instituto Mexicano del Plástico Industrial (IMPI)

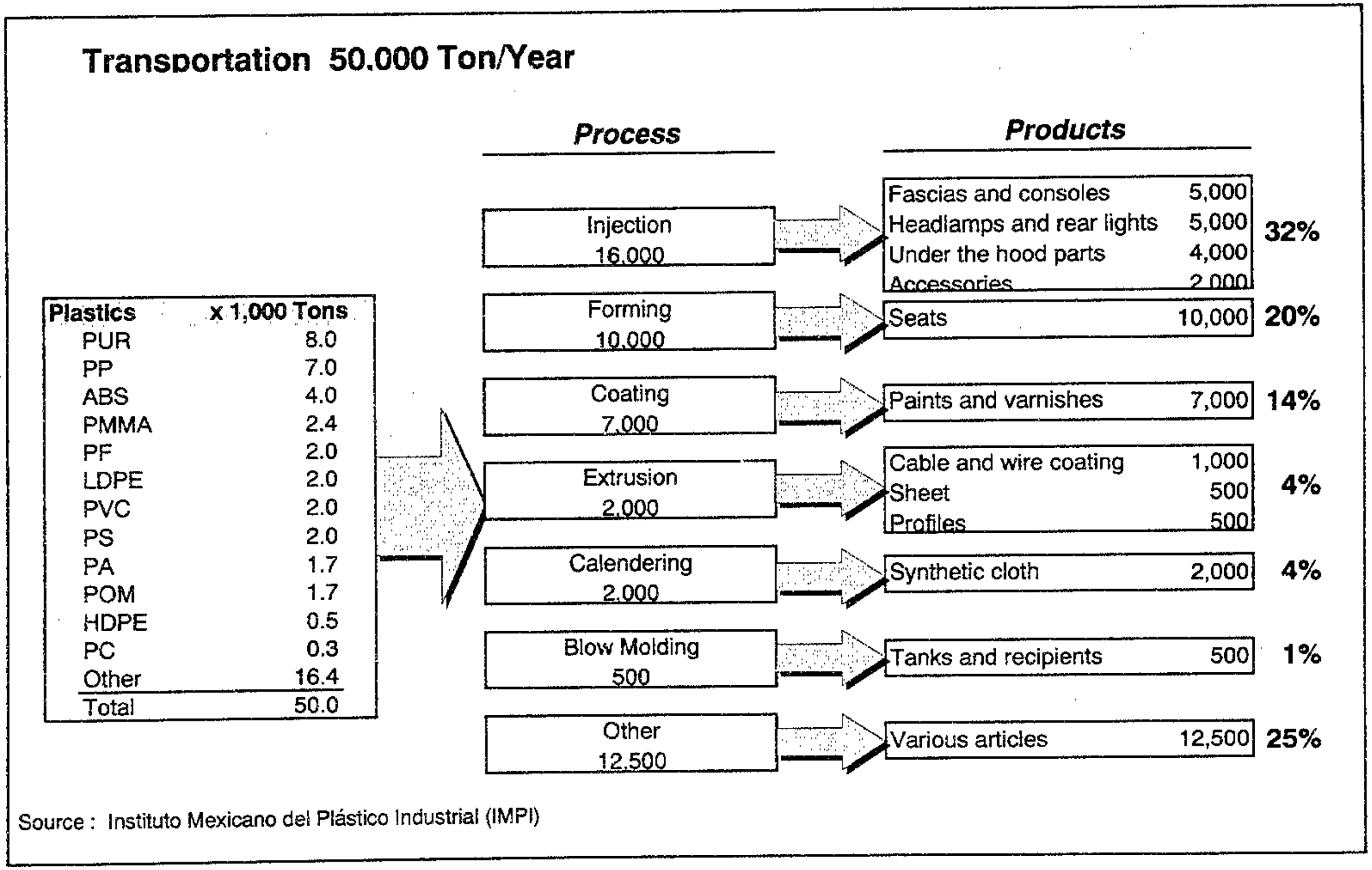
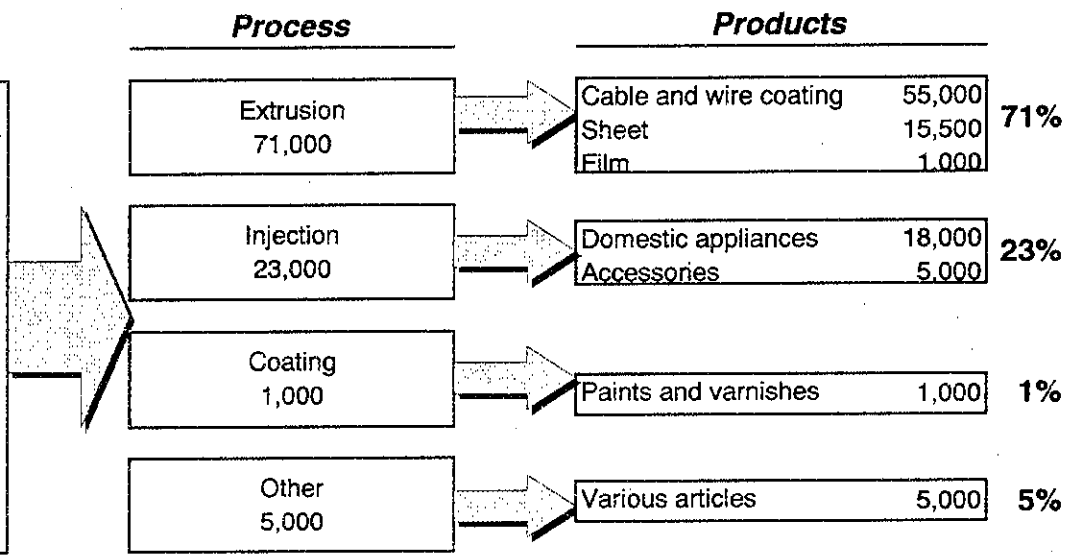


Figure 6.3-3 Plastic Consumption in Transportation Industry, Mexico 1995

Electrical/Electronic 100.000 Ton/Year

Plastics	x 1,000 Tons
PVC	19.5
LDPE	17.0
HDPE	16.0
PS	15.0
PP	11.5
TERMOSETS	7.0
ABS	6.4
LLDPE	2.0
PA	1.7
PC	1.6
PMMA	0.5
POM	0.4
Other	1.4
Total	100.0



Source : Instituto Mexicano del Plástico Industrial (IMPI)

Figure 6.3-4 Plastic Consumption in Electrical/Electronic Industry, Mexico 1995

6.3.4 Supply/Demand Situation and Problems of Plastics in the Automotive and Electrical/Electronic Industries

(1) The amount of plastic consumed in the transportation manufacturing industry totaled 50,000 tons in 1995. However, it is estimated by weight composition of vehicles that plastic parts as much as 100,000 tons (which is twice the amount) have been used in the automotive industry alone, which manufactures about 1 million cars including buses. This indicates that the shortage has been covered by imports of plastic-molded parts.

(2) As shown in Table 6.3-3, the capacity of plants to produce resin is sufficient to meet the current amount of consumption in the automotive and electrical/electronic industries in Mexico, apart from LDPE and HDPE. Nevertheless, resin and plastics are often imported. There are no statistics on whether the plastics used by assemblers and parts manufacturers in the two industries are domestic products, hence there is no option but to rely on interviews.

Polycarbonate (PC), acetal resin (POM) and other engineering plastics which are not produced in Mexico are all imported in the form of molded products.

(3) According to interviews by the Team targeting resin makers, plastic processors, industrial associations and distributors, the fact is that both automotive and electrical/electronic industries import plastic-molded products and the majority of resin materials are imports. This is particularly evident in parts and products geared to exports, due to the following reasons.

a) There is no alternative but to rely on imported resin materials because the domestic counterparts fail to meet the standards in the country to which plastic products are exported (e.g. UL standards).

b) Due to the poor quality of domestic resin, it is often difficult to switch from imports to domestic material. Problems regarding quality include: unreliability caused by uneven polymerization; impurities; and contamination arising in the course of polymerization.

Consequently, plastic processors are confronted with such problems as:

- Irregular molding conditions
- Occurrence of fish-eyes
- Lack of transparency

4) In interviews, plastic processors all mentioned the aforementioned quality problem in domestic resin. Yet, resin makers tend not to take their complaints seriously, blaming the plastic processors' facilities and technology.

Plastic processors are also dissatisfied with resin makers on cost (C) and delivery (D) fronts (say, the latter's bad treatment, method of price setting/changing), showing how little confidence they place on each other.

As a solution, for example, joint research efforts between resin makers and plastic processors should be effective not only in solving technological problems but also in developing a sense of mutual trust. Nevertheless, we might have to wait until the PEMEX privatization issue settles down.

6.3.5 Major Issues Related to the Material Industry for Localization of Resin for Parts Industries

Major markets for the resin makers are packaging materials, general merchandise, and construction materials, not parts industries. As seen in high-grade steel sheet used by the automotive and electrical/electronic industries, quality levels demanded by assemblers and suppliers in both industries for resin and plastic products are much higher and strict than those required by other industries. Given the small market size and high quality requirements, it is rather premature for the plastic materials industry in Mexico to produce all resin materials demanded by both industries. It must be assumed therefore that most of the resin materials for the industries will be imported for a while.

The evolution process of the plastics industry differs largely between countries having their own raw materials and those not having. In a country without its own raw materials, the industry evolves from the downstream. On the other hand, Mexico has petroleum and natural gas resources, allowing the industry to start from the upstream. Now, to promote localization of plastic materials in future, although gradually, evolution from the downstream to the upstream is a logical and practical strategy, i.e., starting from substitution of imported molded products with local molding by using imported pellets, followed by local production of pellets by using imported polymer, local production of polymer by using imported monomer, and so on. In the process, committed efforts are required on the side of resin makers to establish separate production lines for the parts industries and other traditional customers.

Aside from long-term issues to establish local supply capacities for the parts industries, there are three immediate issues to be tackled by the resin makers, as follows:

(1) The plastics industry in Mexico emerged from the upstream, under government initiatives. During the field survey, the Team heard from molders quality problems associated with local materials and the apparent lack of responsiveness of resin makers, who fail to recognize the importance of customer satisfaction which is the foundation of any industry. It is the fact that many plastic processors rely on imported materials, despite the availability of local products. Efforts should be initiated by resin makers to understand requirements of their customers and to improve product quality accordingly.

(2) To meet the constantly changing needs of the parts industries in terms of technology and quality, much faster and higher than those of other users of plastic materials (e.g., pipes and packaging materials), close cooperation of plastic processors in the form of joint research and development, particularly with assemblers of final products, plays a very important role, as discussed in 6.3.4. There are many cases of successful joint research projects under which assemblers and material suppliers have developed new materials and accomplished cost reduction (e.g., replacement of urethane mold bumpers with PP injection mold ones)

(3) For resin makers, cost reduction can be achieved by focusing on general-purpose resins (LDPE, HDPE, PP, PS, and PVC) which consumption is fairly large in amount, including that by the parts industries. This means to have a limited number of production lines with high capacity and produce a small variety of products. Meanwhile, joint development projects with plastic processors can lead to product shapes and molding equipment customized to raw materials and their properties. Successful cases are seen in Taiwan and other countries.

Chapter 7

The Parts Industry : Present and Future

Chapter 7 The Parts Industry: Present and Future

This chapter first analyzes how the assemblers in Mexico obtain parts based on the research and discussions that are in Mexico,. On that basis it then discusses supply trends with reference to the primary suppliers, who play an important role in the acquisition of the parts from SMEs, and studies the relationship between the primary suppliers and the secondary suppliers. In addition, based on the Team's analysis of the supporting industries in Mexico, it discusses the future prospects of the industry. To facilitate the comprehension of the chapter, a basic explanation of the tiers of subcontracting is provided.

7.1 Basic Understanding on the Tier of Subcontracting

Figure 7.1 - 1 shows the general tiers of subcontracting of the supporting industries in under-developed and developing countries. The substructures in Mexico are almost identical to these and the explanation therefore uses this figure.

7.1.1 Structure of Subcontracting

(1) Assemblers

In Tier 0, assemblers ship brand new finished products, such as automobiles and television sets, to domestic and foreign markets. (Used products and replacement parts are excluded from the explanation.)

Assemblers in Tier 1 are mainly huge foreign corporations and they use their (foreign) technologies. The assemblers import parts, including functional components (e.g., radiators and CRTs), either through the primary suppliers or by themselves. Some parts are made in the assemblers' own plants. These parts/components tend to be large, such as automotive engines, outer body panels, inner body panels, and the bodies of televisions and refrigerators.

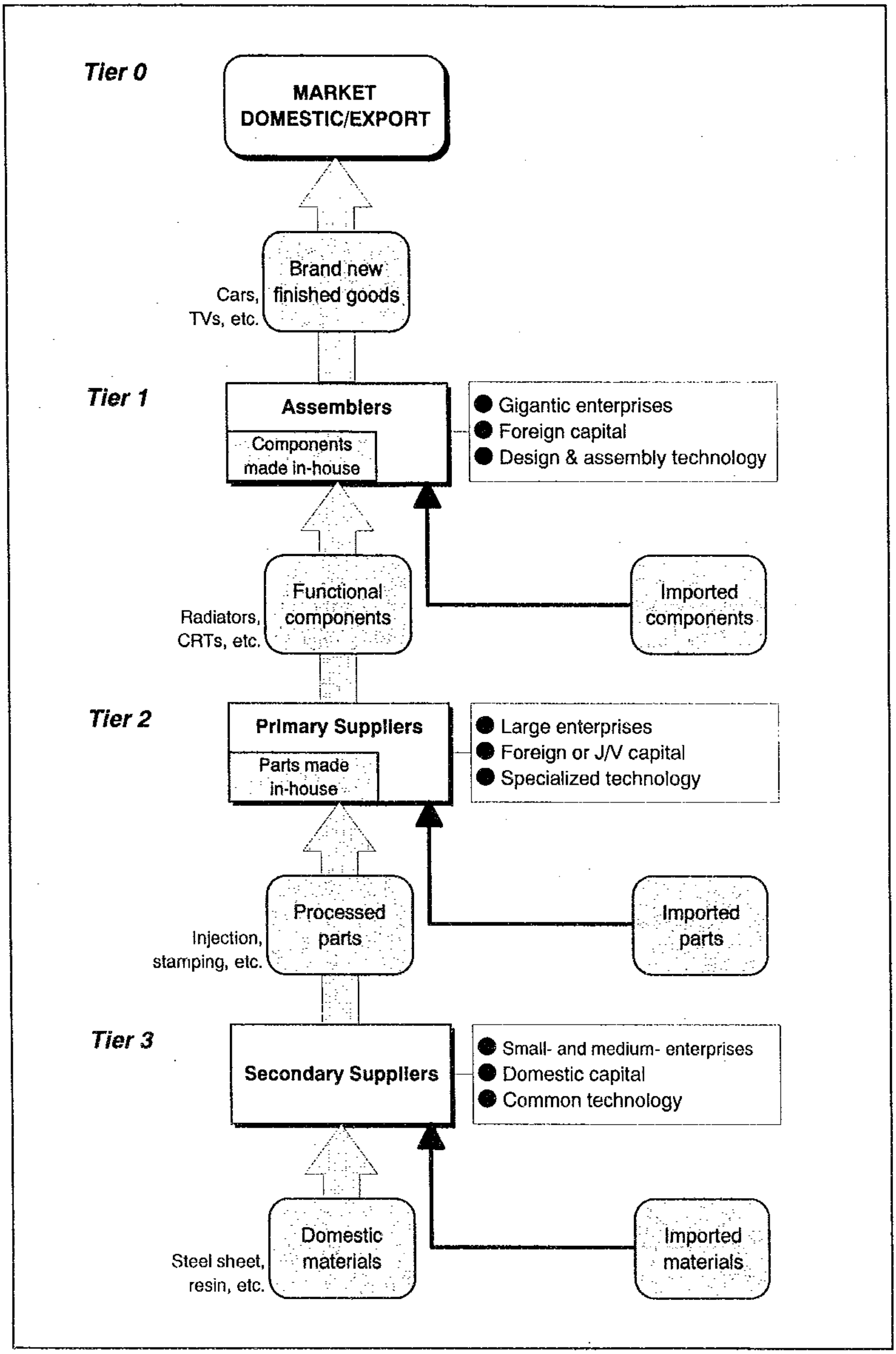


Figure 7.1-1 Characteristics of Supporting Industries by Tier of Subcontracting

It is significant that the primary suppliers possess the knowledge and technology involved in the design and production of functional components, while the assemblers do not necessarily have all the technical information regarding every parts/components. Also, in relation to the subcontractors, the assemblers are only interested in the primary suppliers from whom they purchase parts. The assemblers do not foster or develop relationships with the secondary and lower suppliers. Therefore, the primary suppliers are responsible for developing relationships with the secondary suppliers, with whom they deal directly. Japanese industry, with its clear horizontal structure, has a similar system in which the assemblers have control over the entire substructures of subcontractors.

(2) The primary suppliers

In Tier 2, the primary suppliers are generally large corporations which have specific technology and knowledge of certain functional components (e.g., radiators and CRTs). The primary suppliers assemble functional components from locally acquired parts from the secondary suppliers, imported parts and in-house produced parts (i.e., sub-assemblies).

The primary suppliers play a supporting role as they purchase parts from the secondary suppliers and assemble the parts to produce functional components which are then supplied to the assemblers. For instance, the primary suppliers decide whether they will take on secondary suppliers as subcontractors, produce the parts in-house, or import the parts. Because the design and production of the functional components requires highly advanced skills, if there are no primary suppliers in the country, this function must be supplemented by a foreign company. This means that it is extremely difficult for local SMEs to become primary suppliers.

(3) The secondary suppliers

The secondary suppliers supply parts to the primary suppliers. The tertiary suppliers supply parts to the secondary suppliers. This is the rule of defining primary, secondary and tertiary. This means that although the market or target of the secondary suppliers is the primary supplier, unless there is a substantial number of primary suppliers in an area who prefer to acquire their supplies locally, there will be no reason for the secondary suppliers to exist.

In Tier 3, the secondary suppliers and lower suppliers in the hierarchy are mainly local SMEs. They possess and use relatively easy to acquire technology. The secondary and lower suppliers produce low-functional components and non-functioning components. Frequently, both automotive parts and electrical/electronic parts, are produced by one company and therefore, those suppliers are usually referred to by the characteristics of their products such as a "casting plant", "plastic processing plant" or "stamping plant."

7.1.2 Advantage of Subcontracting

General advantages from diversification and specialization through subcontracting are summarized as follows.

Advantages for Contractors

1) New investments are not required for to comply with increased demand. Investment risk and rise of manufacturing costs can be avoided.
2) Transfer of a part of manufacturing process to subcontractors can prevent having excessive production capacity.
3) Contracts that can not be satisfied by use of the contractor's own facilities can be made on the basis of cooperation by subcontractors. Therefore, business opportunities need not be lost.
4) Flexibility in satisfying an increase in demand is acquired by relying on subcontractors, as supply can be increased without or before increasing one's own capacity.
5) A specialized, advanced technology of a subcontractor can make it possible to offer a highly competitive product.
6) Human resources can be used for research and market development because production is done by subcontractors.

Advantages for Subcontractors

1) Signing contracts to supply a number of, or many, companies can make it possible to fully utilize existing production equipment, resulting in cost reduction or profit increase.

2) Job specialization can facilitate acquisition of cutting-edge production technology and equipment, assuring competitiveness.
3) Innovative technologies from clients, by being used for their products, improves the subcontractor's technology.
4) Costs for market development and sales promotion can be reduced to a great extent.

7.2 The Automotive Parts Industry's Present Situation and Future Prospects

7.2.1 Basic Parts Procurement Policy of Auto Assemblers and the Current Situation

There are currently five major automobile and pick-up truck assemblers in Mexico: GM, Ford, Chrysler, Volkswagen and Nissan. The Team visited GM and Nissan but was not able to obtain as much information as desired. Therefore, the following discussion concentrates on the basic procurement policy of auto assemblers and their current situation according to the information from the manufacturers as well as the observations and conclusion from the study of primary suppliers.

(1) Basic parts procurement policy of auto assemblers

1) The origin of imported parts

Auto assemblers do not arbitrarily limit the countries from which they import parts. However, when it comes to particularly strategic parts for Mexico, manufacturers often invest large amounts of capital in plants in certain countries, and thus will import the parts from these particular countries. Also, the general trend is that foreign assemblers import most of the parts from their own countries, the U.S., Germany and Japan.

2) Procurement of Mexican parts

The assemblers basically wish to procure parts (except for the strategic parts mentioned) in Mexico because local suppliers are able to operate at lower costs, because it becomes possible to manage delivery schedules using the JIT (Just in time) method, because they can provide technical guidance, and because they can cope with design changes with relative ease. Because of these possible advantages, each assembler has gathered or is gathering parts suppliers in the general vicinity of their locations thus forming company towns.

3) Assuring the competitiveness of the Mexican parts

The assemblers are important buyers of Mexican parts. However, their part suppliers must be competitive. Competitiveness is usually evaluated in terms of Quality, Cost, Delivery, and Development. When the assemblers are looking for new suppliers, they place importance on the suppliers' ability to develop. Assemblers expect quality from those suppliers they already deal with.

In order to manage and control product quality, GM, Chrysler, and Ford have established the common quality requirements for parts suppliers (QS9000) and they are urging their suppliers to get QS9000 certification. GM set the deadline for this for the end of December 1997; Chrysler's is at the end of July 1997 while Ford has not yet set a date. Those who fail to obtain the QS9000 certification will lose their eligibility to do business with the Big Three.

To increase the ability of the parts suppliers to develop new products, the manufacturers have set up technical centers. Nissan established a center in Toluca and GM built a center in Ciudad Juárez. The biggest opportunities for the parts suppliers to find new business with assemblers is when the assemblers develop a new series of automobiles and/or change their models. At such times, manufacturers would like to co-develop products with the primary suppliers in order to shorten lead times. Therefore, the technical centers are expected to play an important role.

4) Concentration of the suppliers

An automobile is made of a total of twenty thousand parts. There are more than a thousand components (also called component parts or units) which are sub-assembled. The assemblers, who like to purchase fewer parts in order to lower procurement costs and reduce assembly time, purchase components which are sub-assembled to a high degree and are ready to be assembled.

Furthermore, the assemblers like to narrow down their sources, by possibly having one or two designated suppliers for one component. The assemblers are moving towards what is known as "single sourcing".

5) Enhancement of domestic subcontractors

The five major assemblers mentioned above already have their direct primary suppliers, and they seem to be satisfied with the suppliers' volume and quality. The Automobile Law regulates the ratio of domestic value added (local content). In-house produced components and parts are not added to the ratio, which has driven the industry to improve the subcontractors. However, an easing of regulations provided by the law is taking place and by January 2004 the regulations will most probably be abolished. This will leave the assemblers free from the pressure to focus only on their domestic subcontractors.

(2) Current situation of parts procurement of auto assemblers

Assemblers procure necessary parts by three sources or methods. One is to produce in-house, the second is to import the parts, and the third is to procure them locally. The current situation of the manufacturers' procurement from each source is discussed below. Table 7.2-1 shows the outline of import parts and local procurement parts.

1) In-house produced parts

GM, Ford, Chrysler, Volkswagen and Nissan have their own engine processing and assembly plants. However, the materials for casting cylinder heads and blocks, which are the main parts of an engine, are supplied by various sources as shown below.

Nissan	100% in-house produced
Chrysler	100% by local suppliers
Ford	50% in-house and 50 % local
GM	50% in-house and 50 % local
Volkswagen	Aluminum compound cylinder heads are produced in-house and casting cylinder blocks are by local suppliers

Regarding parts other than those used in engines, large stamped parts such as the outer and inner panels of the body are produced in-house by all the manufacturers. Among the Big Three, Chrysler relies most on in-house production, while GM is the biggest user of suppliers.

2) Import

Table 7.2-1 shows the major parts and components which the manufacturers import.

Most of the parts and components listed in Table 7.2-1 are not produced in Mexico. However, even for the parts and components which are available in Mexico use is made of imports. The largest exporter is the U.S. A number of automotive parts manufacturers in the U.S. are supplying parts and components to the Big Three as well as to the Japanese auto assemblers. These suppliers have great production capacity. On the other hand, the position of the assemblers in Mexico is that they will procure parts and components from any source as long as the suppliers meet their standards in quality, cost, delivery and development.

3) Local content

The ratio (value added) at which the assemblers must procure parts from domestic sources is currently set at 34% by the Automobile Law. Therefore, all the auto assemblers in Mexico procure slightly more than 34% of the parts and components from local suppliers. GM, as of 1994, has 147 local suppliers in Mexico. GM claims that the percentage of local parts used in GM vehicles is slightly above 34% in accordance with the Automobile Law.

7.2.2 Primary Suppliers' Current Situation regarding the Parts Procurement

Primary suppliers procure parts from secondary suppliers, process and assemble the parts, and supply components to auto assemblers. Detailed below is the current situation of parts procurement of the primary suppliers who play a key role in the structure of the supporting industries.

(1) Four Types of the Primary Suppliers in Mexico

Figure 7.2-1 below shows general processes of the primary suppliers for manufacturing components. The current situation of the manufacturing processes of the primary suppliers in Mexico is described below. The suppliers can be classified into four types. The secondary suppliers, who are mostly SMEs, mainly have charge of the primary processing as shown below.

Table 7.2-1 Main Outside Sourcing of Autoparts by Assemblers

A. Import Parts

- Automatic transmission unit
- Engine control unit
- Forged connecting rod
- Fuel injection system
- Forged crankshaft

B. Local Procurement Parts

B.1 Assemble components

- Manual transmission
- Drive axle
- CV joint
- Propeller shaft
- Clutch
- Brake master cylinder
- Brake booster
- Brake hose
- Caliper
- Oil pump
- Water pump
- Radiator
- Shock absorber
- Starter
- Alternator
- Wire harness
- Seat
- Steering unit
- Lumps
- Car radio

B.2 Processed materials

Cast parts

- Rocker cover
- Piston
- Piston ring
- Camshaft
- Intake manifold
- Aluminum alloy wheel
- Hub
- Disc brake
- Drum brake

Forged parts

- Gear blank
- Front axle
- Knuckle joint

Stamped parts

- Exhaust system
- Oil pan
- Fuel tank
- Suspension components
- Body parts
- Door hinge

Plastic parts

- Instrument panel
- Console box

Sintered alloy parts

- Valve guide
- Valve seat

Source : JICA Study Team field surveys

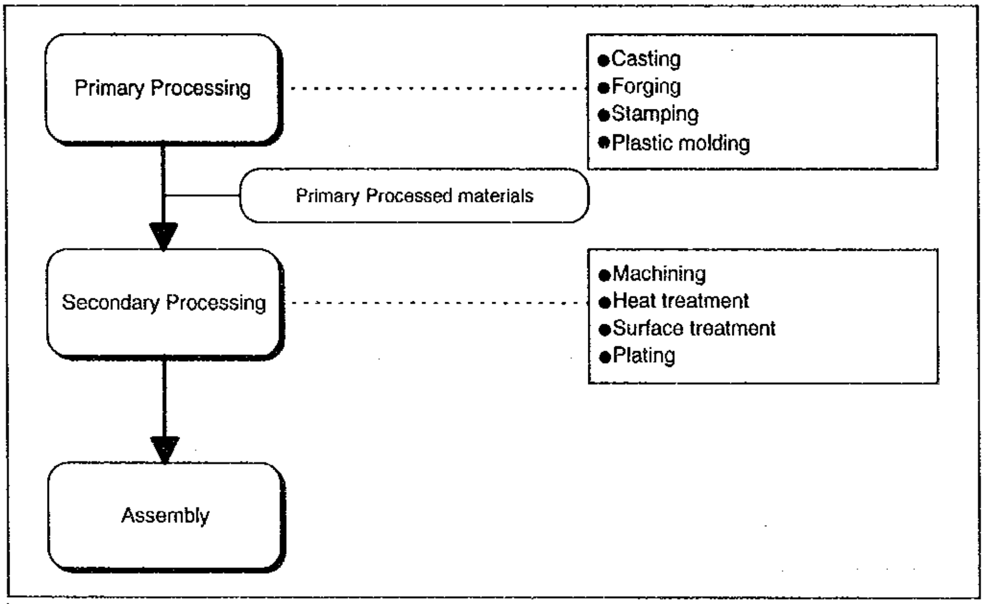


Figure 7.2-1 Pattern of In-house Processing by Primary Suppliers

1) Type A : Companies who externally procure all processed material

The primary suppliers of this type procure all processed materials through domestic purchase or import, and perform only machining, surface treatment, heat treatment and assembly. Some of the companies are shown below.

---

i) Cummins (Product : Diesel engine)

- Local parts
  - Cylinder head (CIFUNSA)
  - Vibration damping pulley (TISAMATIC)
- Import parts
  - Forged crankshaft (Krupp in Brazil)

(Note)Cummins procures from a total of 180 suppliers in Mexico and overseas.

ii) Dirona (Product : Axles)

- Local parts
  - Cast parts (MIN-CER)
- Import parts
  - Cast parts (Tupy in Brazil, Neenah in U.S.)
  - Forged parts (Hungary, India, Brazil)

(Note) Dirona has changed supply source for some parts from local ones to imports due to low quality, high cost and insufficient production capacity of local suppliers.

iii) NABCO (Product : Master cylinder and wheel cylinder for brake)

- Local parts

  - Plastic tank
  - Spring
  - Piston (Cast materials)
  - Rubber parts

- Import parts

  - Cast parts -Aluminum alloy (Japan)

(Note) NABCO has a plan to replace the import parts by local ones manufactured by Nissan's in Aguascalientes.

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2) Type B : Companies who are self-sufficient within their respective company groups

In Mexico, there are several groups made up of part manufacturers who perform high-level production with modern facilities. Though the capital relationships within the individual groups are not publicly disclosed, the companies are firmly united, probably deriving from the same ownership base.

The groups such as UNIK-SPICER, TEBO, Summa, and Condumex manufacture all processed material including casting and forging, stamping, and plastic molding within the individual groups, perform processing and assembling within the groups, and supply components highly sub-assembled to auto manufacturers. Accordingly, these groups seldom subcontract their work to secondary companies outside their own groups. The relationship between the primary and the secondary suppliers is well established within the groups.

The following is the outline of the company groups visited by the Team, with the range of information obtained.

1. **UNIK-SPICER group (the largest in Mexico)**

The group leads about 20 companies and manufactures more than 60 types of automotive parts and components. The UNIK-SPICER group supplies all its products in the form of completely assembled parts to auto manufacturers. The processed materials including castings, forging, stampings and tube material are also manufactured within the group. Listed below are the major parts manufactured.

· Transmission (manual)	· Drive axle	· CV joint
· Steel wheel	· Aluminum alloy wheel	· Piston
· Piston pin	· Piston ring	· Engine valve
· Valve lifter	· Alternator	· Brake drum
· Brake disc	· Caliper	· Spark plug

2. **TEBO group**

The group leads 13 companies and procures all processed materials including aluminum alloy castings, forging, stampings, rubber moldings, rubber compound and plastic moldings from companies within the group. The group has a company specialized in electroplating. Listed below are the major parts manufactured.

· Ball joint	· Steering linkage	· Brake hose
· Water strips	· Brake master cylinder	
· Wheel cylinder & booster	· Caliper	· Brake tube
· Fuel tube		

3. **Condumex group**

· Piston	· Piston ring	· Cylinder liner
· Shock absorber		

4. **San Luis Rassini group**

· Brake drum	· Brake disc	· Caliper
· Torsion bar	· Spring	

5. **Summa group**

· Auto sheet	· Trim

6. **AXA group**

· Wire harness	· Cast products

7. **Proeza group**

· Stamping	· Stamping die	· Gasoline tank (plastic)

8. **Industrial Saltillo group**

· Cast products	· Tooling	· Special machinery

3) Type C : Companies who manufacture major processed material in-house

The company groups of this type manufacture major processed material in-house while they place orders with outside suppliers for the parts which they cannot manufacture with their own facilities, or which exceeds their manufacturing capability. The items externally ordered are mainly small stampings or parts. Listed below are some of the primary suppliers who belong to this type.

1. Eaton Ejes

Product	Front & rear axle for truck
In-house production	Forged parts

2. Atsugi Mexicana

Product	Oil pump, water pump
In-house production	Die-cast parts -aluminum alloy

3. Arbomex

Product	Camshaft, wheel hub
In-house production	Iron cast parts

4. Arvin Walker

Product	Exhaust system
In-house production	Sheet metal work

4) Type D : Companies who mainly manufacture processed material

The primary suppliers of this type mainly manufacture processed material rather than perform processing and assembly. Many of them also supply processed material to other primary suppliers.

Listed below are some of the companies of this type along with their products.

1. Cast Materials

CIFUNSA	MIN-CER	TISMATIC	XOLOX
Tysma	Inyecta Alum (All are local suppliers)		

2. Plastic

K-MEX (Japan)	Nihon Plast (Japan)
Textron (U.S.)	

3. Stamping parts

Yamakawa (Japan)	Yorozu (Japan)
Lunkomex (Germany)	Bentler (Germany)
REFA (Canada)	Autotec (Canada)
IASA (Mexico)	FANSA (Mexico)
Metalsa (J/V of Mexico and U.S. companies)	

(2) Actual status of subcontracting from primary supplier

In the automotive parts industry, casting and plastic molding job orders are often limited to primary suppliers or group companies, not to secondary or tertiary suppliers. In contrast, stamping jobs (press work) are often provided to secondary and tertiary suppliers. Small parts such as brackets which are too small for the large or medium size presses, or parts including plating/painting, are sometimes manufactured at secondary suppliers.

Many Japanese primary suppliers who made investments in Mexico in the 1990s are looking for secondary suppliers who can provide reliable products (mainly stamping) so that they can avoid importing. To date they have not found a good supplier. Some interview results with Japanese primary suppliers are given as follows:

i) INSA (Japan, derived from Tachiesu)

- Start of production: 1992
- Product: Automotive seat

Currently they have 22 or 23 local suppliers. For selection of suppliers, persons in charge of purchasing and quality control first review the factory process. Then, capability of continued supply is judged.

ii) Sanmex (Japan, derived from Sanoh)

- Start of production: 1991
- Product: Brake tube, fuel tube

Plating, such as electroplating (Zn, Ni-Zn) or non-electroplating (Ni-Zn), is subcontracted.

iii) Y-Mex (Japan, derived from Yorozu)

- Start of production: 1994
- Product: Stamping parts (suspension units and body parts)

They are currently negotiating with a stamping parts supplier (There are many stamping suppliers in Toluca.) as to parts not suitable for in-house production. For plastic parts, they are reviewing use of Nihon Plast Mexicana in Querétaro.

iv) Yamakawa (Japan, derived form Yamakawa)

- Start of production: 1994
- Product: Stamping parts (medium size body panels)

Among CKD parts imported from Japan and the U.S., they will use local stamping suppliers for parts not suitable for in-house production. They are currently considering two suppliers as candidates.

v) K-Mex (Japan, derived from Kansei)

- Start of production: 1992
- Product: Plastic molding, meter assembly

Tubes for insert molding are subcontracted at Sanmex, a Japanese company. Rubber molding and stamping parts are also subcontracted at local suppliers. Imported products will be replaced with products from local suppliers. The show room exhibits localized parts and future localized parts.

vi) Sanden Mexicana (Japan, derived from Sanden)

- Start of production: 1990
- Product: Magnetic clutch for automotive air conditioners, stamping parts (brackets)

They plan to replace the small stamping parts imported from Japan with products from local suppliers.

vii) Nihon Plast Mexicana (Japan, derived from Nihon Plast)

- Start of production: 1994

● Product: Steering wheel, plastic parts (ventilator)

Inserts (welded assembly of stamping parts) which are assembled to the steering wheel are currently imported from Japan. They plan to localize these parts instead of imports. These parts require highly accurate welding assembly. They are reviewing and contacting candidate suppliers.

The following explains a few examples of subcontracting from non-Japanese foreign primary suppliers to secondary suppliers.

i) REFA and Autotek, Canadian stamping parts suppliers, and Lunkomex, German stamping parts supplier, have not subcontracted stamping parts.

ii) Metalsa, joint venture stamping parts supplier between Mexico and the U.S., started operation in 1956. Both plants in Monterrey and San Luis Potosi have subcontracted small stamping parts not suitable for in-house production to secondary suppliers. Subcontracting often includes plating or surface treatment.

iii) IASA, Mexican stamping parts supplier, is manufacturing all stamping parts in-house. No secondary supplier is used.

(3) Relationship between Part manufacturers and Foreign Capitals

In this survey, visits to 46 automotive part manufacturers were made for interviews and technological assessment. The following summarizes the relationship between part manufacturers in Mexico and foreign ownerships.

100% Mexican capital	18 companies
100% foreign capital	10 companies
J/V with Mexican capital of 51% or more	11 companies
J/V with foreign capital of 51% or more	5 companies*
Unknown	2 companies
	46 companies

* Including 1 company with capital ratio of 50:50.

Twenty-six companies (59%) out of 44 companies, excluding unknown ones, have foreign equity to some extent.

Thirty-three companies (72%) out of 46 companies have introduced foreign technologies in some way. The technology sources for the remaining 13 companies have not been identified. It is assumed that some of these companies have incorporated foreign technologies. The percentage of foreign technology would be higher.

Technology sources by nation, by 33 companies, are classified as follows:

U.S.	16 companies
Japan	9 companies
Germany	4 companies
Canada	2 companies
Italy	2 companies
	33 companies

Almost half of the companies have introduced technologies from the U.S. Major automotive part manufacturers in U.S. such as Rockwell, DANA, DAYTON, Johnson Control, Eaton, Arvin, Tenneco, Federal-Mogul, etc. have transferred technologies to Mexico. Japanese manufacturers such as Denso, Sanden, Kansei, Yorozu, Sanoh Kogyo, Kiryu Kikai, Tachiesu and Yamakawa Kogyo have made capital investment and introduced technologies into Mexico in 1990s.

7.2.3 Future Prospect of Automotive Part Industry and Secondary Supplier

If the current volume of automobile production does not increase, parts manufacturers will continue in-house production within the group. Individual primary suppliers continue to develop subcontractors for small stamping parts. The latter is replacement of imported parts, not subcontracting part of the in-house production.

If the automobile production volume doubles (possibly meaning creation of import capability), the following changes may occur in the automotive industry.

1) The primary suppliers will subcontract part of the manufacturing process due to high costs of increasing the different manufacturing processes in their own factories.
2) The primary suppliers will specialize in design, development, manufacturing and assembly for highly sub-assembled parts and subcontract parts to secondary suppliers.

3) Types and volume of subcontracting parts to secondary suppliers will increase.
4) Even if the production volume is a single process (essential technology) at secondary suppliers, the economy of scale is attained. Therefore, suppliers are encouraged to make investments.

However, the Automobile Law, a protective regulation for automotive parts, will be gradually deregulated, and abolished in January, 2004. The automotive parts industry has to streamline itself to compete with imported parts. One of streamlining measures is diversification and specialization of jobs. Secondary and subsequent supporting industries, therefore, need to be developed.

7.3 Current State and Future Outlook for the Electrical/Electronic Parts Industry

7.3.1 Differences between the Automotive Industry and the Electrical/Electronic Industry in Mexico

(1) Subcontracting system

The electrical/electronic industry has the same hierarchical structure of subcontractors as shown in Figure 7.1-1 of 7.1. In the automotive industry, however, all the assemblers are more or less the same in terms of distribution of parts sourcing, i.e., the same parts are made by assemblers, primary suppliers, and secondary or lower suppliers. On the other hand, in the electrical/electronic industry, all the assemblers do not necessarily manufacture the same parts internally, and neither do subcontractors, resulting in significantly different patterns of subcontracting system from one assembly company to another.

To illustrate the diverse subcontracting system in the industry, Figure 7.3-1 shows an example of the TV industry. At the center, TV assembly operation is illustrated and surrounded by functional parts of TVs, such as CRTs, mounted PCBs, cabinets and back covers, and yoke coils. These core assembly parts are surrounded by a group of functional parts at the next level, then by low-functional or non-functional parts (although not illustrated in the figure) to form the entire productive chain of TV assembling.

In this illustration, TV assembler A manufactures mounted PCBs internally, in addition to TV assembly operation. Assembler B manufactures CRTs and cabinets in addition to mounted PCBs, together with various parts mounted on PCBs. Assembler C produces a different combination of parts internally (Note that most of TV assemblers manufacture mounted PCBs). In fact, diversity of internally produced parts is not limited to Mexico and is observed throughout the world. Many assemblers supply internally produced parts to other companies, thus serving as the assembler and parts supplier. Accordingly, the similar diversity can be observed among primary suppliers which directly supply parts to assemblers.

(2) Parts industry protection policy

While subcontractors in the automotive industry are protected under the Automobile Decree, there is no such protection measures applicable to the electrical and electronic industry. As a result, parts suppliers have experienced free competition and thus have failed to form a rigid parts supply system seen in the automotive industry. This is reflected in a very low rate of local parts procured by the industry (2%-3% in case of Maquiladora), much lower than the automotive industry (over 60%).

(3) Maquiladora companies

There is no car assembler as Maquiladora. On the other hand, electrical and electronic assemblers operating as Maquiladora for export purposes account for major portions of domestic production (98% for TV). To foster the electrical/electronic industry, strategy should therefore focus on the huge Maquiladora market (in case of TV, world largest production) that uses few locally produced parts by making entry with international competitive products. The situation is clearly different from that facing the automotive industry.

7.3.2 Parts Procurement Policies of Electrical/Electronic Assemblers and Current State of Procurement

In Mexico, world leading electrical and electronic manufacturers operate assembly plants under the status of Maquiladora and export their products mainly to the U.S. The study team visited the following companies:

i) Audio and visual equipment (mainly TVs)
Zenith, RCA (produces mounted PCBs only), Matsushita, Panasonic, and Sanyo
Note: All the companies except for Panasonic are Maquiladora and are located along the U.S. border.

ii) Telephone and communication equipment
AT&T, NEC, Kyushu Matsushita
Note: AT&T and NEC are located in Guadalajara and non-Maquiladora companies, while Kyushu Matsushita is Maquiladora and is located in a border area.

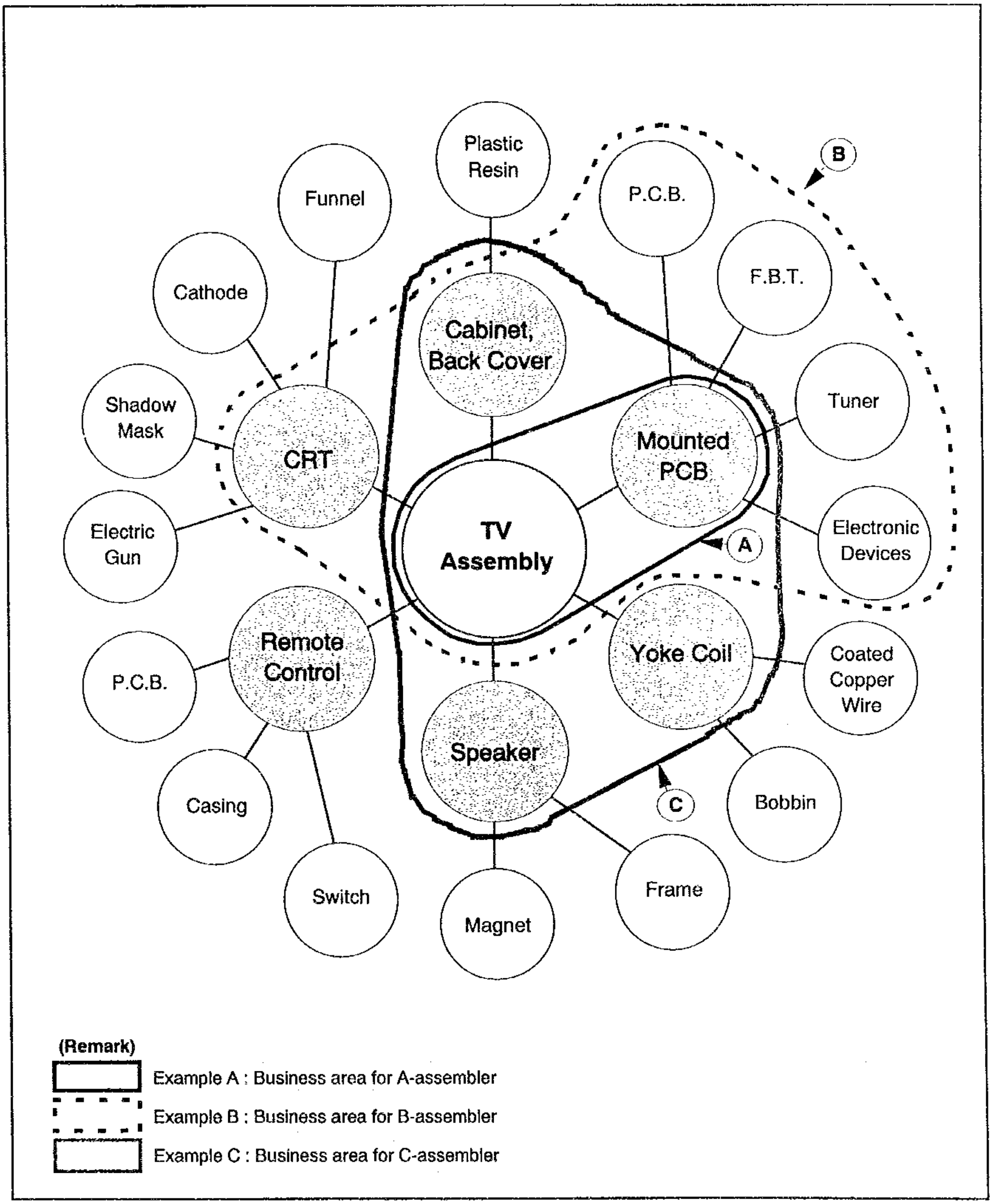

Figure 7.3-1 Productive Chain of TV Assembling

iii) Computers

IBM, Hewlett Packard, COMPUTEC (Acer)

Note: All of them are non-Maquiladora companies, COMPUTEC is located in the State of Mexico and IBM and HP in Guadalajara.

Based on information obtained from interview with the above companies, basic parts procurement policies of assembly manufacturers (assemblers) and the current state of procurement are described as follows.

(1) Changes in the Maquiladora program under NAFTA and parts procurement trends

Electrical and electronic equipment assemblers are divided into 1) export-oriented companies which are concentrated in the border area as Maquiladora, and 2) those serving the domestic market and located in inland areas. Parts souring policies of these two types of companies are very different: the former group is essentially the bonded plant and traditionally imports most of parts; and the latter group procures large portions from domestic sources.

Recently, however, their sourcing policy has changed significantly. The first move was made by local manufacturers in the latter category who started to replace local parts with imported ones to take advantage of the economic liberalization process. Take Panasonic, for instance. The company produces TVs and stereos for the domestic market. In 1992, its use of local parts as a percentage of total consumption was 70%, which plummeted to 17% in 1994. Obviously local products could not compete with imported ones.

The privilege granted to Maquiladora companies to import parts from any country without import tariff will be terminated in 2001 under the NAFTA. Instead, all the companies in Mexico will be able to import parts originated in the NAFTA area with tax free. This change will have the following impacts on procurement of parts by Maquiladora companies.

1) Parts imported from non-NAFTA areas (e.g., Southeast Asia) will be subject to import tariff (set by an importing country).

2) This will encourage Maquiladora companies to procure NAFTA-originated parts. In fact, some assembly manufacturers have started to move in this direction as part of their response to regulatory changes due to the NAFTA.

3) The boarder area is a major candidate for one of parts production bases within the NAFTA area partly because of existing concentration of assembly manufacturers and partly because of low labor and other costs.

Note: The ceiling on domestic sales applicable to Maquiladora companies will be lowered gradually to create increase flow of finished products and part to Mexico with tax free.

(2) Parts procurement strategies of assemblers

Basic sourcing strategies of assemblers in Maquiladora - major potential customers for supporting industries in Mexico - are described as follows. In fact, each assembler has its own strategy by combining the following elements.

1) Many Maquiladora companies have established their own parts supply system from the U.S. from the beginning. These companies will continue to rely on sourcing from the U.S. In particular, U.S.-based assemblers have parent companies which manufacture the same products and supply parts to each other. This strategy, thus, is based on continuation of the traditional arrangement.

2) Foreign assembly manufacturers who purchase parts from Southeast Asia and other non-NAFTA countries will invite parts suppliers which have business relations with parent companies in home countries. Parts suppliers locate their production bases in Mexico, so that parts are treated as local products. By having parts suppliers nearby, these companies attempt to accomplish cost reduction, delivery schedule control, technical assistance, and assured quick response to design modification.

3) Some companies attempt to reduce supply sources in order to simplify the procurement process for a variety of parts. For instance, a company wants to procure from suppliers who can provide a combination of plastic molding, coating, and stamping services, or a supplier who can provide products with diverse types such as capacitors and resistors. This leads to a pyramid structure of parts sourcing.

4) The final strategic option is to organize and foster local suppliers in order to establish a local procurement system. There are tow actual cases as follows:

(Example 1)

Purchase managers of 22 leading manufacturers including Thomson, Philips, Siemens, Honeywell, Bosch, Dali, Cía. Armadora, and GE have gather to create a conference in 1995, which organizes meetings with local suppliers to provide product information. These companies also exchange information as to which parts are used by different companies and which parts are to be subcontracted to local suppliers.

(Example 2)

AT&T in Guadalajara signs a five-year parts procurement agreement with local small companies and provide machinery and technical assistance in an effort to nurture subcontractors. It also provides training for employees of subcontractors and send its new employees to subcontractors' factories to maintain close ties with subcontractors in the process.

(3) Actual procurement by assemblers

Procurement sources of assemblers are divided into "in-house production," "import," and "local procurement." Table 7.3-1 shows share distribution of each source by product category, and Table 7.3-2 major imported parts and locally procured parts.

As seen in Table 7.3-1, percentage share of imported parts is high for electronic equipment, namely TVs, computers, and telephone (87% on average for 13 companies), while that for household appliances is relatively low (59% on average for 7 companies). On the other hand, share of imported parts procured by Maquiladora companies is higher than that of non-Maquiladora companies (94% for 8 companies vs. 66% for 12 companies).

1) In-house production

The NAFTA certificate of origin for TVs, telephone, and computers is conditional to the NAFTA origin of mounted PCBs, and assemblers usually manufacture mounted PCBs internally. Assemblers who do not make them in-house, procure them from sources within the NAFTA area. Major parts manufactured by assemblers are summarized as follows:

Matsushita	: TVs, cabinets, back covers
Zenith	: TVs, mounted PCBs, yoke coils, transformers
Sanyo	: TVs, yoke coils, FBTs, tuners
Mabe	: Refrigerators - bodies, doors, compressors (by J/V company)
Super Matic	: Refrigerators and washing machines - bodies and plastic parts

2) Import

Major parts which totally rely on import are listed in Table 7.3-2. While many of them are not manufactured in Mexico, some are locally produced but assemblers prefer imported products. The largest import source is the U.S., from which assemblers obtained parts before they relocated to Mexico as Maquiladora companies. Also, many assemblers in Mexico and their counterparts in the U.S. under the same company groups mutually supply complementary parts to each other. A primary example is CRTs which are imported from affiliate factories in the U.S. by almost all of assemblers regardless of nationality, be it Japanese or European. Samsung, a leading Korean manufacturer, started CRT production in Tijuana.

3) Local procurement

Table 7.3-2 lists locally procurable parts. Note that all of them are not necessarily procured locally. Each assembler choose local procurement or import according to its strategy. Recently, most companies have established production bases of CRTs and/or mounted PCBs within the NAFTA area in order to obtain the NAFTA certificate of origin. At the next stage, localization of downstream parts and materials will become the center of attention. Interest in local procurement is heightening in an attempt to reduce lead-time created by imports and additional distribution costs.

Table 7.3-1 Parts and Components Sourcing of Electrical and Electronic Assemblers

(Unit : %)

Company [1]	In-house Production	Local Procurement [2]	Import
TV			
(A)*	0	0	100
(B)	0	34	66
(C)*	5	10	85
(D)*	10	1	89
(E)*	0	2	98
Computer			
(F)*	0	0	100
(G)	0	35	65
(H)	0	10	90
(I)	0	5	95
Telephone			
(J)	0	27	73
(K)	0	0	100
(L)	4	31	65
(M)	0	0	100
Refrigerator			
(N)*	0	6	94
(O)	15	30	55
(P)	50	20	30
Washing Machine			
(Q)	25	75	0
Small White Products			
(R)*	10	6	84
(S)	10	40	50
(T)*	0	0	100

Note : 1) Marked by (*) are maquiladora companies
2) includes procurement from maquiladora companies
Source : JICA Team Field Surveys

Table 7.3-2 Main Outside Sourcing of Electparts by Assemblers

A Import Parts

- CRT
- Transistors
- Printed circuit board (PCB)
- Remote controller
- Compressor
- Transformers
- Integrated circuits
- Cabinet
- Capacitors
- Switches
- AC power cord
- Speaker
- Diodes
- Resistors
- Motor
- Monitor

B Local Procurement Parts[1)]

B.1 Electronic Devices and Parts

- Convergence yoke
- Remote controller
- Deflection yoke
- Flyback transformer
- Capacitors
- Resistors
- Switches
- Speaker
- Coil
- Plastic transformer
- AC power cord

B.2 Processed Materials

Plastic Parts

- Cabinet
- Rear cover
- Cushion
- Indicator panel

Stamped Parts

- Speaker frame
- Car radio frame

Note : 1) Some assemblers import or manufacture those parts in their factories depending on their strategies.

Source : JICA Team Field Surveys

7.3.3 Actual Parts Procurement by Primary Suppliers

In the electrical and electronic parts industry, most companies supply parts directly to assemblers with varying quantity, although some serve as both primary and secondary suppliers. For this reason, discussion here is based on the assumption that all the companies are primary suppliers.

(1) In-house production, local procurement, and import

Table 7.3-3 shows percentage distribution of in-house production, local procurement, and import by 23 Maquiladora companies and 12 non-Maquiladora companies which the Team visited and obtained data. The percentage of in-house production is 5-6% for Maquiladora companies, local procurement 5-6%, and import 89%. The percentage of local procurement is much higher than a generally reported 2%. On the other hand, non-Maquiladora companies show completely different compositions, in-house production shows the highest share of 39.4%, local procurement 32.9%, and import 27.7%.

Compared to assemblers who heavily rely on imported parts (94% for Maquiladora and 66% for non-Maquiladora), the import ratio of primary suppliers is very low.

(2) Local parts procurement policy of primary suppliers

As mentioned above, for the electrical and electronic parts industry, primary and secondary suppliers cannot be classified according to product groups they manufacture. As a result, it is not possible to identify prospective markets for secondary suppliers consisting of smaller enterprises (supporting industries) by estimating demand by primary suppliers which mainly consist of medium- and large-sized enterprises. Thus, the visiting survey by the Team asked respondents to cite the areas to be promoted in terms of essential technology. Responses in the electrical and electronic parts industry were arranged according to the order of importance as follows:

1st - Stamping
2nd - Plastic processing
3rd - Machining
4th - Aluminum die-cast

5th - Parts assembly
6th - Electroplating
7th - Casting
8th - Heat treatment
9th - Forging
10th - Surface treatment

Table 7.3-3 Parts Procurement of Primary Suppliers (Electrical and Electronic Sector)

(Unit : %)

Company	In-house Production	Local Procurement	Import	Company	In-house Production	Local Procurement	Import
(Maquiladora)				(Non-Maquiladora)			
A	0	0	100	AA	50	35	15
B	0	50	50	BB	50	50	0
C	10	5	85	CC	0	0	100
D	10	5	85	DD	5	40	55
E	0	1	99	EE	60	20	20
F	20	0	80	FF	0	20	80
G	0	2	98	GG	0	90	10
H	60	10	30	HH	65	25	10
I	15	5	80	II	70	20	10
J	0	0	100	JJ	43	55	2
K	0	3	97	KK	90	10	0
L	0	10	90	LL	40	30	30
M	20	10	70	Average	39.4	32.9	27.7
N	5	5	90				
O	0	1	99				
P	0	0	100				
Q	2	8	90				
R	0	5	95				
S	0	0	100				
T	0	0	100				
U	0	1	99				
V	0	0	100				
W	0	0	100				
Average	6.1	5.3	88.6				

Source : JICA Team Field Surveys

(3) Parts manufacturers and foreign capital/technology

The visiting survey revealed equity ownership of 56 primary suppliers, which is summarized as follows.

	Maquiladora	*Non-Maquiladora*	*Total*
Wholly owned by local capital	9	22	31
Wholly owned by foreign capital	16	5	21
J/V with 51% or more local	0	2	2
J/V with 51% or more foreign	0	2	2
	25	31	56

As for technology, 26 out of 56 companies have introduced foreign technology; 18 U.S. and Canadian companies and 8 Japanese companies. There are a few companies which source of technology is unknown, although they seem to have introduced foreign technology.

7.3.4 Major Issues Facing Electrical/Electronic Parts Industry in Mexico and Cases of Growing Enterprises

(1) Structural problems of the electrical/electronic parts industry in Mexico

The first problem is the lack of prime suppliers directly supplying parts to Maquiladora companies, forming a missing link in the productive chain and preventing growth of secondary or lower suppliers. The lack of large- and medium-sized enterprises might be mainly filled by foreign companies (probably as Maquiladora companies), and some part has to be filled by local companies or joint ventures.

The second problem is the shrinkage of the market for subcontractors as non-Maquiladora assemblers serving the domestic market manufacture most of parts internally (household appliances) and have replaced local products with import (audio and visual equipment).

There are some problems on the local company side to prevent them from entering the electrical and electronic parts market, which are described as follows.

(2) Problems of local electrical/electronic parts suppliers

TV, audio, telephone and computer assemblers operating in Mexico are all foreign companies, and there is no local company having local technology. Naturally, suppliers are required to adapt themselves to management styles of foreign companies. Some are successfully doing so, while others are not. The former group identifies growing areas and operates in such manner to meet management styles of foreign companies. On the other hand, the latter group insists on attitude in the seller's market, as continued from the country's closed economy and believes that buyers should follow the ways of suppliers.

The second problem is the lack of willingness by suppliers to take initiative in their jobs. Many of them manufacture products by using resources provided by buyers instead of locating near buyers and having their own design and engineering resources. For instance, many suppliers doing plastic molding use molds which have been designed, tested, adjusted by customers, together with resin specified by customers. They are satisfied with the status of contract processors. There is often the case that suppliers having latest molding machines fail to accomplish stable quality and/or productivity improvement due to mismatching with molds.

The third problem is small production capacity which prevents suppliers from accepting order from exporters of volume products. They cannot renew or add equipment due to the shortage of operating funds.

For the above reasons, primary suppliers are dominated by foreign companies, with a limited number of local companies. Cases of growing local suppliers are described in the following section.

(3) Cases of growing suppliers

Four suppliers recording strong growth have been selected from those visited by the Team are described as some hints and models for promotion of supporting industries.

(Example 1) KOKOPELI

The company started from plastic molding and has established itself in production of speakers. Now it is producing coffee makers. It also supplies TV cabinets and parts to Philips.

When the owner founded the company, TV manufacturers mostly imported TV cabinets from a U.S. plastic molding company. The owner discusses with employees of TV manufacturers to find out detailed wants and needs of customers, e.g., what types of parts they want and what delivery method meets their requirements. Then, he decided on the areas of production and hired workers accordingly. These early employees are now executive officers of the company.

(Example 2) EUROTEC

The owner conducted detailed market research for a year before starting the business to find out the needs of buyers. In fact, the market study covered not only assemblers operating in Mexico but their U.S. parent companies as well. As a result, he came to conclusion that a company capable of handling plastic molding, stamping, coating and assembly was most wanted. Then, the company was established as a joint venture of two local companies in different businesses, hiring people having experience in the similar business. Recently, the company is receiving a large number of inquiries from a variety of companies.

This is the case of designing a company to meet single sourcing requirements by assemblers to save time and cost in the procurement process.

(Example 3) Cía. General de Electrónica

This is a non-Maquiladora company established in 1960 and produces capacitors, resistors, switches and other parts. The company has successfully adapted itself to the major change in industrial structure by specializing its products for growing markets. As it shifted product lines from parts for audio/visual equipment to telephone, then to household appliances, it successfully explored customers and developed export routes, boosting dollar-based sales.

Machinery and equipment of the company are based on general-purpose ones modified for efficient operation. This is a primary example of minimizing initial investment and maximizing usage of technical know-how.

(Example 4) Phoenix International

The company was founded by three young men (local capital) to assemble wire harnesses and coin changers for vending machines. Recently, it has started plastic molding and supplies telephone bodies to AT&T. At the same time, it purchased full-featured machine tools for its plastic mold maintenance section. In July 1996, the company signed a joint venture agreement with a Canadian company to secure stable jobs and introduce new technology and funds.

In the company, young entrepreneurs are aggressively promoting business based on technical innovation, while carefully watching market trends.

7.3.5 Future Outlook for the Electrical/Electronic Parts Industry

Demand for the electrical and electronic parts industry is sharply divided between the U.S. border area and inland area. In the inland area except for Guadalajara, production for domestic demand dominates and growth potential is limited to the pace of recovery or expansion of the national economy. On the other hand, Maquiladora companies in the border area have huge demand for electrical and electronic parts, but they purchase only 2-5% from Mexico. This is a major opportunity for the parts industry, and entry to the market holds the key to the development of the industry.

Business environment for the electrical and electronic parts industry is expected to improve under the following scenario:

1) Imported parts will be handicapped by tariff under NAFTA, lose competitiveness, and will be replaced with local products.
2) Foreign companies who have exports parts to Maquiladora companies will move their production bases to the NAFTA area. Major locations are various area in Mexico and the border area where assemblers have already concentrated.

3) The process will attract foreign direct investment from the NAFTA as well as other countries, which looks for markets in the border area. These investors will include a large number of independent, large enterprises which are no associated with the U.S., unlike traditional Maquiladora companies.
4) When the Maquiladora act is abolished, many primary and secondary suppliers will be located around assemblers and will form a major market for parts to be supplied by SMEs within Mexico.

Thus, supporting industries made up of SMEs will face major challenges in meeting demand arising in the above process. The first challenge is to effectively compete with products imported from the NAFTA area.

7.4 Cost Comparison of Sample Parts

To examine cost competitiveness of automotive parts and electrical and electronic parts manufactured in Mexico, simulation analysis was conducted as follows, for stamping parts (C.R. steel sheets) and plastic parts.

7.4.1 Sample Parts for Cost Comparison and Methodology

(1) Samples parts for cost comparison

Parts imported from Asia and those produced in Mexico are compared for their cost competitiveness in the Mexican market. Taiwan and Malaysia are selected as they actually export parts to Mexico, representing the NIEs and ASEAN countries, respectively.

The following assumptions are made for cost simulation (see Figure7.4-1 for details:

Case 1 - Stamping and plastic parts manufactured in Mexico by using steel sheets and resin imported from the U.S.

Case 2 - Stamping and plastic parts manufactured in Malaysia by using steel sheets and resin imported from Japan, and exported to Mexico

Case 3 - Stamping and plastic parts manufactured in Taiwan by using steel sheets and resin made in Taiwan, and exported to Mexico

As discussed in Chapter 6, regarding the issues related to raw materials, most of steel sheets and resin consumed by automotive parts and electrical/electronic parts industries in Mexico are imported. This reflects the fact that imported materials are indispensable for functional parts which require sufficient levels of strength, precision, moldability, and durability. For this reason, Case 1 assumes that the both materials are imported from the U.S. On the other hand, Case 2 assumes that they are imported from Japan, while local materials are used in Taiwan under Case 3.

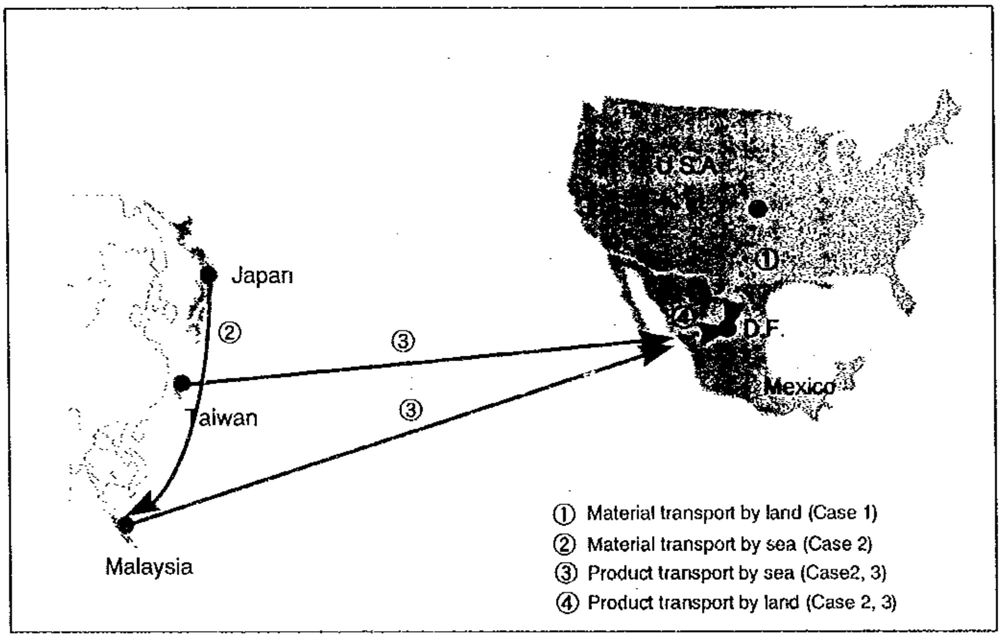

Figure 7.4-1 Flow of Materials and Products

(2) Methodology of cost comparison

Based on cost index of products in the Japanese parts industry (SMEs), as available for each processing technology (as of 1994), each cost element is adjusted for each of the producing countries concerned (Mexico under Case 1, Malaysia under Case 2, and Taiwan under Case 3) by multiplying applicable local factors. As a result, the following data are obtained: 1) product prices in each producing country by index when those in Japan are assumed to be 100, and 2) cost structure in each producing country. Then, for Cases 2 and 3, transportation costs to the capital region of Mexico (D.F.), import duties, and other costs and expenses are added to obtain their sales prices in Mexico.

Cost index of stamping parts and plastic parts in Japan is as follows.

Table7.4-1 Cost Index of Parts in Japan

	Stamping	Plastic
A. Material cost	38.8	35.7
B. Labor cost	32.3	30.6
C. Depreciation	3.9	3.5
D. Other costs	8.8	9.0
Production cost	83.8	78.8
E. Overhead	13.4	18.4
Total production cost	97.2	97.2
F. Profit	2.8	2.8
Sales price	100.0	100.0

Source : Cost Index of Small and Medium Industries 1996, Small and Medium Enterprise Agency of Japan

(Note) Here the above three cases are compared on the basis of sales prices in D.F.. There are some cases, however, where a difference in production cost between regions within the country is larger than that between countries, i.e., it is possible that the cost difference between Querétaro and Chihuahua is larger than that between Mexico and the U.S. Similarly, the difference between companies may be larger even if they belong to the same industrial sector. Finally, actual prices are governed by supply and demand situation, so that prices estimated in this section do not always reflects actual market prices. Nevertheless, they serve as some indicators to show marketable prices.

7.4.2 Local Factors

(1) Material cost

Prices of C.R. steel sheets and resin in the U.S. and Taiwan are estimated, as indicated by index below, by assuming prices in Japan as 1 (500 US$/MT for steel sheets and 733 US$/MT for resin). Note that the figures are export prices for Japan and the U.S., which are usually set lower than market prices. Prices in Taiwan are governed by import prices from Japan. Prices of resin are based on those of ABS and PS.

	Japan	U.S.	Taiwan
Steel sheet	1.0	1.0	0.9
Resin	1.0	1.0	0.9

As shown in Table 7.4-1, the material cost index is 38.8 for stamping parts and 35.7 for plastic parts. As the steel sheet cost is set at 500 US$/MT and the resin cost at 733 US$/MT, in this exercise it is assumed, based on the raw material of 1MT, that the cost index 1 is equivalent to 12.9 US$ (500/38.8) for

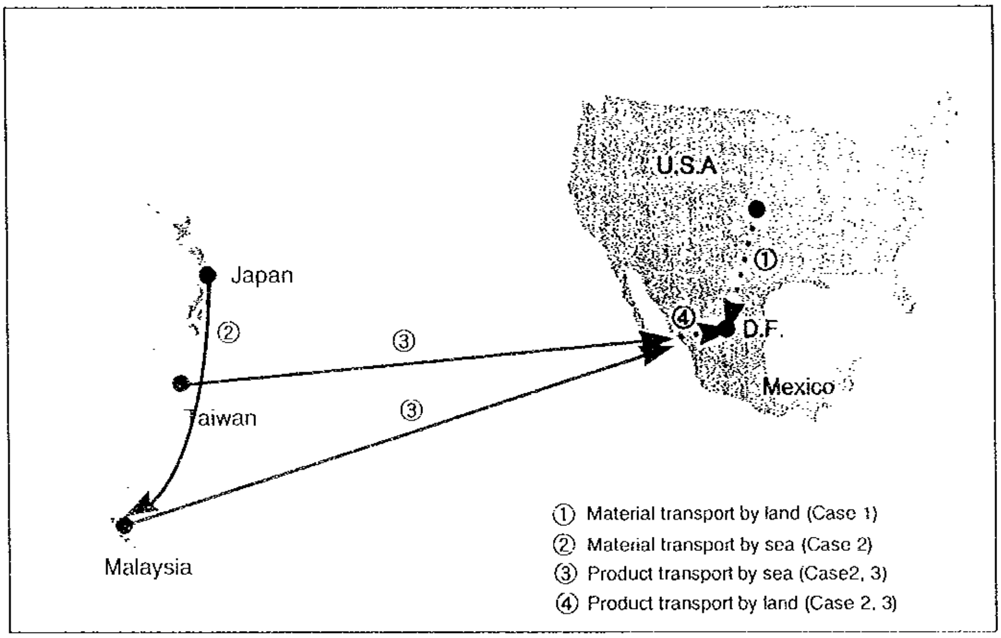

Figure 7.4-1 Flow of Materials and Products

(2) Methodology of cost comparison

Based on cost index of products in the Japanese parts industry (SMEs), as available for each processing technology (as of 1994), each cost element is adjusted for each of the producing countries concerned (Mexico under Case 1, Malaysia under Case 2, and Taiwan under Case 3) by multiplying applicable local factors. As a result, the following data are obtained: 1) product prices in each producing country by index when those in Japan are assumed to be 100, and 2) cost structure in each producing country. Then, for Cases 2 and 3, transportation costs to the capital region of Mexico (D.F.), import duties, and other costs and expenses are added to obtain their sales prices in Mexico.

Cost index of stamping parts and plastic parts in Japan is as follows.

Table7.4-1 Cost Index of Parts in Japan

	Stamping	Plastic
A. Material cost	38.8	35.7
B. Labor cost	32.3	30.6
C. Depreciation	3.9	3.5
D. Other costs	8.8	9.0
Production cost	83.8	78.8
E. Overhead	13.4	18.4
Total production cost	97.2	97.2
F. Profit	2.8	2.8
Sales price	100.0	100.0

Source : Cost Index of Small and Medium Industries 1996, Small and Medium Enterprise Agency of Japan

(Note) Here the above three cases are compared on the basis of sales prices in D.F.. There are some cases, however, where a difference in production cost between regions within the country is larger than that between countries, i.e., it is possible that the cost difference between Querétaro and Chihuahua is larger than that between Mexico and the U.S. Similarly, the difference between companies may be larger even if they belong to the same industrial sector. Finally, actual prices are governed by supply and demand situation, so that prices estimated in this section do not always reflects actual market prices. Nevertheless, they serve as some indicators to show marketable prices.

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(1) Material cost

Prices of C.R. steel sheets and resin in the U.S. and Taiwan are estimated, as indicated by index below, by assuming prices in Japan as 1 (500 US$/MT for steel sheets and 733 US$/MT for resin). Note that the figures are export prices for Japan and the U.S., which are usually set lower than market prices. Prices in Taiwan are governed by import prices from Japan. Prices of resin are based on those of ABS and PS.

	Japan	U.S.	Taiwan
Steel sheet	1.0	1.0	0.9
Resin	1.0	1.0	0.9

As shown in Table 7.4-1, the material cost index is 38.8 for stamping parts and 35.7 for plastic parts. As the steel sheet cost is set at 500 US$/MT and the resin cost at 733 US$/MT, in this exercise it is assumed, based on the raw material of 1MT, that the cost index 1 is equivalent to 12.9 US$ (500/38.8) for stamping parts and 20.5 US$(733/35.7) for plastic parts. Based on this assumption, in calculating transportation cost index as shown below, the transportation cost for 1MT of each material is estimated and is then converted to an index by applying either of the above factors (12.9 or 20.5).

The cost for materials imported from the U.S. to Mexico under Case 1, and that under Case 2 (imported from Japan to Malaysia) are added by costs and expenses summarized below. Import duties in Malaysia are assumed to be null under the assumption that tax exemption for export industry will apply.

- Case 1
  - In-land transportation cost from the U.S. to Mexico (approx.3,600km)
    @57.89 US$/MT
    @ 0.58 US$/km
  - Import duty: 10% by considering NAFTA's relaxation schedule
- Case 2
  - Marine transportation cost from Japan to Malaysia
  Including shipping charge, marine insurance, and port charge:
    Steel sheet coil : 60 US$/MT
    Resin : 56 US$/MT (container)

The result is summarized in Table 7.4-2.

Table 7.4-2 Local Factor of Material Cost

	Material Cost Index	
	Steel Sheet	Resin
Japan	1.0	1.0
Mexico	1.29	1.23
Malaysia	1.13	1.08
Taiwan	0.9	0.9

(2) Labor cost

Based on "Comparison of Investment Related Costs in Major Cities and Regions in Asia: May - June 1996" by Japan External Trade Organization (JETRO) and data in Mexico obtained from SECOFI under the present study, unit cost indices are determined. Then, the quality of labor force or productivity must be taken into account. This can be called "productivity index" to measure how many workers are required to do a certain job when those in Japan are assumed to be one. Based on the result of the field survey and empirical data, the local factor of labor cost in each country is set as shown below. By multiplying the unit labor cost index by the productivity index, the local factor is obtained.

Table7.4-3 Local Factor of Labor Cost

	a) Unit cost	b) Productivity index	c) Local factor(a x b)
Japan	1.0	1.0	1.0
Mexico	0.11	1.4	0.154
Malaysia	0.11	1.5	0.165
Taiwan	0.41	1.3	0.533

Source : JICA Study Team estimate

Note that the same processing method is assumed for all the countries, e.g., labor-intensive or capital-intensive.

(3) Depreciation

Contribution of the fixed cost to the total production cost, typically in the form of depreciation of building, machinery and equipment, increases for the following reasons. This tends to occur in developing countries.

1) Small production capacity
2) Low operation rate
3) High rejection rate
4) High equipment purchase cost or a large number of new equipment (under depreciation)

Cost comparison here is made between products manufactured in the export-oriented factories in Malaysia and Taiwan and those by local SMEs of Mexico. For this purpose, it is assumed that production and exports of Malaysian parts are carried out mostly by Japanese companies. Production and exports in Taiwan are also dominated by foreign companies or large companies with modern facilities. For this reason, production conditions other than the equipment purchase cost are assumed to be same as those in Japan. For factories in Mexico, production capacity is assumed to one half that in Japan, 80% in operation rate, and 20% up in rejection rate. The result of calculation under the following assumptions is shown in Table 7.4-4.

	Capacity	Operation Rate	Rejection Rate	Equipment cost
Japan	1.0	1.0	1.0	1.0
Mexico	0.5	0.8	1.2	1.1
Malaysia	1.0	1.0	1.0	1.1
Taiwan	1.0	1.0	1.0	1.1

Table 7.4-4 Local Factor of Depreciation Cost

	Depreciation Index
Japan	1.0
Mexico	3.3
Malaysia	1.1
Taiwan	1.1

Note) Calculation of depreciation index for unit production volume in Mexico

$$\frac{\text{Rejection rate (1.2)} \times \text{Equipment cost (1.1)}}{\text{Production capacity (0.5)} \times \text{Operation rate (0.8)}} = 3.3\text{times}$$

(4) Other costs and overhead

"Other costs" include purchased parts costs, other direct costs (including royalty), indirect labor cost, energy cost, and other indirect costs (welfare and utilities costs). Essentially, they consist of costs which are roughly proportional to labor cost, and energy and utilities costs. Energy and utilities prices in the three countries are equivalent to or lower than those in Japan.

"Overhead" consists of sales and administration expenses, covering some portions of labor cost, as well as transportation costs, social expenses, and interest payment.

Unfortunately, these cost data are not available in any of the three countries. Since "other costs" and "overhead" contain significant labor cost portions, the labor cost index set in Table 7.4-3 is used as the surrogate.

(5) Sales margin and sales price

Japanese suppliers are facing serious price pressure from their customers, and based on actual results, their profit margin is assumed to be 2.8% of sales.

On the other hand, counterparts in the three countries have a different view on profit margin and seem to secure higher profit margins. In Mexico, the profit margin of 15% is assumed on the basis of experience of procurement managers. While there are many cases with a higher margin, the 15% margin is considered to be the minimum level to close deals. In contrast, the profit margin in Malaysia and Taiwan is assumed to be 5% as export-oriented companies face severe competition in the international markets.

By adding the above profits to respective production costs, sales prices are obtained.

(6) Ex-factory sales price

By multiplying cost indices in Japan (Table 7.4-1) by respective local factors in (1) through (5), cost indices of stamping and plastic parts in the three countries are obtained as shown in Tables 7.4-5 and 7.4-6.

Table7.4-5 Cost Index of Stamping Parts

	Japan	Mexico	Malaysia	Taiwan
A. Material cost	38.8	49.9	43.9	34.9
B. Labor cost	32.3	5.0	5.3	17.2
C. Depreciation	3.9	12.9	4.3	4.3
D. Other costs	8.8	4.7	1.5	4.7
Production cost	83.8	72.4	55.0	61.1
E. Overhead	13.4	2.1	2.2	1.1
Total production cost	97.2	74.5	57.2	62.2
F. Profit	2.8	13.1	3.0	3.3
Ex-factory sales price	100.0	87.6	60.2	65.5

Table7.4-6 Cost Index of Plastic Parts

	Japan	Mexico	Malaysia	Taiwan
A. Material cost	35.7	43.9	38.4	32.1
B. Labor cost	30.6	4.7	5.0	16.3
C. Depreciation	3.5	11.6	3.9	3.9
D. Other costs	9	4.8	1.5	4.8
Production cost	78.8	65.0	48.8	57.1
E. Overhead	18.4	2.8	3.0	1.5
Total production cost	97.2	67.8	51.9	58.6
F. Profit	2.8	12.0	2.7	3.1
Ex-factory sales price	100.0	79.8	54.6	61.6

The figures denote prices of these parts in the countries when those in Japan are indicated in 100, together with cost structure. As shown in the tables, product prices in Mexico are higher than those in Malaysia and Taiwan due to higher material costs, depreciation, and profits.

7.4.3 Comparison of Prices in Mexico

To compare sales prices in Mexico, the following costs are added to prices of parts produced in Malaysia and Taiwan, which are shown in Tables 7.4-5 and 7.4-6:

- Marine transportation cost to Mexico
- Import duties in Mexico
- In-land transportation cost in Mexico

(1) Marine transportation cost

Stamping and plastic parts are generally kept in container when they are transported on ocean. They have larger volume than materials and require higher transportation costs. Although varying with the type and shape of parts carried, some are nearly ten times in transportation cost compared to their materials. The following assumptions are made for cost estimation:

- Yield of stamping material - 75%
  i.e. Total weight of stamping parts from 1MT steel sheet is 0.75MT.
- Yield of resin (recycled) - 100%
- Volume ratio of packed stamping parts to steel sheet coil per unit weight - 1:2
- Volume ratio of packed plastic parts to resin per unit weight - 1:3

Unit marine transportation costs of the two parts by using containers are 125 US$/MT (Taiwan to Mexico), 135 US$/MT (Malaysia to Mexico) for stamping parts, and 273 US$/MT (Taiwan to Mexico) and 294 US$/MT (Malaysia to Mexico) for plastic parts.

(2) Import duty and in-land transportation cost

The import duty is assumed at 10%. The in-land transportation cost from a port of entry (Manzanillo) to the capital region (approx. 500km) is estimated as follows:

@19.87 US$/MT
@ 0.71 US$/km

(3) Comparison of prices in Mexico

The results of cost comparison analysis are shown in Tables 7.4-7 and 7.4-8, and Figures 7.4-2 and 7.4-3.

Table7.4-7 Sales Price Index of Stamping Parts in D.F.

	Mexican Product	Imported Malaysian Product	Imported Taiwanese Product
A. Material cost	49.9	43.9	34.9
B. Labor cost	5.0	5.3	17.2
C. Depreciation	12.9	4.3	4.3
D. Other costs	4.7	1.5	4.7
Production cost	72.4	55.0	61.1
E. Overhead	2.1	2.2	1.1
Total production cost	74.5	57.2	62.2
F. Profit	13.1	3.0	3.3
Ex-factory sales price	87.6	60.2	65.5
G. Import duty and transportation	-	14.9	14.7
Sales price in D.F.	87.6	75.1	80.1

Table7.4-8 Sales Price Index of Plastic Parts in D.F.

	Mexican Product	Imported Malaysian Product	Imported Taiwanese Product
A. Material cost	43.9	38.4	32.1
B. Labor cost	4.7	5.0	16.3
C. Depreciation	11.6	3.9	3.9
D. Other costs	4.8	1.5	4.8
Production cost	65.0	48.8	57.1
E. Overhead	2.8	3.0	1.5
Total production cost	67.8	51.9	58.6
F. Profit	12.0	2.7	3.1
Ex-factory sales price	79.8	54.6	61.6
G. Import duty and transportation	-	23.1	22.7
Sales price in D.F.	79.8	77.7	84.4

In consequence, stamping parts made in Mexico are more expensive than those imported from Asia. On the other hand, Mexican plastic products are cheaper than those imported from Taiwan, but are more expensive than imports from Malaysia, thus, not price competitive against Malaysian products.

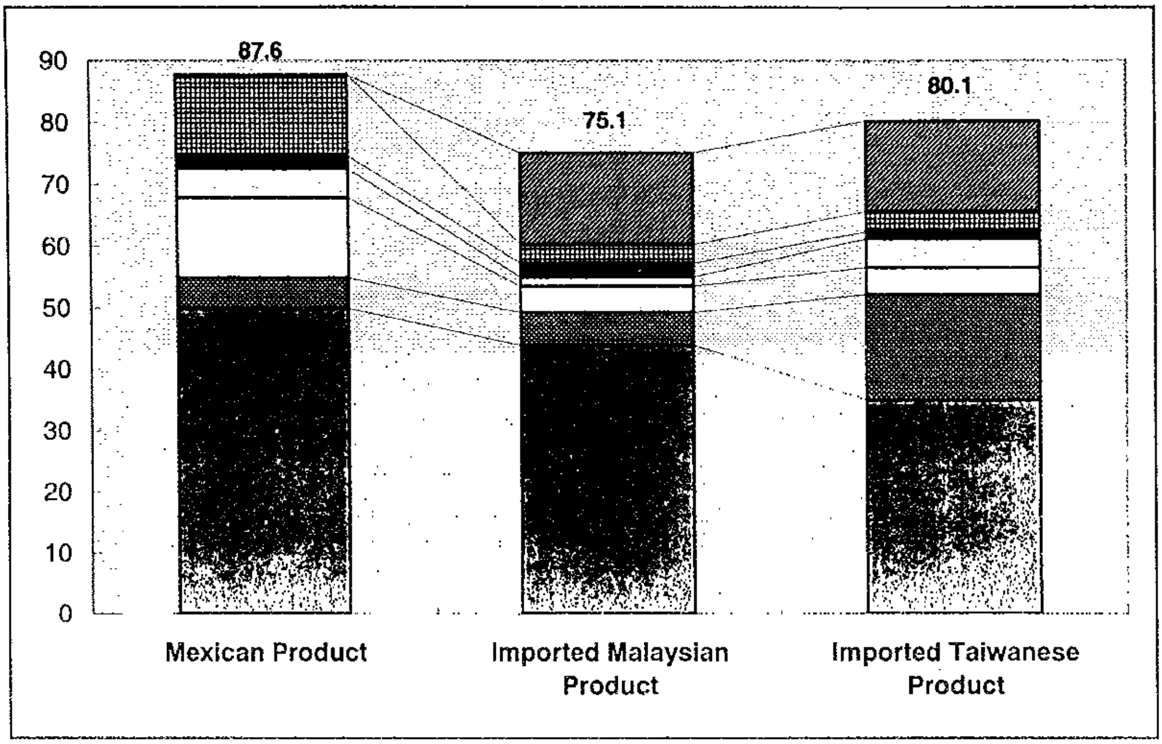

Figure 7.4-2 Sales Price Index of Stamping Parts in D.F.

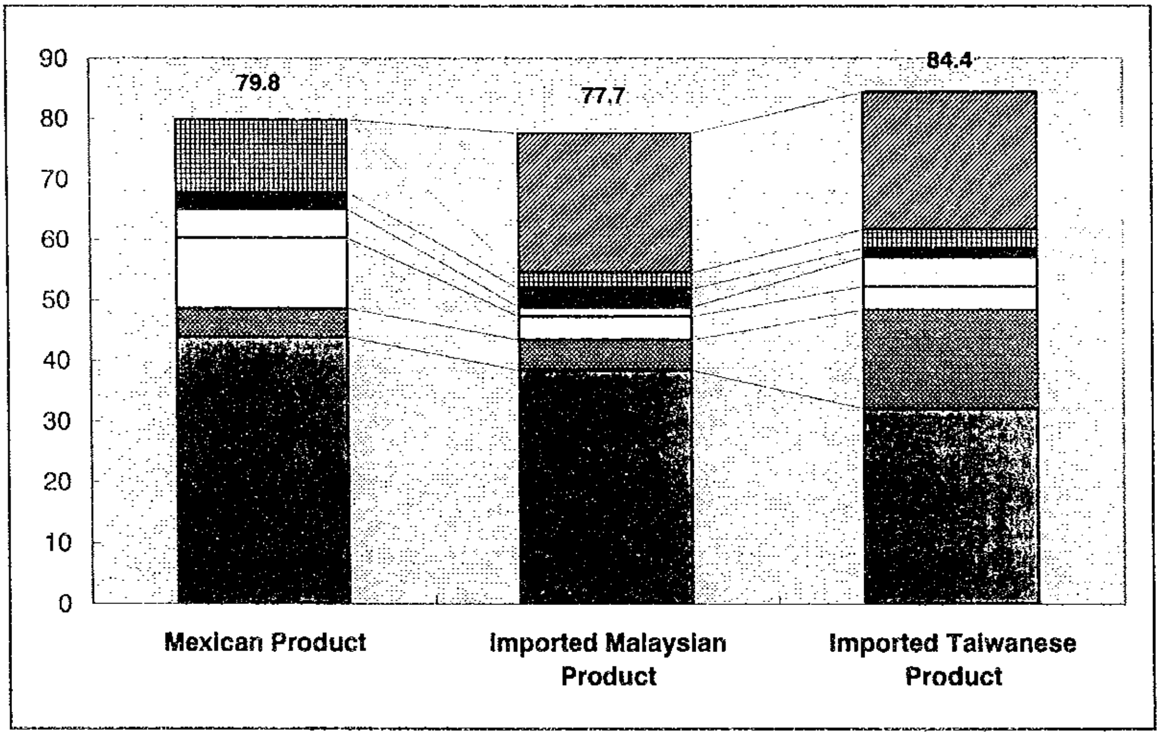

Figure 7.4-3 Sales Price Index of Plastic Parts in D.F.

Legend

- Material cost
- Depreciation
- Overhead
- Import duty and transportation
- Labor cost
- Other costs
- Profit

Major findings from cost indices shown in Tables 7.4-7 and 7.4-8 are as follows:

- Material costs of Mexican products are high. While it is difficult to compete with Taiwan products which can use cheap materials from local sources, the higher cost compared to the Malaysian case which also imports materials from Japan is attributable to the in-land transportation cost from the U.S.
- Sales prices in Mexico of the parts made in Malaysia and Taiwan are inflated by transportation costs from each country to Mexico, which account for an average of 19% of sales price for stamping parts and 28% for plastic parts.
- There is a significant difference in profit margin.

Based on the above two considerations, cost simulation is made by varying import duties on materials from the U.S. and transportation costs of products from Asia to measure their cost impacts.

a) Table 7.4-9 presents the result of cost simulation without import duty on materials imported from the U.S. Compared to products imported from Asia, the relative sales price of stamping parts remains unchanged, while that of plastic parts is lower than that of Taiwan and Malaysian products.

Table7.4-9 Sales Price Index of Mexican Products in D.F.

(with Tariff 10%)

	Stamping	Plastic
A. Material cost	49.9	43.9
B. Labor cost	5.0	4.7
C. Depreciation	12.9	11.6
D. Other costs	4.7	4.8
Production cost	72.4	65.0
E. Overhead	2.1	2.8
Total production cost	74.5	67.8
F. Profit	13.1	12.0
Ex-factory sales price	87.6	79.8
G. Import duty and transportation	-	-
Sales price in D.F.	87.6	79.8

(without tariff)

	Stamping	Plastic
A. Material cost	45.4	39.9
B. Labor cost	5.0	4.7
C. Depreciation	12.9	11.6
D. Other costs	4.7	4.8
Production cost	67.9	61.0
E. Overhead	2.1	2.8
Total production cost	70.0	63.8
F. Profit	12.3	11.3
Ex-factory sales price	82.3	75.1
G. Import duty and transportation	-	-
Sales price in D.F.	82.3	75.1

b) As for sales prices of parts (products) made in Asia, the marine transportation cost to Mexico accounts for significant portions. Both stamping and plastic parts are to be transported by container which cost is fixed. However, container has a limit of weight and volume independently, i.e., products with large specific gravity are limited by weight, and those with small specific gravity by volume.

Both stamping parts and plastic parts increase in volume per unit weight after packing. The baseline case in this analysis assumes that the packing volume of a product increases twice that of the volume of a material (steel sheet coil) for stamping parts and three times for plastic parts. Naturally, the ratio varies greatly with type, shape, and size of parts. In the analysis, the ratio was varied as follows to compare the resultant prices under three cases:

	Baseline case		
Stamping parts	2	4	10 times
Plastic parts	3	6	9 times

The results are shown in Figures 7.4-4 and 7.4-5.

As for stamping parts with large specific gravity, the packing volume increase by ten times that of steel sheet coils raises sales prices close to Mexican products. Nevertheless, Mexican products are still most expensive.

On the other hand, prices of imported plastic parts are much more sensitive to the packing volume. The marine transportation cost has larger impacts on sales prices, creating cost competitiveness of Mexican products. Thus, for Mexican manufacturers of plastic parts, an opportunity to rival imported parts exists in products which shape and size require relatively high transportation costs.

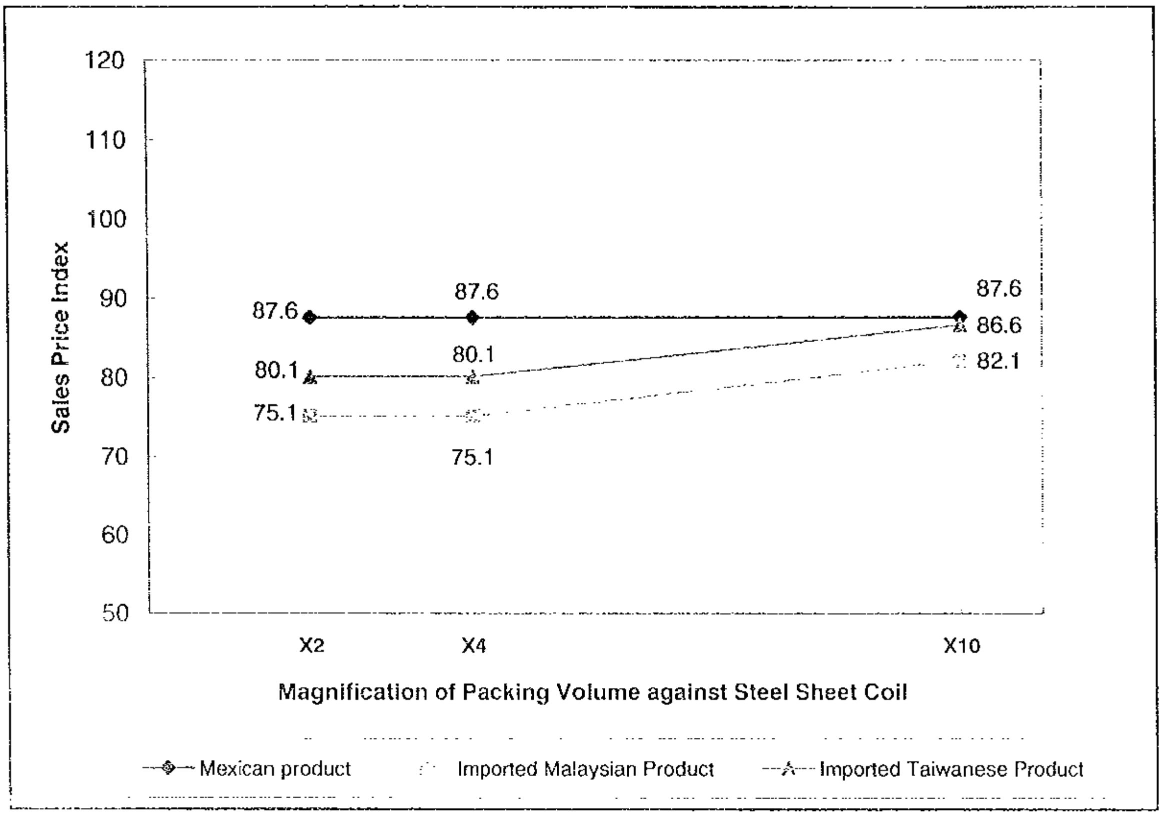

Figure 7.4-4 Impact of Packing Volume on Sales Price Index of Stamping Parts

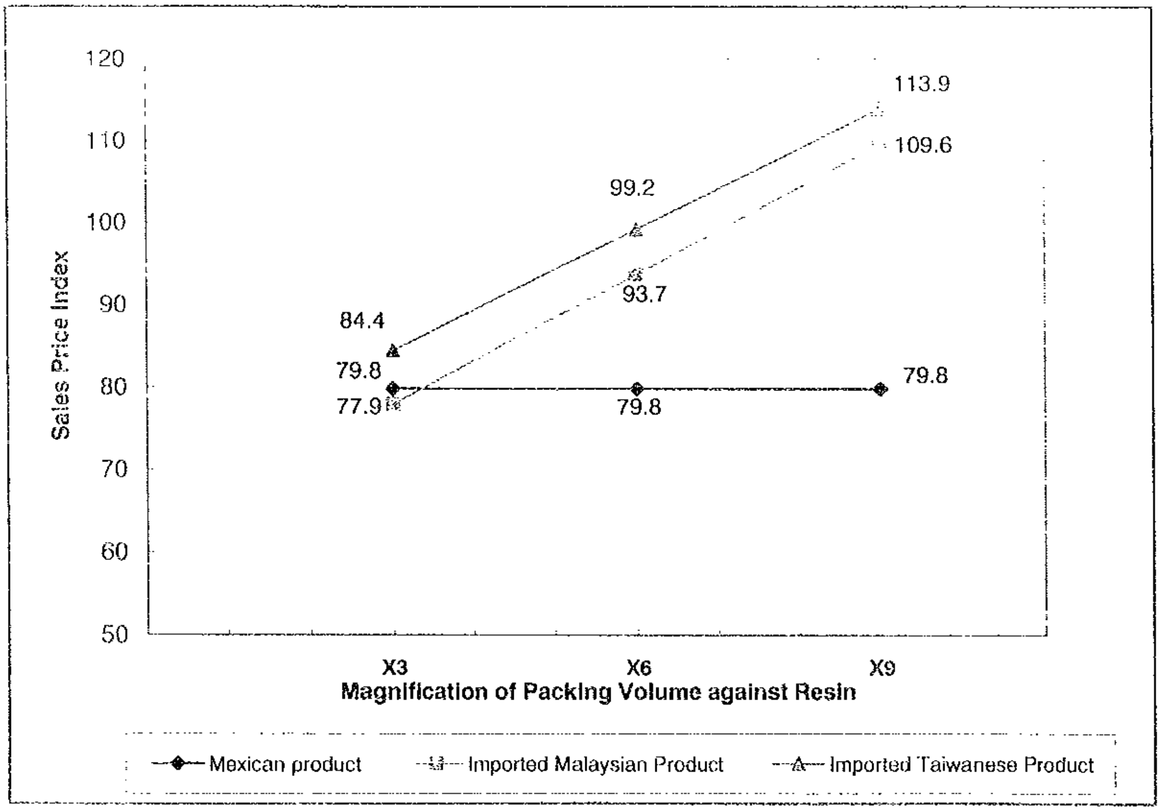

Figure 7.4-5 Impact of Packing Volume on Sales Price Index of Plastic Parts