

MAQUILADORAS AND THEIR TRANSACTION PATTERNS

Patricia A. Wilson*

RESUMEN

Basándose en los resultados de la encuesta reportada en su libro *Free Trade and local Development*, la autora muestra que el relativamente alto porcentaje de materiales mexicanos que utilizan las maquiladoras en el interior de México no es resultado de una gran demanda por parte de la inversión extranjera que haya estimulado a una industria local de proveedores. Mas bien, reneja el hecho de que las firmas locales, en su lucha para sobrevivir, buscan mercados de exportación a que puedan acudir si se clasifican como firmas maquiladoras. Las maquiladoras extranjeras que están adoptando a la moderna tecnología flexible compran un mínimo de materiales de origen mexicano. Este análisis identifica las conexiones locales que se podrían duplicar o intensificar con estas firmas de alta tecnología, además de nuevas conexiones que podrían establecerse. La política del gobierno mexicano no debe limitarse al nivel nacional sectorial, sino afinarse a los obstáculos y oportunidades específicos tanto a cada sector como a la geografía del país, con el fin de transformar grupos de firmas interrelacionadas en redes transaccionales.

ABSTRACT

Drawing from the original survey in her book *Free Trade and Local Development: Mexico's New Maquiladoras* (University of Texas Press, forthcoming in 1991), the author finds that the relatively high percentage of Mexican inputs used by the maquiladoras of the interior is not a result of foreign investment creating enough demand to stimulate a local supplier industry. Rather, it is the result primarily of local firms seeking to survive by looking for export markets through maquiladora status. The foreign maquiladoras that are adopting the leading edge flexible technology buy the least amount of domestic inputs. The analysis identifies the local linkages that could be replicated or strengthened among these high-tech firms and some missing linkages that could be established. Public policy must not be limited to broad national-level sectoral policy, but rather finely tuned to the obstacles and opportunities specific to both place and sector for transforming clusters of related firms into effective transactional networks.

• **Patricia Ann Wilson** is a professor of urban and regional planning at the University of Texas at Austin, and currently directs the Master's Program in Planning and Latin American Studies. Since 1975 she has been a member of the Interamerican Planning Society. Please send correspondence to the Graduate Program in Community and Regional Planning, University of Texas at Austin, Austin, Texas 78712.

*Introduction*¹

FOR Mexico's assembly industry to be more than a source of foreign exchange and low-paying jobs, the maquiladora plants must create linkages with the domestic economy. These linkages occur through the network of transactions that the plant creates with local firms: e.g., the purchase of locally manufactured inputs and local services, subcontracting to local firms, the sale of products as inputs to local manufacturers, and the creation of spin-off firms. Each transaction serves as a possible conduit for technology transfer and an impetus to more diversified job opportunities.

The published data on Mexico's maquiladoras show that interior maquiladoras purchase a much higher percentage of their inputs domestically than do maquiladoras located along the border. What gives rise to this pattern? What kinds of maquiladoras in the interior do the most domestic sourcing—high tech or low tech, foreign or national, large or small? What sectors are benefitting? Are the inputs largely local or from elsewhere in Mexico? What about twin city sourcing along the border? A survey of 70 maquiladoras from the interior and the border provides some evidence. This paper focuses on the local transaction patterns of the maquiladora industry in the large interior city of Guadalajara, where all 26 maquiladoras were surveyed. The transaction patterns among maquiladoras in Guadalajara are contrasted with those of Monterrey, Tijuana, Juárez, and Nuevo Laredo.

In Guadalajara there are two large clusters of maquiladoras, each with its own pattern of local networks: one is the sector of mostly small, home-grown, craft-based maquiladoras in apparel, footwear, furniture, jewelry, and toys. These maquiladoras represent the tip of a long-standing craft sector in Guadalajara. The other large cluster of maquiladoras is the electronics sector: foreign subsidiaries, many quite large, producing electronics components and subassemblies. The electronics maquiladoras form a part of Guadalajara's much larger electronics industry, which includes foreign plants that are not maquiladoras but do export, joint ventures between foreign and Mexican capital, and locally owned start-ups. In addition to the crafts cluster and the electronics cluster, there is a small cluster of auto part maquiladoras, primarily U.S. branch plants, attracted in the late 1970s and early 1980s to Guadalajara by the local metal mechanics industry.

1 The author wishes to thank the Commission on International Migration and Cooperative Economic Development, Washington, D.C., for their financial support of this project and Mario Carrillo Huerta, Umberto Lona, Paul Castillo, and Juan José Palacios for their collaboration in the field research.

Conceptual Framework

Mexico has opted for an export-led development strategy. One of the pitfalls of such a strategy is the reliance on foreign capital, technology, raw materials, and markets. The result can be an isolated enclave of export-oriented manufacturing that does not create a broad-based internal industrialization. This risk is particularly high with foreign assembly industry, such as Mexico's maquiladora industry. Foreign assembly plants tend to be industrial enclaves. They are rewarded with tax exonerations for bringing in raw materials and machinery from abroad and exporting the output. And in fact the record shows that after 25 years, the maquiladoras on average source less than 2 percent of their raw materials domestically (INEGI). Yet the government of Mexico continues to vigorously promote the maquiladora industry as part of its overall export-led industrialization strategy, encouraging plants to locate in the interior where they have shown a greater tendency to source domestically.

The changing global economy points to a possible new opportunity for creating greater local linkages from the maquiladora industry: the rise of flexible production (Swyngedouw, 1987; Gertler, 1988; Schoenberger, 1987). As a corporate strategy aimed at meeting Japanese competition, flexible production emphasizes quality competition over cost competition, and adaptability to changing market opportunities over production for a standardized mass market. Economies of scope overshadow economies of scale as flexibility becomes the hallmark of the competitive edge. Vertical disintegration replaces vertical integration as large producers unburden themselves of all but their most productive of technologically sensitive endeavors in the pursuit of flexibility. What replaces the vertically integrated global complexes of mass production is a series of tightly integrated multifirm networks of buyers, suppliers, and subcontractors. Some authors refer to this change in corporate strategy as the rise of post-Fordist flexibility and the decline of Fordist mass production.²

These new flexible interfirm networks have a spatial dimension to them. The need for just-in-time deliveries, the careful sharing of technology, and the supervising of quality control between firms create the need for geographical clustering of these networks that telecommunications cannot totally obviate. While many observers have predicted that the rise of flexible production will bring the far-flung corporate empires back home (e.g., Sanderson, 1987; Schoenberger, 1987), others admit the possibility of clustering in Third World locations (e.g., Scon, 1989, Wilson, 1990). The electronics cluster in Guadalajara already has been dubbed Mexico's Silicon

2 See review of literature in Wilson, 1990.

Valley by some of the international business press (World Press Review, 1988).

The rise of flexible production also creates a new opportunity for small-scale producers to enter the international market without an inherent disadvantage from the lack of economies of scale. In fact, the economic development literature has formalized a craft paradigm modelled after the successful entry of north-central Italy's locally owned craft shops, particularly in textiles and clothing, into the international market (Piore and Sable, 1984; Scott, 1989). The basis of their success has been networking and cooperation among the local small firms. Part of Guadalajara's long-standing and well-networked crafts industry has entered the export market by becoming maquiladoras.

Economic Development in Guadalajara

Until the 1930s, Guadalajara was a commercial center serving the large landowners in the surrounding agricultural region. Trade was dominated by a few powerful merchants. Beginning in the 1930s the merchants diversified into the production of consumer articles for regional market, primarily by subcontracting to small workshops of craft producers using temporary, family, and home workers, largely female. By the mid-1960s other urban centers in the region had grown up and begun to take over some of the region-serving commercial functions of Guadalajara. The Guadalajaran oligarchy entered manufacturing on a larger scale, often employing craft workers in formal factories such as that of the nationally known shoe manufacturer, Canada (Escobar, 1988, pp.7-8). At the same time Mexican capital from outside the region -both domestic and foreign-began to set up factories in Guadalajara. Outside manufacturers were attracted in part by the growing regional market and industrial infrastructure, but also by the cooperative, trained labor force.

The first U.S.-owned maquiladoras arrived in Guadalajara in the late 1960s. The presence of a female industrial labor force stemming from the craft industries was particularly attractive to them (Gabayet , 1983). Burroughs (now Unisys), arriving in 1968, employs 80 percent (about 640) women line workers. General Instruments and TRW (since bought out by Shizuki), arriving in 1973/74, employ 80 to 90 percent women line workers (450 to 500 each).

Foreign auto part maquiladoras started showing up in the late 1970s. They use a predominantly male labor force. Attracted by the existing metal mechanics industry and its labor force, Borg Warner opened up two auto parts plants, one in 1978 and one in 1980. Another U.S. auto parts producer, Reliance Electric, and a Spanish auto parts manufacturer both established maquiladoras in 1981.

Fifteen of the 24 maquiladoras in Guadalajara have been established since the crisis of 1982, largely in crafts (eight plants) and electronics

(three), with one each in home appliances, auto parts, plastics, and chemicals. The 1980s have also witnessed the growth of non-maquiladora manufacturing plants, especially in electronics (see below). The state of Jalisco, reflecting Guadalajara's growth, more than doubled its share in total foreign investment in Mexico from 1.7 percent in 1982 to 3.8 percent in 1987 (DEPRODE, 1988). The maquiladora growth rate for Jalisco, which also reflects the Guadalajara metropolitan area, exceeded both that of the border and the interior for these years in terms of number of plants, but not in terms of number of employees (see Appendix 1).

Methodology

While the Mexican government (INEGI) records the amount of domestic inputs used by each maquiladora, the published data allow only a broad sectoral or geographic analysis of the plants by average percent of national inputs used. The Mexican government does not gather data on local inputs -i.e., inputs manufactured in the local metropolitan area. Heretofore, information on local inputs purchased by maquiladoras has been purely anecdotal.

For this analysis all 26 maquiladora plants in Guadalajara were interviewed, providing 100 percent coverage (two responses, both from small plants, were thrown out because of inconsistent answers).³ Plant managers were asked to specify the degree and nature of four kinds of local linkages:

- (1) local productive inputs purchased "i.e., raw materials used in the production process that are manufactured in the local metropolitan area,
- (2) local productive services purchased (specific questions were asked about tool and die, metal stamping, and plastic molding),⁴ (3) sales made locally, and (4) local spin-off companies started. Follow-up questions were asked about the names of local manufacturers, service providers, and spin-off firms in order to subsequently survey a selection of local suppliers and spin-offs about their sourcing patterns. Questions were also asked about the degree and nature of non-local domestic inputs (i.e., from elsewhere in Mexico). Finally, respondents were asked to rank location

3 To be considered a maquiladora a plant had to be currently registered as a maquiladora and operating as a maquiladora. In the interior it is not unusual to find part-time and temporary maquiladoras-that is, plants producing primarily for the domestic market that become maquiladoras in order to export when the domestic market is slack, and plants that produce only a portion of their output under maquiladora status. In the latter case, the survey questions were directed at that portion of the plant's operations carried out under maquiladora status, it was dropped from the survey, thus accounting for the discrepancy between SECOFI figures and the number of operating maquiladoras.

4 Pretesting of the survey instrument along the border showed these three productive services to be the most sought after by the maquiladoras.

factors to determine in which cases access to local goods and services was considered important.⁵

Crafts Network

Maquilization of the Crafts. Most craft industries responded to the fall of the internal market in 1982 in one of two ways (Escobar, 1988, p. 10): Some began to deformalize the work process again, by increasing home work and temporary work, not paying taxes, and scaling back to family-sized operations (Escobar, 1988, p. 10). The lack of operating capital made others decide to return to subcontracting for larger companies in Guadalajara. However, there was another strategy followed that has not been noted in the literature: the “maquilization” of the craft industries. Faced with a falling internal market and capital shortages, a number of craft manufacturers sought maquiladora status in order to produce for the export market and find a U.S. client who would provide most of the raw materials. Some did not like either the red tape or the vagaries of the foreign client’s demands, and subsequently stopped using their special legal status. In visiting craft manufacturers registered as maquiladoras we found several who were no longer operating as such. Ten craft producers, however, were actively operating as registered maquiladoras at the time of the survey in 1988/89.

The crafts sector of maquiladoras largely accounts for Guadalajara’s relatively high percent of local inputs (see Table 1). Sixteen percent of the inputs used by the ten firms, on average, are made in the Guadalajara metropolitan area. Most are small, locally owned companies in footwear, furniture, clothing, jewelry, and toys. Unlike maquiladoras in these sectors along the border, the ones in Guadalajara have emerged from a strong local tradition of craft manufacturing for the domestic market. In fact, seven of the ten craft manufacturers operating as maquiladoras in Guadalajara sell also on the domestic market, four of them a minor portion of their output and three of them the majority of their output. The latter use maquiladora status primarily as excess capacity warrants. An eighth plant -one of the clothing manufacturers- existed as a factory for the domestic market before restructuring recently as a maquiladora exporting all of its output. Almost all have started operations as maquiladoras since the 1982 crisis, and most since 1987.

5 Plant managers were also asked questions about the degree of use of computer- controlled production machinery, just-in-time inventorying, and other characteristics of flexible production. They were also asked about the degree to which the plant did manufacturing versus assembly. As a result the plants could be categorized as flexible producers (whether manufacturing or assembly), manufacturers that did not use flexible producers methods (rather, they used more traditional mass production methods), and labor-intensive assembly operations. This categorization is explained in greater detail in Wilson, 1990.

Technology. Unlike the craft maquiladoras along the border, most of these maquiladoras do not offer just contract labor services to simply assemble inputs brought in by a North American client firm. The plant managers in fully 70 percent of them characterized their maquiladora production process as being largely manufacturing as opposed to assembly.⁶ Many of the craft-based firms in Guadalajara add value to the product by cutting, forming, molding, dyeing, and painting, in addition to the more traditional labor-intensive assembly of stitching and joining. On the other hand, none of them go beyond the mass production model to adopt the techniques of flexible manufacturing. Almost all of them reported no use of computer-controlled machinery or just-in-time inventorying (*JIT*), nor had any plans to introduce them in the future (see Appendix 3).

Local Inputs. Guadalajara's craft-based maquiladoras use more local inputs on average than do any other cluster. (Table 1). The toy firm, which manufactures mylar (metallic) balloons, uses locally made photopolymer engravings for each design and adds locally manufactured plastic sticks and connectors. Nevertheless, it imports most of its major raw material, nylon. The footwear producers get their main raw materials largely from their U.S. clients both for leather and synthetic shoes. However they do buy locally manufactured tacks, nails, glue, thread, and dyes. The furniture manufacturers, whose raw materials come largely from the United States, also buy locally manufactured rivets, tacks, solder, screws, wood, glues, nails and staples. Of the two apparel plants, one buys no local inputs and the other buys thread and glues from local manufacturers. The manufacturer of fine jewelry buys locally produced industrial gases.

While this use of local inputs is unusually high for maquiladoras, it is not for domestic industry. According to plant managers (often owners) who produce for the internal market in addition to their maquiladora operations, their export production uses fewer local inputs than does their domestic-oriented production. The difference is due primarily to the fact that their U.S. clients provide most of the inputs.

National Inputs. Several of the craft-based maquiladoras also use significant raw material from elsewhere in Mexico (see national inputs in Table 1, which are a sum of local and non-local domestic inputs). The balloon manufacturer gets a part of its major input, nylon, and some of its dyes from Mexico City and Monterrey. One of the furniture makers, which makes water beds, gets some of its wood, paint, and varnish from elsewhere in Mexico. However, its principal input, plastic cloth, comes from the United

⁶ Among craft-related sectors in the border sample, only three plants were identified, two in footwear and one in apparel. Only one of the three—one of the footwear plants—identified itself as primarily a manufacturer as opposed to assembly plant. All three are large, ranging from 240 line workers to 1300. None of the three reported any local inputs.

States. Other furniture makers buy metal stampings from the state of México and Monterrey. The shoe manufacturers buy some of their chemicals and plastics (for synthetic shoes) from Mexico City and Puebla. A small portion of leather comes from León. The jewelry maker gets a small portion of its gold from Mexico City.

Other Transactions. While the craft maquiladoras use a comparatively high amount of local inputs compared to the other maquiladoras, they use few local manufacturing services and have created no spin-offs that we could identify. In terms of local manufacturing services, only two of the ten use local tool and die and two use local plastic molding. None uses metal stamping. Most get their plastic molding from their principal U.S. client and have their metal stamping done in either Mexico City or the United States.

Unlike the domestic craft producers in Guadalajara, which subcontract much of their work and employ a high proportion of temporary workers (Escobar, 1988), only one footwear firm among the maquiladora craft factories does a large amount of subcontracting and none rely on temporary employees. While the maquiladoras provide jobs that are more protected and regulated than in most of the smaller craft plants, they do not experience the fluid interaction among firms that the domestic craft producers are known for.

Electronics Network

Maquiladoras

The six electronic maquiladoras use a very small percentage of local inputs, varying from 0 to 6 percent. Neither do they use substantial Mexican inputs from elsewhere in the country. Nevertheless, a substantial proportion of them do use local productive services and have created some important spin-offs. Moreover, the sheer size of some of them means that while the percentage of local inputs is small, the volume is important.

The six electronics maquiladoras are all fully owned subsidiaries of foreign firms, five by U.S. companies and one by a Japanese firm. Unlike the crafts maquiladoras, these plants are an outgrowth of foreign industry, having been established from the beginning as complete maquiladoras exporting nearly all their outputs. They include the three oldest maquiladoras of Guadalajara: Unisys (formerly Burroughs), General Instrument, and Motorola. These large plants were all established in the late sixties and early seventies and employ between 500 and 2500 line workers each. The other three were established since 1985 -Tulon (Easterline), Digital Power, and Shizuki.⁷ The newer plants are smaller, ranging from

7 Shizuki bought out the old TRW maquiladora in 1987, closed it, then constructed a new

under 50 production workers up to 650 in case of Shizuki. The older plants produce electric cable assemblies and wiring harnesses for computers, power supplies, semiconductors, electronic voltage surge suppressors and relays. The newer plants make power supplies, circuit board drills, and capacitors.

Technology. Only three maquiladora plants in Guadalajara make substantial use of computer-controlled production machines, a key element of flexible technology. Two of them are electronics firms—the two largest and oldest electronics maquiladoras in Guadalajara, Unisys and Motorola. Unlike General Instrument, Unisys and Motorola significantly updated their technology and shop floor methods in the 1980s to incorporate some flexible production capabilities. While these two do use more local productive inputs than the other electronics maquiladoras (4 percent on average compared to 0.5 percent for the other electronics maquiladoras), this may reflect the time they have had to develop some local suppliers rather than some inherent tendency of the technology. Certainly, the use of just-in-time inventorying is not associated with greater local inputs (see Appendix 3) • While all but one of the six electronics maquiladoras use JIT or are in the process of implementing it, they reported that they do so with inputs coming from the United States.

Local and National Inputs. Unisys, which makes electronic cables, harnesses, and power supplies for Unisys equipment, gets most of its raw materials from Unisys in Dallas. They buy only metal chassis made in Guadalajara and terminal connectors made in Mexico City. The Motorola Semiconductor plant, which manufactures wafers, brings in all the chip parts from the United States and Europe. Some chemicals are purchased in Monterrey. The only local productive input is industrial gases from the Union Carbide plant in Guadalajara. The plant also purchases local packing material. General Instrument has been unable to find good local suppliers, but is talking to IBM about their local suppliers such as U.S.-owned ADTEC for double-sided high-density printed circuit boards and U.S.-owned Cherokee for power supplies. Taking all the electronics maquiladoras together, the main local productive inputs are industrial gases, metal chassis, varnish, screws and tools. Nonproductive local materials include packaging materials such as cartons, dry ice and styrofoams, and rubber boots and uniforms for workers.

As to national inputs from elsewhere in Mexico, a few of the electronics maquiladoras get gases and chemicals from Monterrey (in fact, Motorola helped to set up some of these suppliers); machine parts, lubricants, screws, tools, and coolants from Mexico City; and solvents, solder, and casting agents from both Mexico City and San Luis Potosí. The Unisys

plant in 1988.

general manager said that they currently buy cables and connectors that are assembled in Mexico City, but are in the process of setting up suppliers in San Luis Potosí and San Juan del Río to manufacture cables and connectors using fifty percent domestic content.

Spin-Offs. The older electronic maquiladoras—Unisys, Motorola, and General Instrument—have generated three local spin-offs. Before it became Unisys, Burroughs created Compubur, a joint venture between Burroughs and Mexican capital that manufactures computers for the Mexican market. In 1985 a former Burroughs general manager left and formed Electrónica Pantera as a joint venture with a Mexican partner. With 210 production workers, it builds cables and harnesses for the growing Guadalajara computer industry (Hewlett Packard, IBM, Compubur, Wang, Cherokee) and exports a small part (2 percent) to the United States. They in turn source 25 percent of their inputs from Guadalajara, including connectors from a Canadian-owned manufacturer that also supplies the local IBM plant but which—at the time of the interview—had not yet qualified to supply local plants of other blue-chip electronics firms.

General Instrument generated a spin-off in 1983 when the plant manager left to start Sistemas Delfi, a joint venture with the national telephone company of Mexico, Telmex. With 100 production workers they make computer keyboards, keys and printed circuit boards, primarily for Telmex (60 percent of output), but they also do special orders of PCBs and computer keys for Hewlett Packard, IBM, and Unisys. Sistemas Delfi, whose machines were brought from the United States under the maquiladora regimen, exports as a maquiladora when there is excess capacity (but was not doing so at the time of the interview). This spin-off uses 80 percent national inputs for its Telmex products, including 50 percent from Guadalajara—metal and plastic parts, along with gas tubing from General Instrument. Its other clients provide their own raw materials. Productive services such as metal stamping, plastic molding, and tool and die are done in-house.

Services. Four of the six electronics maquiladoras use local tool and die to some degree, covering from a part to all of their needs. Two of the six use local metal stamping, and only one uses local plastic molding. Much of the latter two services still come from the parent company or are done in-house. One of the local metal stamping firms used by the foreign electronics plants was started by a former Hewlett Packard engineer. A frequently cited tool and die supplier of the foreign electronics plants, TROMOL Troquelas y Moldes, is a local company with totally Mexican capital.

The two oldest electronics maquiladoras (which are also the two that employ flexible technology) use local productive services more heavily than do the others. Motorola uses several local productive services: tool and die, metal stamping, plastic molding, and metal plating. They helped create some of these local service providers. They brought in a very high-tech

Japanese metal plating shop. They developed a high-quality local tool and die shop, which eventually stopped supplying Motorola and the other maquiladoras because of fluctuations in demand. It now supplies the local internal market. They created some locally owned packaging companies to make dry ice and styrofoam. They also developed a chemical plant and electric capacitors plant in Monterrey to supply them. As the manager of the Motorola wafer fabrication plant said, they came here from Nogales to be an integrated manufacturer instead of an assembler.

Foreign non-maquiladora exporters

Unlike the border cities, the electronics industry in Guadalajara is composed of more than just foreign-owned maquiladoras producing for their parent company. There is a sector of large, foreign-owned electronics plants that do not operate as maquiladoras but do export the majority of their output, which is primarily computer-related. IBM initiated the trend with its landmark case in 1981 in which the Mexican government allowed it to manufacture for the domestic market as a fully owned subsidiary of the U.S. computer giant, dropping its requirement for a 51 percent Mexican partner. As the Mexican market collapsed, however, IBM began exporting more of its output. By 1988 the IBM plant was exporting about four-fifths of the personal computers and memory boards assembled there to 44 countries in the Pacific Rim (interview, July, 1988). Hewlett Packard (1982), Cherokee (1985), Wang (1985), Tandem (1988), and Siemens (Encitel) followed with their own plants. Also in 1988 the existing Kodak plant opened up a new line with 1,000 additional employees producing floppy disks and magnetic heads primarily for export and was due to open an automated production line of high-density printed circuit boards in 1989.⁸

There is very little buying and selling of products among these wholly owned foreign subsidiaries—whether maquiladora or not—for several reasons. They may not be set up as profit centers and can sell only to their parent company; they may have to send products back to their parent company for testing before they can be sold; in the particular case of maquiladoras, they may not want to deal with the red tape in getting permission to sell locally or they may not need local sales to complement their parent company's demand. The only examples we found of transactions among the foreign-owned electronics firms were Cherokee supplying power supplies to IBM and the Siemens plant (Encitel) providing inputs to Hewlett Packard.

⁸ The Kodak plant had been established in Guadalajara in 1966 to make film for the Latin American market, including Mexico. (Source: interview with plant manager, December 1988).

Two of the spin-offs from the electronics maquiladoras have become suppliers to the foreign electronics firms: Electrónica Pantera, which supplies Hewlett Packard, IBM, Compubur, Wang, and Cherokee, and Sistemas Delfi, which supplies Hewlett Packard and IBM (see above). Similar to Sistemas Delfi, Mítel de México, a joint venture between the Canadian company and Telmex, supplies electronic parts not only to Telmex but also to other electronics firms in Guadalajara.

Both to satisfy local content requirements and have greater just-in-time supplier capabilities, IBM has brought in two captive suppliers from the United States, and Hewlett Packard has brought in one. IBM brought in Space Craft Inc. (SCI), which formed a joint venture with the Juárez-based Mexican group ELAMEX to produce high-density printed circuit boards with wholly imported inputs. Called Adelantos Tecnológicos (ADTEC), the venture with 51 percent Mexican capital had wanted to supply IBM from Juárez, but IBM insisted it needed a supplier of sophisticated two-sided PCBs close at hand. According to the general manager, ADTEC applied for maquiladora status in order to sell to U.S. buyers in addition to the local IBM plant. However, after landing a contract to supply the local Hewlett Packard plant, ADTEC decided that local demand by the foreign electronics firms was sufficient. Instead, they registered under PITEX to keep open the export option (interviews, July and December, 1988). IBM has also brought in another U.S. supplier, Molex, which set up as a wholly owned subsidiary of its U.S. parent company. Hewlett Packard has brought in Matsa, which organized as a joint venture, similar to ADTEC.

Endogenous firms ⁹

We identified six endogenous, or locally owned, electronics producers. Only one of these firms has worked itself into the supplier network of the local multinational electronics firms: Instrumentos Electrónicos Profesionales (IEP). IEP sells manually assembled printed circuit boards not only to its Mexican parent company, Mexel, but also to Tandem and Wang. Lack of capital keeps them from expanding into sophisticated surface mount technology as ADTEC and Kodak have.

The remaining endogenous electronics producers, which sell only to domestic firms, include Logix, which was started by a local employee of IBM; Kitron, which is most like a Silicon Valley garage start-up firm; Infor Espacio, which designs and builds computer printers; and Wind, which builds its own brand of computers for the Mexican market. These firms do

⁹ Paul Castillo, Master's candidate in Community and regional planning at the University of Texas, identified most of the endogenous electronics firms and conducted interviews with them as part of his Master's thesis on technology transfer in the Guadalajara computer industry (forthcoming).

their own product design, buy the parts (almost totally foreign-made), and assemble them.

Kitron, for example, started up in 1980 with six local partners, four of whom work in the firm. They are a member of the Cámara Nacional de la Industria Eléctrica y Electrónica (CANIECE). They have nearly 30 employees, nine engineers in R&D, ten production workers, four supervisors and four clerical staff in operations. They design and assemble digital control instruments. Ten percent of their inputs are domestic-metal housings manufactured in Mexico City. Sixty percent of their inputs are directly imported-integrated circuits and switches. Thirty percent are bought through local distributors although they are manufactured abroad-resistors and connectors. All the engineers were educated in Guadalajara, read English, and follow the industry journals.

Microtón, another local electronics start-up, was established in 1979 to design and assemble computer products. The firm imported 80 percent of its raw materials directly and bought the remaining 20 percent through local distributors of foreign-made components. It was not a member of any industry association. In 1982 Microtón tried to establish its own line of computers, but government red tape for importing equipment proved to be too complicated. The firm subsequently developed an inexpensive way to build a buffer multiplexor (which allows a computer to be used while its printer works). By December of 1988 they were unable to find a firm willing to market their buffer in Mexico and had decided to close up the design and production activities altogether to become simply a computer service and software firm.

While the foreign-based electronics industry in Guadalajara is gradually networking among itself through spin-offs, captive suppliers, and joint ventures, there is a growing endogenous electronics industry that continues to source almost all inputs from abroad. It is almost totally unlinked to the foreign-based electronics industry in Guadalajara.

Auto Parts Network

Four of the five auto pans maquiladoras were established between 1978 and 1981 to manufacture engine, transmission, and brake parts. Three are U.S. subsidiaries and one is a Spanish subsidiary. The only automotive maquiladora built in Guadalajara after the 1982 economic crisis is a Honda plant, established in 1988, which assembles motorcycles. Two of the three U.S. plants are partial maquiladoras, producing primarily for the Mexican market and exporting to the United States as excess capacity warrants. The Spanish plant, which sells exclusively to Europe, is applying for permission to sell a portion to the domestic market. Honda has permission to sell 10 percent of its output in the domestic market. The rest goes to the U.S. market. These plants are small, ranging from 25 to 125 production workers. The use of female workers varies considerably, from only 2 percent in the

Two of the spin-offs from the electronics maquiladoras have become suppliers to the foreign electronics firms: Electrónica Pantera, which supplies Hewlett Packard, IBM, Compubur, Wang, and Cherokee, and Sistemas Delfi, which supplies Hewlett Packard and IBM (see above). Similar to Sistemas Delfi, Mitel de Mexico, a joint venture between the Canadian company and Telmex, supplies electronic parts not only to Telmex but also to other electronics firms in Guadalajara.

Both to satisfy local content requirements and have greater just-in-time supplier capabilities, IBM has brought in two captive suppliers from the United States, and Hewlett Packard has brought in one. IBM brought in Space Craft Inc. (SCI), which formed a joint venture with the Juárez-based Mexican group ELAMEX to produce high-density printed circuit boards with wholly imported inputs. Called Adelantos Tecnológicos (ADTEC), the venture with 51 percent Mexican capital had wanted to supply IBM from Juárez, but IBM insisted it needed a supplier of sophisticated two-sided PCBs close at hand. According to the general manager, ADTEC applied for maquiladora status in order to sell to U.S. buyers in addition to the local IBM plant. However, after landing a contract to supply the local Hewlett Packard plant, ADTEC decided that local demand by the foreign electronics firms was sufficient. Instead, they registered under PITEC to keep open the export option (interviews, July and December, 1988). IBM has also brought in another U.S. supplier, Molex, which set up as a wholly owned subsidiary of its U.S. parent company. Hewlett Packard has brought in Matsa, which organized as a joint venture, similar to ADTEC.

Endogenous firms⁹

We identified six endogenous, or locally owned, electronics producers. Only one of these firms has worked itself into the supplier network of the local multinational electronics firms: Instrumentos Electrónicos Profesionales (IEP). IEP sells manually assembled printed circuit boards not only to its Mexican parent company, Mexel, but also to Tandem and Wang. Lack of capital keeps them from expanding into sophisticated surface mount technology as ADTEC and Kodak have.

The remaining endogenous electronics producers, which sell only to domestic firms, include Logix, which was started by a local employee of IBM; Kitron, which is most like a Silicon Valley garage start-up firm; Infor Espacio, which designs and builds computer printers; and Wind, which builds its own brand of computers for the Mexican market. These firms do

⁹ Paul Castillo, Master's candidate in Community and regional planning at the University of Texas, identified most of the endogenous electronics firms and conducted interviews with them as part of his Master's thesis on technology transfer in the Guadalajara computer industry (forthcoming).

their own product design, buy the parts (almost totally foreign-made), and assemble them.

Kitron, for example, started up in 1980 with six local partners, four of whom work in the firm. They are a member of the Cámara Nacional de la Industria Eléctrica y Electrónica (CANIECE). They have nearly 30 employees, nine engineers in R&D, ten production workers, four supervisors and four clerical staff in operations. They design and assemble digital control instruments. Ten percent of their inputs are domestic-metal housings manufactured in Mexico City. Sixty percent of their inputs are directly imported-integrated circuits and switches. Thirty percent are bought through local distributors although they are manufactured abroad-resistors and connectors. All the engineers were educated in Guadalajara, read English, and follow the industry journals.

Microtón, another local electronics start-up, was established in 1979 to design and assemble computer products. The firm imported 80 percent of its raw materials directly and bought the remaining 20 percent through local distributors of foreign-made components. It was not a member of any industry association. In 1982 Microtón tried to establish its own line of computers, but government red tape for importing equipment proved to be too complicated. The firm subsequently developed an inexpensive way to build a buffer multiplexor (which allows a computer to be used while its printer works). By December of 1988 they were unable to find a firm willing to market their buffer in Mexico and had decided to close up the design and production activities altogether to become simply a computer service and software firm.

While the foreign-based electronics industry in Guadalajara is gradually networking among itself through spin-offs, captive suppliers, and joint ventures, there is a growing endogenous electronics industry that continues to source almost all inputs from abroad. It is almost totally unlinked to the foreign-based electronics industry in Guadalajara.

Auto Parts Network

Four of the five auto parts maquiladoras were established between 1978 and 1981 to manufacture engine, transmission, and brake parts. Three are U.S. subsidiaries and one is a Spanish subsidiary. The only automotive maquiladora built in Guadalajara after the 1982 economic crisis is a Honda plant, established in 1988, which assembles motorcycles. Two of the three U.S. plants are partial maquiladoras, producing primarily for the Mexican market and exporting to the United States as excess capacity warrants. The Spanish plant, which sells exclusively to Europe, is applying for permission to sell a portion to the domestic market. Honda has permission to sell 10 percent of its output in the domestic market. The rest goes to the U.S. market. These plants are small, ranging from 25 to 125 production workers. The use of female workers varies considerably, from only 2 percent in the

Honda plant to 75 percent in one of the U.S. plants. Only one of the plants, a Borg Warner plant, reported a substantial use of temporary workers (25 percent). This plant uses 60 percent women line workers.

The auto parts maquiladoras cite the existence of the local mechanics industry as an important location factor for both inputs and experienced labor force. In fact the local productive inputs they use come mainly from this sector: metal casting boxes, metal ball bearings and pellets, brass, nails, and cutting tools, plus solvent and paints. Nevertheless, the plants do not use much of these inputs. The use of local inputs, which varies from 0 to 10 percent for five plants, averages only slightly higher than that for the electronics plants (see Table 1). Two out of the five use local tool and die services and two use local metal stamping. Only one of the firms, Honda, reports any significant use of local subcontracting (and just to a moderate degree).¹⁰

Unlike the electronics plants, the auto parts maquiladoras use substantial inputs from elsewhere in Mexico, averaging 37 percent of total inputs (see Table 1). Far from its parent company, the Spanish plant gets a major part of its solvents and paints from Mexico City, Puebla, and Monterrey. One of the U.S. plants that is a partial maquiladora gets its main input, steel, from Monterrey and Mexico City. Other domestic inputs from outside Guadalajara include rivets, ball bearings, steel bars and plates from Monterrey and Mexico City.

Borg Warner opened its first plant in Guadalajara in 1978, called Industria de Repuestos. It produces rings for car engines and pillow blocks for transmissions using a substantial degree of computer-controlled production machines. It is the third flexible technology user identified among the maquiladoras in Guadalajara, along with Motorola and Unisys. Industria de Repuestos is a partial maquiladora, exporting 15 percent of its output (primarily rings) to the United States. In 1980 Borg Warner opened another branch plant, BW Componentes. This one is a total maquiladora producing time chains for car engines for its parent company in the United States.

The Spanish plant, Renza (Elementos de Freno), currently gets its metal stamping from Italy and Spain but is planning to open a metal stamping factory in Guadalajara for easier access. Renza has also applied to sell 5 to 10 percent of its output domestically, primarily in Guadalajara.

Other

The appliance firm is of note (see Table 1) because of its high percent of local inputs. Belonging to Krups, the German home appliance manufac-

¹⁰ Very few maquiladoras anywhere in the sample subcontract. Only one other maquiladora in Guadalajara - a footwear plant - subcontracts as much as Honda does. It seems that the maquiladoras are at the end of the international subcontracting line.

turer, this plant is the exception for foreign-owned maquiladoras in terms of its high degree of local sourcing. Opened in December of 1988, the plant uses plastic inputs from Guadalajara, glass from Monterrey, metal from the United States, and electric motors from Germany. Labor represents only 10 percent of their total costs, and access to raw materials is cited as a major location factor in coming to Guadalajara, along with low turnover rates and skilled labor. The Krups firm, which in 1989 employed only 24 workers—all skilled—plans to be at capacity in 1991.

The U.S.-owned plastics firm is of note because of the startlingly high use of national inputs, 96 percent. The plant, which manufactures plastic tablecloths, gets its major input, plastic resin, from Mexico City and Puebla (coming originally from the petrochemical complex in Tampico).

A Comparison with Monterrey

Monterrey is a city of heavier industry and more conflictive labor relations than Guadalajara. It is Mexico's second largest industrial city and the leading producer of metal and glass for the internal market. Monterrey's leading "grupos", or economically dominant industrialist families, were greatly affected by the crisis of 1982, the dismantling of tariff protections accompanying Mexico's membership in GATT, and the decline of the internal market. By 1983 the unemployment rate for Monterrey had reached 11.5 percent, more than twice the 1980 rate of 5.5 percent. In 1986 the state of Nuevo León began to promote maquiladoras to absorb the unemployed labor created by the decline in domestic industry. There were three registered maquiladoras in 1986, 18 in 1987, 58 in 1988, and 73 in 1989, of which about 60 percent were located in Monterrey. Nevertheless, the unemployment rate in February, 1989, was down only to 10 percent. As a point of comparison with the Guadalajara findings, 15 out of 34 (44 percent) maquiladoras were surveyed in Monterrey.¹¹

11 The total number of maquiladora plants in Monterrey is difficult to pinpoint. The list provided by the local Association of Maquiladoras in February, 1989, had 58 plants listed, but included many that were not yet built and many that had registered in Monterrey (because of the particular bureaucratic ease of registering there) but were located along the border or elsewhere. Also, in 1988 some of the maquiladoras changed to PITEX, which allows more national inputs and national sales than maquiladora registration, involves less red tape. The Association itself had only 25 local members at the time of the survey (some of which were not maquiladoras, but simply wanted to stay informed). I used the government figure of 34 plants as the base (data for June, 1988, from INEGI, Secretaría de Programación y Presupuesto). The plants to be interviewed in Monterrey and the border cities were selected to be representative of the sectoral and plant size mix for that city. A stratified random sample proved impossible in part because of incomplete knowledge about the universe (particularly, the number of workers in each plant in Monterrey) and in part because a number of plant managers along the border did not grant interviews.

Monterrey's startlingly high local content in its maquiladora products (see Table 2) does not mean that Monterrey is creating new local manufacturing capacity to supply foreign-initiated export activity. Rather the high local content reflects in great part the successful efforts of some of Monterrey's local "grupos," or national industrialist, to adapt to the new milieu by using excess capacity for the export market. Thus the maquiladoras associated with a local "grupo" average 32 percent of local content, while the independent foreign subsidiaries average only 5 percent.

Put in another way, five of the top six maquiladoras in terms of local (or national) content are associated with a local "grupo" (see Appendix 4). Two of the five are majority owned by long-standing local "grupos" who "were restructuring towards the export market by adding maquiladora operations. One is operated by a local "grupo" who restructured by seeking a foreign buy-out. The remaining two are joint ventures, with the local "grupo" holding the minority share. One of these joint ventures existed before becoming a maquiladora in 1986.¹²

A related factor explaining Monterrey's high local content is that all of the firms surveyed that reported some local content (i.e., greater than zero) are mass production manufacturers. These seven maquiladoras, therefore, show high degrees of manufacturing versus assembly, and little or no use of computer-controlled production machinery. Because of the high value added in these top seven manufacturing firms, four of them do not qualify for 806/807 tariff preferences in entering goods into the United States. Three of these plants enter goods duty-free into the United States under GSP, which requires 35 percent domestic (i.e., Mexican) content. Reflecting the high value-added manufacturing, labor costs represent a low percentage of total costs for these firms (less than 14 percent) compared to the remaining maquiladoras surveyed in Monterrey (whose labor costs average 46 percent of total costs).

The high usage of temporary workers in these plants reflects the striking difference in labor relations between Guadalajara and Monterrey. The heightened industrial working-class consciousness and unionization in Monterrey compared to Guadalajara led the local "grupos" to restructure not only by looking for export markets but also by reducing labor costs through the hiring of temporary workers with little job security and low benefits.

12 We found two maquiladoras that were created by the same local "grupo" as part of their restructuring process using foreign capital: USEM using Emerson Electric, created a manufacturing maquiladora and an assembly plant maquiladora in 1986, the former making metal castings for electric motors, the latter assembling electric motors. Both export all their production to the United States the former using GSP and the latter 806/807. There are no supplier relations between the two plants.

Sectorally, most of these plants represent Monterrey's leading industrial sectors-metal (three plants), glass (one plant), and citrus processing (one plant). One of these seven firms sources all of its inputs locally: a joint venture with a local "grupo," it manufactures glass table tops using local glass, chemicals and packaging material, all for export to the United States.

The main locally manufactured productive inputs that these seven firms buy are glass, laminated steel, galvanized steel, aluminum finishing stock, iron castings, cooper wire, paint, chemicals, insulation material, and orange juice. Several also get packaging material, including cardboard cartons and plastic bags, and wooden pallets. One firm, however, said it no longer sources laminated steel bearings, steel bars, or cooper wire locally because the exchange rate with the dollar has made them too expensive. They now source these items from the United States.

The use of local services among the maquiladoras is surprisingly limited, compared to Guadalajara. Of the top seven plants, only four use local producer services, mainly tool and die. One uses some local plastic molding although most of their plastic molding is done in the United States. One uses local painting and metal stamping. Several said that the exchange rate now makes local services (and some raw materials) too expensive.

The three users of flexible technology, two of which are in electronics, utilize no local inputs other than packaging material (boxes and plastic bags). One had been in Monterrey previously as a joint venture between Mexican and U.S. capital and then restructured as a maquiladora with 100 percent U.S. capital. None of the three have generated local spin-offs or use local productive services.

The remaining five plants also use local productive inputs, only two use local packaging materials, one uses local tool and die, and one uses local plastic molding. Neither do they use any national productive inputs.

The motivation for maquiladoras unassociated with local "grupos" to locate in Monterrey does not hinge on the availability of local inputs. One electronics plant relocated here from the border because of higher labor turnover rates at the border. Mattel, who has a plant in Tijuana, opened one in Monterrey because of better schooling and work ethic, availability of technical personnel, and a labor cost that they found to be 13 percent lower than at the border -an important consideration for their very labor-intensive production process.

Local spin-offs are not happening in Monterrey nearly to the degree that they are happening in Guadalajara. Of the fifteen plants surveyed we identified only one case, where one Carrier plant (Elizondo #1) created another plant (Elizondo #3) for low-volume, short-batch production of air-conditioning parts for both export and the internal market. We did discover two unusual spin-offs to the Texas border: two of the plants created their own U.S. parent companies, although with 100 percent Mexican capital, locating "headquarters" in a warehouse in Laredo in one case and McAllen in the other case.

There are fewer local sales, sales to each other, and partial maquiladoras in Monterrey than in Guadalajara. Only two are partial maquiladoras, with one-S&P Metals (Maquilas Metalicas) -selling 10 percent of its steel profiles as a non-maquiladora directly to a local manufacturer of trailers. They sell 50 percent of their output as a maquiladora to another firm in their own "grupo" which then exports it. The other plant, Oranjegos, sells only 20 percent of its fruit concentrate on average as a maquiladora. At any given moment it may be operating totally as a maquiladora if the internal market is not there; at other times it may not be using its maquiladora status at all.

Two of the Monterrey maquiladoras, both subsidiaries of U.S. firms, have applied for and been approved to sell up to 20 percent of their product on the internal market: American Electric and Rogers Electronics. Rogers Electronics wants to integrate into the growing network of trade among foreign-owned electronics firms in Mexico and is starting to sell to IBM and Hewlett Packard in Guadalajara.

Three firms—all mass production manufacturers with high local inputs—report a sizably higher amount of national inputs than local (i.e., a spread of 10 or more points). One gets a major component—steel—from Altos Homos in Monclova, Coahuila. Another gets 50 percent of its iron castings from Torreón, Aguascalientes, Mexico City, and Saltillo. A third gets wire and insulating tape from elsewhere in Mexico.

A Comparison with the Border

Thirty border plants—ten each from Tijuana, Juárez, and Nuevo Laredo—we-re interviewed, representing 2.7 percent of all border plants. The border maquiladoras generated very few local linkages. Only one maquiladora out of the 30 surveyed reports any local inputs: Located in Tijuana, it is a sporting goods plant manufacturing wooden oars for its parent company in Los Angeles. It uses sandpaper and varnish made in Tijuana.

Five of the 30 border plants interviewed indicate some use of non-local national inputs. Three are in Tijuana and two in Nuevo Laredo. The Japanese home appliance manufacturer, Sanyo, which manufactures and assembles vacuum cleaners in Tijuana, buys resins and motor ventilators manufactured in Mexico City and the state of México. While it has the greatest use of national inputs among the border maquiladoras interviewed, it is not a pure maquiladora. Sanyo sells 40 percent of its output on the internal market. Another Japanese company in Tijuana with national inputs manufactures and assembles electric transformers and coils. It brings in its main inputs—laminated steel and copper wire—from the United States but buys Mexican-made alcohol, glue, tools, and argon gas from distributors in Tijuana. The third company in Tijuana with national inputs is the sporting goods manufacturer, which uses unspecified minor inputs from Guadalajara and Monterrey.

One of the two plants with non-local domestic content in Nuevo Laredo repairs, laminates, and converts cars. Owned by a Mexican American from Laredo, the company buys Mexican-made paints from a distributor in Nuevo Laredo and cleaners made in Monterrey. However, its principal inputs of wood and resin come the United States. A U.S.-owned shoe plant that assembles moccasins in Nuevo Laredo sources a small percentage of its leather from León, Gto.

Unlike in Guadalajara, there are fewer partial maquiladoras along the border. In fact the only one in our sample is the Sanyo plant in Tijuana, which produces 40 percent of its output for the Mexican market. Of the maquiladora production, 55 percent goes to the United States and 45 percent to other countries, including Canada, Panama and Asia (Japan, Hong Kong and Malaysia).

Very few border maquiladoras use productive services from the Mexican side or from the U.S. twin city, except in Tijuana. The most frequently used local productive service is tool and die, with four of the ten Tijuana plants using occasional local tool and die services, one often Nuevo Laredo firms, and none of the Juárez firms. Most of the plants needing tool and die services get it done in the United States (non-border). Of the 13 plants reporting the use of metal stamping services, almost all source this service in the United States as well, including Japanese firms. One Japanese firm sources it in Japan and another Japanese plant does some of it in-house as well as sourcing from both the United States and Japan. Only one firm—a U.S. assembler of switches for automobiles in Juárez—reported sourcing metal stamping in their twin city of El Paso.

Plastic molding—both extrusions and injection molding—is used by 16 (over half) of the maquiladoras surveyed along the border. All the U.S.-owned plants reported getting their plastic molding from the United States (non-border) except two: the automobile switch assembly plant in Juárez that gets its plastic molding along with metal stamping in El Paso, and an electronics plant in Tijuana that gets it from Singapore.

Among the Japanese plants in Tijuana, there is an interesting trend going on in the plastic molding. Some maquiladoras continue to source plastic molding from Japan, while some have substituted those imports with their own in-house plastic molding, and others have brought captive suppliers over from Japan who then diversify their maquiladora clients. In our sample of five Japanese maquiladoras in Tijuana,¹³ two still bring their plastic molding from Japan and one does it in-house. Another, Sanyo, does part of it in-house and gets part from a Japanese supplier, Mutsutech, which Sanyo brought over as a captive supplier from Japan. Mutsutech set up as

13 There were a total of 19 Japanese maquiladoras in Tijuana in 1989 according to Echeverri-Carrol (1989).

a maquiladora that sells all of its output in the foreign trade zone in Tijuana to other maquiladoras—not only Sanyo now, but also Matsuchita and Hitachi. Mutsutech, in turn, imports all of its inputs from Japan and the United States. Another Japanese plant has developed a local supplier relationship with a plastic molding company in Otay, California.¹⁴ In 1988 the Sony plant in Nuevo Laredo began¹⁵ to manufacture its own plastic cassette holders with robotic machines brought from Japan, after having imported cassette holders manufactured in Japan by Sanyo.

The role of the twin cities in the border maquiladoras' transactions networks is quite limited, primarily to non-productive services. In terms of productive inputs produced in the twin cities, the survey found one Tijuana maquiladora buying tools made in the San Diego area, another Tijuana plant buying resin from the San Diego area, and a Juárez company buying tools and oil from El Paso. In terms of twin city productive services, the survey found one Japanese company in Tijuana sourcing plastic molding in Otay and one Juárez company sourcing plastic extrusion and metal stamping in El Paso. None of the 30 border respondents reported any local spin-oils from their plants.

Conclusions

The relatively high percent of Mexican inputs—local and national—used by the maquiladoras of the interior is not a result of foreign investment creating enough demand to stimulate a local supplier industry. Rather it is the result primarily of local capital seeking to survive by looking for export markets through maquiladora status. Local producers, as they become maquiladoras, continue to use some of their local supplier networks for inputs. In contrast, foreign-owned and initiated maquiladoras, like those that typify the border region, continue on the whole to rely almost exclusively on imported inputs.

In the case of Guadalajara, the maquiladoras with greatest local inputs are part of the endogenous crafts sector—mainly small, locally owned plants producing shoes, clothing, furniture, jewelry, and toys. Most continue to sell on the internal market, but export to U.S. clients as excess capacity warrants. In Monterrey, the maquiladoras with greatest local inputs were initiated primarily by the leading local industrial families, or “grupos,” in an attempt to survive the decline of the domestic market by seeking U.S. clients, joint ventures, or even buy-outs. In both locations, local content in

14 We were unable to determine the national origin of this supplier.

15 While not included in this survey, the Sony plant in Nuevo Laredo was one of the plants I visit during the pretest of the survey imminent.

these maquiladora operations still consists of minor inputs and is less than in their counterpart domestic operations.

The foreign-owned and initiated maquiladoras remain largely integrated to their U.S. supplier networks, despite the interior location. Even in Guadalajara, the plant managers claim they maintain just-in-time inventories with U.S.-based providers. Despite the few local (or national) inputs used by the foreign-owned maquiladoras in Guadalajara, there is nonetheless a developing local transactional network involving the foreign-owned electronics firms. The older ones especially have established joint ventures, created spin-offs, brought in outside suppliers, and worked with a few local service providers. There is now a nationally recognized electronics market in Guadalajara. The emerging network, however, excludes almost all the small endogenous electronics firms.

In Monterrey the foreign-initiated maquiladoras that are unassociated with local "grupos" have located there to escape the high labor turnover rates of the border and have access to an industrial milieu along with urban amenities, but not because of access to local raw materials. They have established very few local linkages in terms of inputs, services, or spin-off firms.

In the interior as well as the border, the maquiladoras that employ flexible technology use fewer domestic and local inputs than average, while the maquiladoras employing mass production technology tend to use more than average domestic and local inputs (see Wilson, 1990). In Monterrey most of the domestic content is accounted for by the mass production manufacturers. In Guadalajara the use of domestic inputs is split more evenly between mass production manufacturers and labor-intensive assembly plants (with emphasis on the former), reflecting the mixed classifications of the craft-producing maquiladoras.

The border plants are still largely appendages of the U.S. firms, without much local networking. The main exception is the Japanese plants in Tijuana which are bringing in captive suppliers as a local source of some inputs and manufacturing other inputs themselves. The heralded anecdotes about U.S. border maquiladoras bringing in captive suppliers did not show up in this survey.

It is true that foreign assembly industry tends to be an enclave. Nevertheless, this analysis of maquiladora transaction patterns shows that the lack of linkages is not due to some inherent structural characteristic that transcends policy intervention. The new wave of flexible technology in maquiladoras generates fewer linkages than ever, yet the flexible producers in Guadalajara generate some important linkages that can be encouraged and replicated. While Mexican national policy, especially in computers and technology transfer, has helped create some local linkages, this analysis makes it apparent that most of the obstacles and opportunities should be identified and treated at the local level with finely tuned efforts aimed at making each sectoral cluster of firms into an effective transactional network.

Policy Implications: Building Transactional Networks in Guadalajara

From this analysis of maquiladora transaction patterns, a strategy e-merges that could be tailored to the case of Guadalajara and perhaps elsewhere in Mexico: Mobilize local businesses cluster by cluster, whether in traditional crafts, electronics, heavy manufacturing, or services, to network among themselves and directly with the exterior. The public sector can play a catalyst role at the local or regional level, although implementation should be pursued by the firms themselves. The basic steps are as follows:

1. Analyze transaction networks, looking at who produces what, how, and for whom, what inputs and services are used, and who supplies them.
2. Identify gaps in supplier chains-i.e., inputs and services for which there is sufficient local demand but no local production.
3. Create communication networks among the firms. Trade associations are a vital communications link.
4. Help trade and industry associations provide member firms with management assistance, new firm start-up assistance, group procurement, worker training, financial assistance such as loan guarantees, sector-specific marketing and technology assistance, and physical facilities that promote interaction.

Of course, public policy and planning intervention will probably not be enough to turn clusters of related businesses into effective transactional networks in some places (e.g., the border) and in others may not be necessary to achieve the same result. Yet Guadalajara, with its long-standing crafts sector embedded in the local economy and its endogenous as well as foreign electronics sector, seems a propitious candidate for effective public sector efforts to create local transactional networks around the maquiladora industry.

Some additional considerations specific to Guadalajara are necessary. The craft sector is the main contributor to the high percentage of local inputs in Guadalajara's maquiladora industry. Yet there is probably a ceiling to local integration of maquiladora craft production that is far below the degree of local integration of domestic craft producers because of the use of client-supplied inputs by the maquiladoras. As a conduit for technology transfer and a solution to capital shortages, maquiladora status provides an easy short-term solution. To increase local linkages, however, it would be necessary to develop more independent conduits to the export market that would not require such extensive use of imported inputs. The networking strategy suggested above could be used to create new conduits.¹⁶

16 Why even bother with small craft firms as a source of employment? Young small firms have a high failure rate. They produce low-wage, low-quality jobs. Their existence is dependent on demand by large firms who subcontract out to them. Escobar points out

The foreign electronics firms in Guadalajara have established a small local transactions network through generating spin-offs, bringing in captive suppliers, encouraging joint ventures, and using some local productive services. But the network has not extended to endogenous electronics manufacturers, except for one. Public sector efforts to encourage networking in the electronics sector should focus on integrating the endogenous electronics firms among themselves, with the maquiladoras and other foreign electronics firms, and directly to the exterior.¹⁷

This analysis of the maquiladoras' transaction patterns in Guadalajara points to the need to assist local business development not on a firm-by-firm basis, but in the context of turning sectoral clusters into effective collaborative networks of firms. By building on existing clusters that are embedded in the local economy, local linkages are more likely to be forged. Only in this way could the foreign assembly industry gradually be transformed into a catalyst for integrated local development. In this light, maquiladoras should be seen as a transient measure-by choice and necessity-in an export-led strategy that can lead to a comparative advantage beyond that of cheap labor.

that in Guadalajara many of the local large firms are former small craft shops, that the craft producer were until the crisis of 1982 regularizing employment conditions, and that the craft sector has been a long-term source of vitality, including a channel of up-ward mobility for workers from employee to owner. Gabayet (1983) adds that they also present a flexible source of income for female workers

17 Monterrey presents a different set of circumstances. Since much of the large-scale maquiladora industry in Monterrey is not forcing initiated, its phenomenal growth should be seen largely as a short-term strategy by local economic groups to survive, restructure and enter the export market. To increase local sourcing in the long run will require, as for the Guadalajara craft producers, a more autonomous conduit to the exterior.

TABLE 1
CHARACTERISTICS OF GUADALAJARA'S MAQUILADORAS BY SECTOR, 1988-89

Sector	Núm. of Plants	Average		Year Established (average)	Average Núm. of Workers	Average % Female
		% Local Inputs	% Natl. Inputs			
I) CRAFTS	10	16	23	1984	45	65
Toys	1	40	70	1984	70	60
Furniture	2	25	43	1987	28	43
Footwear	4	10	15	1983	65	54
Textiles & clothing	2	8	8	1983	21	100
Jewelry	1	10	10	1985	28	86
II) ELECTRONICS	6	2	6	1978	749	72
III) AUTO PARTS	5	4	37	1982	59	38
IV) OTHER	3	10	45	1987	90	85
Appliances	1	30	35	1988	24	95
Plastics	1	0	96	1985	97	80
Chemicals	1	0	0	1987	150	80

TABLE 2
CHARACTERISTICS OF MONTERREY'S MAQUILADORAS

Sector	Average			Year Established (average)	Average Num. of workers	Average % female	Average Training (wks.)
	Núm. of Plants	% Local Inputs	% Natl. Inputs				
I) Associated with a local "grupo"	8	32	39	1985	181	41	7
Glass	1	100	100	1987	60	0	8
Metal	3	34	53	1984	286	0	5
Food	2	25	25	1983	100	85	12
Electric/elec- tronic	2	0	0	1986	167	78	3
II) Independent	7	5	6	1987	202	76	4
Electronics	2	0	0	1988	249	93	4
Auto parts	1	10	20	1986	60	50	8
Other	4	6	6	1986	216	75	8

APPENDIX 1

ANNUAL GROWTH RATES OF MAQUILADORA PLANTS BY REGION, 1982-87*			
Year	Region		
	Border	Interior	Jalisco
1982	-3.3	-3.6	18.2
1983	2.6	3.7	0.0
1984	12.0	11.6	0.0
1985	13.1	12.9	7.7
1986	17.1	14.6	14.3
1987	25.1	18.8	56.3
Average:			
82-87	11.1	9.7	16.1

ANNUAL GROWTH RATES OF MAQUILADORA EMPLOYMENT BY REGION, 1982-1987**			
Year	Region		
	Border	Interior	Jalisco
1982	-3.0	-2.2	-4.7
1983	18.7	19.2	16.5
1984	32.3	32.1	25.0
1985	6.2	6.5	-17.3
1986	17.9	17.2	2.1
1987	21.5	20.4	13.7
Average:			
82-87	15.6	15.5	5.9

Source: INEGI, Tables 13 and 14.

* Monthly averages per year.

**Monthly averages from January to november.

APPENDIX 2

A. AVERAGE PERCENT OF LOCAL INPUTS USED IN MAQUILLADORAS BY TYPE OF PLANT AND LOCATION, 1988/89

TYPE OF PLANT	SAMPLE BORDER	GUADALAJARA	MONTERREY	NATION**
FLEXIBLE PRODUCERS	1.7	0.0	6.0	0.7
MASS PRODUCTION MANUFACTURERS	14.5	2.6	10.5	31.9
LABOR INTENSIVE ASSEMBLY	3.1	0.0	9.2	3.3
AVERAGE	8.1	0.7	9.6	19.9

B. AVERAGE PERCENT OF NATIONAL INPUTS USED IN MAQUILLADORAS BY TYPE OF PLANT AND LOCATION, 1988/89

TYPE OF PLANT	SAMPLE BORDER	GUADALAJARA	MONTERREY	NATION
FLEXIBLE PRODUCERS*	2.6	0.0	9.7	0.7
MASS PRODUCTION MANUFACTURERS	31.0	17.1	31.0	43.3
LABOR INTENSIVE ASSEMBLY	7.0	3.6	13.3	6.7
AVERAGE	17.4	6.3	23.9	27.5

*Flexible producer: measured as those plants that have substantial use of computer-controlled production machinery. They also exhibit a high degree of other flexible production characteristics (see Wilson, 1990).

Mass production manufacturer: measured as those plants with low or no use of computer-controlled machinery, but a substantial degree of manufacturing.

Labor-intensive assembly plant: measured as those plants with low or no use of computer-controlled machinery and little or no manufacturing.

**Weighted average to reflect performance of border region.

Source: Wilson survey, 1988/89

APPENDIX 3
CHARACTERISTICS OF GUADALAJARA'S MAQUILADORAS BY LOCAL INPUTS

%Local inputs	Type ¹	Parent company ²	Sector	No. of workers ³	Plant age ⁴	Computer use ⁵	Just-in-time Inventorying ⁶	% Nat'l inputs	%Fem ⁷
40	M	Local	Toys	70	5	F	F	70	60
30	M	Local	Furniture	43	2	F	F	50	25
30	M	Krups (G)	Appliances	24	1	F	F	35	95
20	A	Local	Footwear	120	1	F	F	20	60
20	M	Local	Footwear	15	2	F	F	20	15
20	A	Local	Furniture	12	2	F	F	20	60
15	M	Local	Textiles	8	1	F	F	15	100
10	M	Local	Jewelry	28	4	F	F	10	86
10	F	Borg Warner	Auto Parts	25	11	B	D	13	60
6	F	Unisys	Electronics	790	21	A	B	12	80
5	M	Renza (SP)	Auto Parts	47	8	F	F	50	33
5	M	Borg Warner	Auto Parts	125	9	C	D	10	75
2	F	Motorola	Electronics	2440	20	B	D	4	70
2	M	Easterline	Electronics	100	4	F	F	4	15
1	A	Honda (Jap.)	Auto Parts	40	1	E	B	15	2
0	M	Efka Plastics	Plastics	97	4	C	F	96	80
0	M	Reliance Elec.	Auto Parts	57	8	F	D	95	20
0	A	Digital Power	Electronics	16	2	F	B	15	95
0	M	(Mexican-DF)	Footwear	68	12	D	E	10	70
0	A	Local	Footwear	55	7	D	E	10	70
0	M	Local	Textiles	34	11	F	F	0	100
0	M	Shizuki (Jap.)	Electronics	650	2	F	A	0	80
0	A	Gen. Instrum.	Electronics	500	15	C	E	0	90
0	M	(US)	Chemicals	150	2	C	F	0	80

- 1 F: Flexible producer; measured as those plants that have substantial use of computer-controlled production machinery. They also exhibit a high degree of other post-fordist characteristics (see Wilson, 1990).
M: Manufacturer; measured as those plants with low or no use of computer-controlled machinery, but a substantial degree of manufacturing.
A: Labor-intensive assembly plant; measured as those plants with low or no use of computer-controlled machinery and little or no manufacturing.
- 2 If foreign, name of parent company and abbreviation of national origin of company are given (except in case of one US parent company whose name could not be determined). Locally owned Mexican firms whose parent company is in Guadalajara are indicated by "local". The one Mexican plant whose headquarters are in Mexico City is indicated by "Mexico-DF".
- 3 Line workers.
- 4 Age in years since date operations began.
- 5 A, B: Substantial use of computer-controlled production machinery.
C-E: Little or no use of computer-controlled production machinery, but with plans to use more in the near future.
F: No use of computer-controlled production machinery and no plans to introduce it in the future.
- 6 Use of just-in-time inventorying, following same scale, A-F, as for computer-controlled production machinery.
- 7 Percent of line workers that are female.
- SOURCE: Wilson survey, 1988/89.

APPENDIX 4
CHARACTERISTICS OF MONTERREY'S MAQUILADORAS BY PERCENT OF LOCAL INPUTS

Input	% Local inputs	% Natl inputs	Parent company ²	Local "grupo" ³	Sector	Plant age ⁴	No. of workers ⁵	% fem ⁶	Use temps ⁷	Training weeks ⁸
100	100	M	Senreck	Yes	Glass	2	60	0	High	8
50	90	M	(McAllen)	Yes	Metal	8	50	0	Low	6
50	50	M	Local	Yes	Food	2	100	90	High	12
34	35	M	Carrier	Yes	Metal	3	320	0	Med	4
25	25	M	Am. Electric		Electric eq.	3	400	65	Med	4
18	35	M	Emerson El.	Yes	Metal	3	488	0	Low	6
10	20	M	(McAllen)		Auto Parts	3	60	50	High	8
0	0	A	Mattel		Toys	4	200	90	High	1
0	0	F	Calmar Inc.		Plastics	3	200	95	Med	4
0	0	M	Local	Yes	Food	9	100	80	High	12
0	0	F	(Mc. Allen)	Yes	Electronics	2	70	95	Low	4
0	0	M	Lasting		Ceramics	0	65	50	Low	4
0	0	F	James El.		Electronics	1	48	90	Low	4
0	0	A	Emerson El.	Yes	Electronic eq.	3	263	60	Low	1
0	0	A	Rogers El.		Electronics	1	450	95	Low	4

- 1 F: Flexible producer; measured as those plants that have substantial use of computer-controlled production machinery. They also exhibit a high degree of other post-Fordist characteristics (see Wilson, 1990).
- 2 M: Manufacturer; measured as those plants with low or no use of computer-controlled machinery, but a substantial degree of manufacturing.
- 3 A: Labor-intensive assembly plant; measured as those plants with low or no use of computer-controlled machinery and little or no manufacturing.
- 4 If foreign, name of parent company is given (all US in this case). Locally owned Mexican firms whose parent company is in Monterrey are indicated by 'local'. Three locally owned firms have set up nominal company headquarters just across the border in McAllen, Texas. They are indicated by '(Mc Allen)'.
Yes indicates the plant is associated with a local industrial conglomerate.
- 5 Plant age given in years since date operation began.
- 6 Line workers.
- 7 Percent of line workers that are female.
- 8 Use of temporary workers-Low: less than 25 % of line workers; Med: 25 % to 50 %; High: greater than 50 %.
- 9 Average number of weeks of on-the-job training a line worker receives.

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