THE EVOLUTION AND REORGANIZATION OF “MAQUILA INDUSTRY”

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• Importance of maquila industry: quantitative and qualitative
• The economic crisis in the maquila industry
• Industrial Reorganization.
• The case of TV industry
• The case of auto industry.
Maquilas still important for Mexico?

Source: Carrillo based on INEGI, Cimex-Wefa, Banco de Mexico, DEE-Colef.
Industrial Upgrading & Evolution’ Capabilities

First Generation ‘labor intensive’

Assembly Activities
Unskilled manual labor

1960 - 1982

Second Generation ‘tech intensive’

JIT/TQC ‘JPS’
Production Linkages
Technology Activities
Decision Making

1983 - 1994

Third Generation ‘knowledge intensive’

Development of Local Suppliers
Design, R&D, engineers
Coordination of plants activities in Mexico. Learning by monitoring

1995 - 2003

Fourth Generation ‘Centrillized Coordination’

2004 -

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Maquila Evolution in Mexico. Electronic and Autoparts Plants

1990 n=357; 2002 n=298

260,000 jobs lost & 911 plants during 36 months

50,662 jobs lost & 257 plants during 36 months

Source: Carrillo, Based on INEGI, 2006
Changes in Mexican Perspectives on China Aggressive Growth

- Ignorance
- Astonishment
- Perspective of zero sum game: China the winner and Mexico the looser
- Business Opportunity & Redefine

Two industries: two realities

Source: Carrillo, Based on INEGI, 2006
1. THE CASE OF TV.

**West Europe**
- Mexico: 62%
- UK: 15%
- Germany: 13%
- France: 10%
- Other 7: 8%

**Japan**
- Malasya: 30%
- Korea: 30%
- Thailand: 19%
- Other 7: 21%

**2004**
- Mexican market share in NAFTA region: 60%

PRODUCT CHANGE

TV: product life cycle

<table>
<thead>
<tr>
<th>Embryonic</th>
<th>Growth</th>
<th>Maturity</th>
<th>Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly in Baja California</td>
<td>T.V Black &amp; White</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Producen, 2003
Impact in the market sales

Sources: CEA Market Research, 2003; And company internal information. Ahihiro Koido, 2004
Source: U.S. Census Bureau. Foreign Trade Statistics
Mexico’s North West Display Devices Cluster

- 15 OEM’s with more than 22,000 employees.
- More than 200 direct suppliers with 20,000 additional employees.
- TV Annual Production higher than 19 million of units and 6 million units of PC monitors.

Source: Producen, 2003
**TV INDUSTRY STRUCTURE IN BAJA CALIFORNIA (2003)**

**PRODUCTION:** 18.9 MILLIONS OF UNITS

- **OEMs TV Manufacturers**
  - (15 - w/22,000)

- **Components (passives, electric, metallic and plastics)**
  - 2nd. Tier
  - 120-180 w/15,000
- **Strategic Components and subassemblies**
  - 1st. Tier

- **Raw materials**
  - Basic and indirect materials
  - 3rd. Tier
  - -- w/2,000

- **Multiple Services:** indirect and support

- **Foreign Suppliers**

- **Mexican Suppliers (12)**

**Source:** Carrillo, 2005. Project Conacyt no. 36947 “Aprendizaje Tecnológico y Escalamiento Industrial. Perspectivas para la Formación de Capacidades de Innovación en las Maquiladoras en México”, COLEF.
## Technological Change

<table>
<thead>
<tr>
<th>PLANTA</th>
<th>INICIOS 2003</th>
<th>MEDIADOS 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADI SYSTEMS MEXICO, S.A. DE C.V.</td>
<td>CRT: Solo monitor PC</td>
<td>CRT: Solo monitor PC</td>
</tr>
<tr>
<td>DIAMOND ELECTRONICS, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DELTA ELECTRONICS MEXICO, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BENQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JVC INDUSTRIAL DE MEXICO, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAMSUNG MEXICANA, S.A. DE C.V. (DISPLAY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANYO MANUFACTURING, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SONY DE TIJUANA ESTE S.A. DE C.V.</td>
<td>CRT: Solo monitor PC</td>
<td>CRT: No se ha hecho publica decision de cual/cuales</td>
</tr>
<tr>
<td>SONY DE MEXICALI, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG ELECTRONICS MEXICALI S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MITSUBISHI PIMS S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PANASONIC (MATSUSHITA TELEVISION AND NETWORK SYSTEMS DE B.C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHARP ELECTRONICA MEXICO, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HITACHI CONSUMER PRODUCTS DE MEXICO, S.A. DE C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAEWOO ELECTRONICS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Producen, 2003
### Proyectos de inversión en Baja California

<table>
<thead>
<tr>
<th>EMPRESA</th>
<th>MONTO (Millones de Dólares)</th>
<th>NUEVA INversIÓN</th>
<th>EMPLEOS NUEVOS</th>
<th>PRODUCTO QUE ELABORA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITACHI</td>
<td>17</td>
<td>800</td>
<td>17</td>
<td>TV’S PLASMA</td>
</tr>
<tr>
<td>JVC</td>
<td>13</td>
<td>300</td>
<td>13</td>
<td>TV’S PLASMA</td>
</tr>
<tr>
<td>PANASONIC AVC NETWORKS</td>
<td>10</td>
<td>450</td>
<td>10</td>
<td>TV’S DIGITAL/PLASMA</td>
</tr>
<tr>
<td>SAMSUNG</td>
<td>10</td>
<td>400</td>
<td>10</td>
<td>TV’S PLASMA/CELLARES/MONITORES P/COMPUTADORA</td>
</tr>
<tr>
<td>SHARP ELECTRONICA</td>
<td>13</td>
<td>300</td>
<td>13</td>
<td>TV’S LCD</td>
</tr>
<tr>
<td>SMK ELECTRONICA</td>
<td>5</td>
<td>750</td>
<td>5</td>
<td>CONTROLES REMOTOS, CONTROL PANEL</td>
</tr>
<tr>
<td>SONY</td>
<td>30</td>
<td>500</td>
<td>30</td>
<td>TV’S PLASMA</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$98 MDD</strong></td>
<td><strong>3,500</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SEDECO, 2006
### 2. THE CASE OF AUTO INDUSTRY.

#### NAFTA: Vehicle production

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Canada (%)</th>
<th>Mexico (%)</th>
<th>U.S.A. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>9,663,396</td>
<td>12.3</td>
<td>2</td>
<td>85.7</td>
</tr>
<tr>
<td>1980</td>
<td>9,869,454</td>
<td>13.9</td>
<td>5</td>
<td>81.2</td>
</tr>
<tr>
<td>1990</td>
<td>12,551,529</td>
<td>15.5</td>
<td>6.5</td>
<td>77.9</td>
</tr>
<tr>
<td>2000</td>
<td>17,698,866</td>
<td>16.7</td>
<td>10.7</td>
<td>72.6</td>
</tr>
<tr>
<td>2005</td>
<td>17,203,096</td>
<td>16.4</td>
<td>8.7</td>
<td>74.9</td>
</tr>
</tbody>
</table>

Light Vehicles = 63% in 1996; 75% in 2001

Source: Automotive News

Vehicle park: 17.8 millions
16 years average age
2002: 18 people per car
NAFTA: Sales of Cars and Trucks

Cars continue to dominate in Mexico throughout the forecast

Source: Automotive News; Global Insight
Production, exports and imports of cars and LV in Mexico (000s units)

Fuente: Secretaría de Economía con información de la AMIA.
Mexico has different clusters:

- North
- Center
- Bajío

Cluster of Northwest

Source: Secretaría de Desarrollo Económico
## 2005 Investment projects

<table>
<thead>
<tr>
<th>Firms</th>
<th>Models</th>
<th>Size/Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ford</strong></td>
<td>- Fusion</td>
<td>- Medium</td>
<td>August 2005.- Beginning Production of Hermosillo project:</td>
</tr>
<tr>
<td></td>
<td>- Zephyr</td>
<td>- Luxury</td>
<td>Ford Fusion Platform, substitute the Focus platform</td>
</tr>
<tr>
<td></td>
<td>- Milán</td>
<td></td>
<td>✓ Luxury Medium Vehicle substitute a compact one</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Expected Production: 300,000 annual units</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Exclusive production in Mexico</td>
</tr>
<tr>
<td><strong>Volkswagen</strong></td>
<td>- Jetta A5</td>
<td>- Medium</td>
<td>July 2005.- First container to Europe of new Jetta A5:</td>
</tr>
<tr>
<td></td>
<td>- Bora</td>
<td>- Compact</td>
<td>✓ Medium vehicle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Expected Production: 220,000 annual units</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Exclusive production in Mexico for NAFTA, Europe and the rest of the world</td>
</tr>
<tr>
<td><strong>GM</strong></td>
<td>- HHR</td>
<td>- Medium</td>
<td>August 2005.- Beginning Production of new project:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Luxury</td>
<td>Chevrolet HHR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Vehicle type Crossover</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ <strong>Expected Production</strong> : 100,000 annual units</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Exclusive production in Mexico</td>
</tr>
<tr>
<td><strong>Toyota</strong></td>
<td>- Mega Cab</td>
<td>- Pick-up</td>
<td>August 2005.- Beginning Production of project Mega Cab:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Luxury</td>
<td>✓ New vehicle, the biggest in their type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ <strong>Expected Production</strong> : 80,000 annual units</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Exclusive production in Mexico</td>
</tr>
<tr>
<td></td>
<td>- Tacoma</td>
<td>- Pick-up</td>
<td>2005.- Beginning Production of pick-up Tacoma in Mexico:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Luxury</td>
<td>✓ Launch of new plant in Tecate, Baja California</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ New generation of Tacoma</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ <strong>Expected Production</strong> : 30,000 annual units</td>
</tr>
</tbody>
</table>
LOCATION OF TIER ONE AUTOPART SUPPLIERS
(includes maquiladora)

CHIHUAHUA
ALCOA FUJIKURA
ALUMAX
AVON AUTOMOTIVE
BERGEN CABLE ETCHNOLOGIES
BERG TECHNOLOGIES
CAPSONIC AUTOMOTIVE
CARLISLE
COOPER INDUSTRIES
CRONI
CUMMINS DIESEL
DELPHI
EAGLE OTTAWA
ELECTRISOLA

BAJA CALIFORNIA
AMERICAN RACING
AUTOLIV
GONHER
KENWORTH
NKS SAFETY TECHNOLOGY
PARKER HANNIFIN
PILKINGTON
PIONEER
WABASH TECHNOLOGIES

Baja California
AMERICAN RACING
AUTOLIV
GONHER
KENWORTH
NKS SAFETY TECHNOLOGY
PARKER HANNIFIN
PILKINGTON
PIONEER
WABASH TECHNOLOGIES

SINALOA
DELPHI
MEXICORVOS

SONORA
AM MEX PRODUCTS
ATRONICS
BENTLER
CHARLES E. GILLMAN
CHATA ENTERPRISE
EXEMPLAR MANUFACTURING
ITT INDUSTRIES
LEONI WIRING SYSTEMS
MOLEX
Oxford Automotive
PRESTOLITE WIRE CORP
ST. CLAIR TECHNOLOGIES
TRW
T.S.E BREAKS
TYCO
YASAKI’S EWD (ACOSA)

Source: Bancomext

COAHUILA
ALLIED SIGNAL-HONEYWELL
BENTELER
CASTECH
CITATION TOOLS
CIFUNSA
DELPHI
DOUGLAS & LOMASON
FEDERAL MOGUL
FINDLAY INDUSTRIES
GENERAL CABLE
IRVIN AUTOMOTIVE
JOHN DEERE
JOHNSON CONTROLS
LEAR CORP.
MAGNA INTERNATIONAL
MAGNA SEATING SYSTEMS
MAHLE
MANNESMANN-SACHS
MASCOTEC
OXFORD AUTOMOTIVE
PILOT INDUSTRIES
PLASTIC OMNIUM
RASSINI
STABILUS
STERYR-DAMLER-PUCH
TAKATA
TEKSID WIAT
TEN-MEX
TEXTRON AUTOMOTIVE
TBW

NUEVO LEON
ACCURRIDE
AISIN
ALLIED SIGNAL
ALCOA FUJIKURA
AUTOCLIMAS
CARUSI
CATERPILLAR
DELPHI
DENSO
DONNELLY
ENTRELEC
FREIGHTLINER
GONHER

TAMAULIPAS
ALPINE ELECTRONICS
AMMEX PRODUCTS
BBB INDUSTRIES
BBR INDUSTRIES
BRONCO ELECTRONICS
DELPHI AUTOMOTIVE SYSTEMS
DELPHI VALEO
DELPHI ELECTRONICS
FEDERAL MOGUL
FEDERAL TECHNOLOGIES
FERNAG
FUJITSU TEN
GLOBE MOTORS
GODAM
GRANITE MANUFACTURING
HERTZ LEMEZ
INVEVYS
ITT AUTOMOTIVE
KIMKO

Source: Bancomext
SUPPLY CHAIN STRUCTURE

1994

FOREIGN COMPANIES

LOCAL COMPANIES

CAR ASSEMBLERS

SUPPLIERS

12 TRUCKS ASSEMBLERS

2005

100 600 150

50 100 200

30 60 30

CURRENT SITUATION

EXPECTED GROWTH

Source: Bancomext, 2003
Regions of Technology

Future is related with the introduction of sophisticated electronic controls that accelerated the vehicles today like the airplanes. Control Systems “By Wire”

MEMS (Micro-Electro-Mechanical Systems) will be key in the near future.
**DELPHI Upgrading Process**

**DELPHI SEC** *(SENSORS AND VALVES PLANT)*
- Assembly and manufacture of several components
- Manufacture processes engineering
- Sub-plants by product family
- Lean manufacturing
- Multifunctional working cells
- 1 engineer by 2-3 cells
- Statistical controls
- Development of some Mexican managers

**DELPHI PACKARD** *(WIRE HARNESS PLANTS)*
- 100% assembly
- Basic processes engineering
- Scarce links with the local environment

**DELPHI MTC** *(MULTI PRODUCT)*
- Creation of a technical center
- MTC takes some decisions, e.g., suppliers of the MTC
- Parent co. keeps decision making about manufacture
- Global suppliers for plants
- Links plants - MTC
- Quality control with documentation
- Several Mexican managers
- Greater links with the local & regional environment (Universities and institutes)

Source: Based on Dutrenit et al 2002;
Baja California Auto Vocation

Positioning and Opportunities: 84 plants & 29,000 direct employment (64% in Tijuana)

- 3 Final Assemblers (Kenworth, Toyota, Shelby Cobra), probably one more in road
- Auto parts, Electronic and Plastic.
- Air bags, windshield wiper, bumpers, machining and wheels polished, electronic sensors for cars and safety belts among others.
- Communications, gas, electricity and water
- Skill workers and labor peace
- Fifth world economic region
- Opportunities:
  ✓ Steel coming from Scrap
  ✓ Metal mechanics-electronic-plastics
  ✓ Two Industrial Automobile Parks
  ✓ A Hub (concentrator) of Parts
  ✓ An 'Automobile' University

Goal: Be site for Final Assemblers (OEMs), Tier 1 and to incubate local companies Tier 2 and 3
Challenges for the BC region

- To attract new FDI and retain existing firms
- To reduce the cost operations and increase the productivity and competitiveness of the firms
- To improve high human skill formation
- To focus on the development of specific clusters

- Automotive parts, components
- Aerospace
- Electronics (large-size LCD flat screen TVs)
- Software
- Medical/Hospital instruments and supplies
- Niche market, upscale, J-I-T goods

China is the “wrong threat” look the US and Canada instead. But in the long run China auto industry will be part of the US market. Mexico is in competition with Canada and the Southern US states to win projects for the US market, and should concentrate on that.