Silicon Islands and Silicon "Valles": Informational Networks and Regional Development Strategies in an Era of Globalization

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Mexico's Democratic Opening: Opportunities Beyond Political Reform?

Often promised, never realized, the relatively clean Mexican election of July 6, 1997 ruptures the flow of nearly 70 years of authoritarian one-party rule. Let us summarize the democratic opening: The ruling Party of the Institutionalized Revolution (PRI) lost control of the federal lower house to a tenuous alliance of opposition parties, the neo-liberal PAN and the left-of-center PRD. Together the opposition control 262 of 500 seats; Cuauhtemoc Cardenas, the standard bearer of the PRD, took the mayorship of Mexico City in a landslide; and the PAN's two victories increased their governorships to six. One analyst estimates that more than 40 % of Mexico's population is administered by PAN governors or mayors (Economist: 19.July.97). If one adds the enormous population of Mexico City, it is readily apparent that well over half of Mexico's population is administered by the PAN or the PRD at the state and municipal levels. By any interpretation of 20th century Mexican political history, this is truly a monumental shift in power at the federal, state and municipal level.

More important for the problem of regional economic development is the remarkable fact that opposition-party governors now administer states containing virtually all of Mexico's most advanced urban-industrial regions: Mexico City, Monterrey, Guadalajara, Tijuana, Guanajato and Queretero. Assuming that the oppositional democratic trend expands to states like Morelos, political actors and policy makers governing these states will inevitably face pressing questions from their constituents regarding whether this impressive electoral shift is translatable into higher levels of economic development and social opportunity. Surely, one assumes, the accumulation of power at the state and regional levels of Mexico's most dynamic urban-industrial agglomerations provides the opposition governors with some developmental opportunity or at least comparative advantage for their region's economic development.

Reconsidering these new electoral opportunities raises questions about the promise of Mexico's regional growth strategies for economic growth as well as income distribution profiles, new productive alliances and new sources of technical transformation. But many questions about the relationship of economic and political reform immediately arise. Beyond the obvious value of democratization, how can regional-level, political control act as a lever to incubate innovation necessary for the social and economic transformation of Mexico's regions? How can the shift in state and regional control counter the centralized power of the authoritarian PRI, who still control virtually all state tax revenues and national economic planning bodies while, at the same time, raise the living standards of the majority whose incomes have plummeted since 1982? At the macro-level, how can the shift in control of key urban-industrial regions help resolve structural dilemmas that Mexico has confronted since the late sixties: erratic macro-economic policies, feeble economic growth, declining real incomes, rising inequalities, low

investor confidence and weak industrial investment? Of course, regional economic policy is not autarchy: it must articulate with Mexico's overall national economic development strategy.

To be sure, Mexico's highly centralized developmental model, formerly based upon state industry, national regulation and deep import substitution, is no longer viable in a post-NAFTA world. Global economic, social and cultural integration is a permanent, non-reversible process, one accelerated by the micro-electronics revolution. To date, the PRI's recovery program has implemented the standard neo-liberal formula: export-oriented industrial strategies (allegedly modeled after Southeast Asian economies), privatization of public industries, abolition of communal land tenure and internationalized access to natural resources. For party loyalists and privileged members of presidential cliques, this has meant unrestrained access to state-determined franchises and/or to former public industries usually at bargain prices. All of which has not reduced inequality, raised workers' living standards, nor resolved Mexico's chronic high unemployment. Neither, in the industrial sector, are the PRI's current strategies upgrading the skills of workers nor the competitiveness of small and medium-sized industries (SMIs). Instead, burdened by high debt (originating in the 1994-95 financial crisis), federal paralysis and, in general, technocratic indifference, the SMI sector is collapsing (i.e. *El Barzón*, a middle class movement of debtors) rather than becoming integrated into a new model of development. Because the SMIs are a pivotal site of employment generation and technology transfer, they should be harnessed at the regional level if Mexico is to enter the highly productive, micro-electronics networks upon which the new global economy rests. Yet, there is little evidence of any federal initiative on these critical issues.

Oppositional control of Mexico's most dynamic regional industrial centers combined with federal indifference to SMIs and the need for regional economic governance cries out for political actors and regional policy makers to rethink regional economic development strategies in order to redress official indifference. What, therefore, is a viable regional economic development strategy for Mexico's regions in an increasingly globalized economy? While a daunting question, we argue here that this question should be pursued by regional political actors, regionally-based firms and regional economic and social planners. For it is readily apparent that unless oppositional victories are complemented by successful regional economic growth strategies, the fruits of democratic reform at the sub-national level risk becoming a temporary, ephemeral victory, one easily exchanged for renewed promises of patronage from the authoritarian-populist center in the next electoral cycle (i.e. Chihuahua in 1998).

Regional Development Strategy: Maximizing Opportunities within Global Production Networks

In a nutshell, this paper argues that democratization at the state level offers the opposition---both the PAN and PRD--- an unprecedented opportunity to implement a dynamic regional economic development strategy. Oftentimes, regional economic centers possess political and civic movements---a resource called "social capital" ---which can be invested in order to implement economic development strategies. Putnam defines social capital as a the aggregations of "norms of reciprocity and networks of civic engagement" which become resources for mobilizing citizens toward economic and social transformation (Putnam:1993:167). Drawing upon Putnam, Fox applies this concept to oppositional movements in Mexico, arguing for the "co-production of social capital" in some instances; that is, where "state reformists and local societal groups willing and able to take advantage of openings from above, involving limited but substantial participation in government development programs" (Fox:1996:1098). Properly implemented, these strategies can valorize the potential of locally situated "social capital", that is, a region's capacity to cooperate, to generate positive norms, restrain socially destructive practices and coordinate among competing interests within local civil societies. Accordingly, regional development strategies should mobilize the social networks, cultural cohesion and collective interest contained within Mexico's highly differentiated regional identities. Finally, such a strategy should relentlessly pursue the region's comparative economic advantages within the global economy in a realistic and aggressive way.

Regional development strategies, however, must be realistic about the demands of participating in a hyper-competitive, globalized economy, one increasingly integrated by micro-electronics networks in the areas of finance, production, communications and commerce (Castells: 1996). Realism, however, does not mean denationalization, passivity nor submission, rather it acknowledges the technical and material basis of the new, irreversible, global production system now penetrating if not already governing most of Mexico's industrial sectors. Instead, a realistic regional strategy searches for niches and linkages to the new global production system. After establishing a foothold it seeks to take advantage of opportunities associated with the most dynamic international firms', i.e. global-regional firms, as they relentlessly search for innovative advantage in the areas of technology, design, sub-contracting, labor organization and regional specialization. Acting in alliance with appropriate international firms, regional strategists endeavor to exact higher income for workers, diffuse technical knowledge to all skill levels, strengthen linkages between local and international firms, upgrade local productive capacity, integrate knowledge industries (technical schools, universities and institutes) and create a specialized, world-class regional production center. Ultimately, this strategy intends to incubate specialized local firms and regional production complexes.

The Regional Development Agency as Facilitator of the Global-Regional Strategy

Practically, at the level of the newly democratized region, a realistic strategy must mobilize key social actors--- politicians, firms, economic planners, civic associations, business associations, labor organizations and higher educational institutions as well as the regional intelligencia---into a new alliance committed to deepening and upgrading regional economic and social development. Success should be measured by greater innovation, inter-firm linkages, higher income/skill levels and locating higher value added processes within their respective region. Most important, the coordination function must be addressed realistically. Contrary to neo-liberal dogma, the global-regional strategy has a strong role for public life and public agency. Here mobilized social capital translates into the establishment of a dynamic, pro-active, professionally competent, "developmentalist" regional planning agency (RPA). The latter must be armed with the expertise and temperament to recruit the right kind of global firms, the power to coordinate among actors as well as the authority to manage land and infrastructural planning. Typical patronage patterns will destroy the regional development agency before it leaves the starting gate.

While counter-intuitive at first glance, the micro-electronics or information revolution offers regional actors a surprising degree of autonomy. Despite the awesome level of institutionalized presidential power at Mexico's federal center, and the centralized structure of international firms, evidence from Southeast Asia (Mexico's alleged model) indicates that the most advanced international firm strategies---global-regional strategies---also allow a certain degree of flexible decentralization of certain functions such as sourcing, process innovation, product re-engineering and even design. This potential for innovation can sustain regional development initiatives under certain conditions. Bear in mind that the micro-electronics revolution allows the simultaneous exercise of *centralized* oversight via integrated data networks, video conferencing and "real time" monitoring systems and d*ecentralized* control and interaction among actors within dynamic global-regional centers. In turn, all actors are "wired" or linked to other similar production centers in any given industrial production network, i.e. computers, hard disk drives, software or e-commerce. What transforms regions and raises living standards in the new global economy is access to and integration within the new communication and production networks (Castells:1996).

Late-developers attempting "to catch" up so as to benefit from innovations originating in dynamic regions like Silicon Valley know that development agents must play an important role. Within this milieu, a competent, regional development agency's mission is one of "facilitating" rather than owning or coercing firm obedience. The objective is to guide the region's firms and workers up the global "value chain" and thus to capture higher skill, higher income and more

advanced technologies. Facilitating means the RDA must implement a vision that is capable of inserting local regional firms into the new globalized, productive networks. Participation in the network is vital because new technologies and innovative processes are knowledge-based occurring within very short innovation cycles. "Learning by doing requires knowledge of, and participation within global production networks. Unlike centrally administered Fordist industries (i.e. mining, steel or oil refineries), knowledge-based industries like micro-electronics and bio-technology are virtually impossible for the state to nationalize or coerce effectively. The decline in state sovereignty and democratic efficacy, on the other hand, is counter balanced by the new advantages available to regions who maximize global networks and communications systems. Thus it can be argued that the loss of state economic sovereignty associated with globalization can be recouped, to some degree, by enterprising regions integrated into global networks. The benefit or the "silver lining" of the informational dimension of globalization is that potentially dynamic regions now have the opportunity to maximize global information networks rather than remaining dependent on the rigid, centralized communications inefficiently controlled from the federal center.

Mobilizing social capital and regional comparative advantages means that the RDA must become pro-active: it must organize producer associations, integrate information in electronic directories for member firms and global-regional actors, establish higher educational-firm internships, rationalize credential and professional certification for workers, and, in general, coordinate the application of federal guidelines, licenses and incentives for firms at the state and regional level. It must facilitate technological deepening by using local access to Mexico's highly developed social networks so as to reduce bureaucratic delay at the federal ministerial level. While the agency varies, all production systems require "coordination" among firms, workers and institutions. For all the reasons discussed thus far, the moment has arrived for Mexico's newly democratized regions to implement regional development strategies guided by a facilitative, pro-active but focused RDA.

Regional Options: The Advantages of Global-Regional over Transnational Firms

As a resource for participating in world-quality innovative networks and fostering inter-firm linkages at the regional level, an ideal typical distinction was made earlier between global-regional firms and transnational firms. This distinction does not suggest corporations have abandoned the maximization of competitive self interest or express the reincarnation of "Mother Teresa". Instead, it's an argument about changes in "firm strategy" under global conditions, about how firms compete in new ways so as to maximize their organizational control over human resources and regional markets, and most of all, about how regional actors need to recruit the right international partner ---a global-regional firm ---so as to generate benefits for

workers, firms and social actors within a given region. In sum, the "firm strategy" perspective assumes that, under new global conditions, centrally administered firms have the latitude for more decentralized regional operations. Hence, globalization does not always yield apocalyptical outcomes. Doom narratives aside, the micro-electronics revolution and the use of flexible production systems operating in a wider global production network may combine to create opportunities for the regeneration of regional fortunes, social capital and an effective regional development strategy.

Let us consider the specific aspects of the new firm strategies. Global-regional firms compete by integrating telecommunications and computer technologies, decentralizing some operational decisions and even design of products to the subsidiary and even to the work group, and forming flexible relationships with regional firms and educational institutions (i.e. alliances, sub-contracting and joint ventures). Local institutions matter, for as innovators in a knowledge-based informational industry, such firms seek to develop reciprocal alliances with regional universities and professional-business associations. This is all in contrast with the transnational firm strategy which is vertically integrated, rigidly organized, largely based on intra-firm exchanges, has national-origin senior management, and centralized control of design and process innovation. To be sure, the global-regional strategy varies by sector and nationality, (i.e., autos or electronics, Japanese or American) or by management team over time and probably by phase of the business/product cycle. Nonetheless, the research discussed below confirms that some international firms in the high technology sector have deviated from the prototypical transnational firm strategy. Increasingly firms have embraced a more flexible, subcontractor based, regionally integrated, global-regional firm strategy that depends on production networks. In a nutshell, this divisional model combines centralized administration of finance, functional specialization and electronic monitoring of subsidiaries together with decentralized control of regional operations especially subcontracting and management of vendors.

A skeptic might ask, empirically, how one would recognize a change in firm strategy? Departures from the transnational strategy are evident when: firms formerly characterized by high intra-firm transactions and low degrees of sub-contracting, innovate by decentralizing decision-making processes or new productive initiatives down to the level of their subsidiaries; or when they encourage process and even product innovation such as design within the subsidiary as well as local firms; and when they treat world regions (Southeast Asia, North America, Latin America) and local regions (Penang, Silicon Valley, Guadalajara) as valued resources for recruiting global managers, absorbing local innovations and applying local insights so as to customize standard processes or products for regional markets. Driven by the desire to compete by maximizing collaboration and by diffusing innovation at all skill levels, the

advantage of the global local firm strategy, in contrast to the transnational firm strategy, for Mexico's emergent regions are myriad. The global-regional strategy institutionalizes both formal and informal networks to disseminate a culture of innovation among managers, engineers and technicians who shift among international firms, local suppliers and subcontracting firms.

Neither a panacea nor an effort to replace a nationalist utopia with a post-Fordist version, the global-regional framework is a modest effort to understand and cope with the hitherto inexorable march of that much feared beast, globalization. While cosmopolitan in insisting on global networks, it also recognizes the unique and indispensable contribution of local actors and local social capital. Finally, the global-regional strategy offers a new dimension of hope for some, but certainly not all, regional actors who are capable of mobilizing social capital and maximizing regional comparative advantages (Gordon and Lubeck: 1995).

Organization of the Argument

Having situated the potential of regional economic development strategies within the current moment of Mexican industrial development, the remainder of the paper moves to an empirical analysis of electronics production in two regions: Guadalajara, Mexico and Penang, Malaysia. First, Malaysia and Mexico are compared at a general level and Malaysia is described in detail so as to inform Mexican and North American readers. Not surprisingly, each region entered electronics production at a similar moment and even tried to recruit some of the same international firms. Penang, however, has been much more successful both because it articulated more closely with the global-regional development strategy and because it developed the regional institutional mechanism to maximize linkages and higher value added processes. After analyzing the reasons for Penang's relative success as a specialized manufacturer of electronic components and consumer goods, the paper assesses the origins, strengths and weaknesses of Guadalajara and offers recommendations for regional development strategies in Mexico. Application of this argument to other Mexican regions remains to be done.

Mexico and Malaysia as Aspiring NICs

The comparative method requires one to pay close attention to "similarities" and "differences" (Ragin: 1987). How then are Mexico and Malaysia similar and different? And what are the consequences of these similarities and differences? While Mexico and Malaysia possess radically differing histories, social structures, cultures and continental locations, the two countries do, nonetheless, share some similarities that mark them as promising "second tier" NICs. Chief among these similarities, is the fact that both are now committed to a strategy of

export-oriented industrialization. Table I presents a statistical comparison of two aspiring NICs.

TABLE 1 The Statistical Comparison of Mexico and Malaysia

Basic Indicators	**Mexico**	**Malaysia**
Population (millions mid-1995)	91.8	20.1
1995 Infant Mortality Rate (per 1000 live births)	33	12
GNP per capita (dollars- 1995)	3320	3890
GNP per capita avg. annual growth % (1985-95)	0.1	5.7
Avg. annual rate of inflation % (GDP deflator)	36.7	3.3
Average Annual Growth Rate of Production & Manufacturing (%)		
GDP (1980-90)	1.0	5.2
GDP (1990-95)	1.1	8.7
Industry (1980-90)	1.0	7.2
Industry (1990-95)	0.5	11.0
Services (1980-90)	1.1	4.2
Services (1990-95)	1.5	8.6
Changes in Distribution of Manufacturing Value Added (%)		
Machinery, Transport Equipment- 1970	NA	8 (a)
Machinery, Transport Equipment- 1992	25 (a)	34 (a)
Total Exports (million $)		
1980	15,600	13,000
1995	79,543	74,037
Percentage Share of Manufactures Exports		
1980	12	19
1993	75	65

Percentage Share of Machinery & Transport Exports

1970	11 (a)	2 (a)
1993	31 (a)	41 (a)

Average Annual Growth Rate of Goods and Services Exports (%)

1980-90	6.6	10.9
1990-95	6.8	14.4

Proportion of Exports by Sector to OECD Countries (%)

(1993) Elect. Machinery, Electronics	32.3 (a)	47.1 (a)
(1993) Transport Equipment	21.4 (a)	1.3 (a)

Source: World Bank World Development Report 1997. Except (a)- World Bank World Development Report 1995.

It is clear that Mexico and Malaysia have broadly similar industrial structures: that is, both have attracted highly capitalized, high tech, foreign investments in the auto and electronics industries respectively while, at the same time, maintaining traditional exports of hydrocarbons and agricultural commodities. During the mid-eighties, due to global recession, a decline in petroleum prices, external debt and overextended state sectors, the industrial policy of both shifted dramatically. Bowing to global forces each moved away from state-centered, import substitution industrialization (ISI) and toward export-oriented industrialization (EOI) guided by increasingly free trade regimes. At the same time, both states retained significant state sector investments in strategic industries (petroleum, steel, cement) and entered regional economic blocs (i.e., NAFTA, AFTA and ASEAN). And finally, both states have been long governed by semi-democratic, authoritarian political systems, dominated by single parties (PRI and UMNO), which have endeavored to control regional, class and ethnic cleavages by distributing patronage and monopoly rents to loyal clients.

Differences matter a great deal. Malaysia is divided ethnically among, first, a majority group of Muslim Malays who control the state, an entrepreneurial group, the Chinese (29%) who dominate business and a minority group of Indian-origin Tamils (10%). Unlike the model East Asian NICs (Japan, Korea, Taiwan and Singapore), where ethnic nationalism and Confucian administrative culture, tend to forge overlapping ties and alliances between economic and political elites, Malaysia's respective elites are divided by ethnicity and religion. For example, the ruling National Front is led by a Malay political party, UMNO, (United Malays National

Organization) which negotiates with Chinese and Indian parties to form a majority large enough to control amending the constitution. Hence, politics involves elite bargaining over the distribution of patronage resources, access to office and communal autonomy (i.e. Chinese education). A New Economic Policy (NEP) was introduced after interethnic rioting in 1969, a policy which has successfully redistributed income, employment and corporate equity to Malays.

If one examines state industrial policy since Prime Minister Mahathir assumed office in 1981 and initiated his "Look East policy", one discovers an eclectic blend of policy interventions rooted in Malaysia's social structural cleavages and effort to become a regional center of the export-oriented electronics industry. Building upon the NEP, Mahathir first initiated a state-sponsored auto, steel and cement industry partially based on the Korean model and an aggressive entrance by Malays into the financial sector. At the same time, he strengthened Malaysia's reliance on export-oriented industrialization, led by international electronics manufacturing mostly located in Free Trade Zones (FTZs) in virtual imitation of the Singaporean strategy. Penang is the most successful regional example of this strategy. And finally, as the success of the latter tightened labor markets and higher value added processes became feasible, Mahathir's industrial policy makers shifted to developing local technological capacity, upgrading SMIs and deepening interfirm linkages within Malaysia. Most importantly, "Vision 2020" is designed to raise the productivity of skilled and professional workers, so as to relieve the labor shortages and move manufacturing up the "value chain".

Like the mature Asian NICs, but unlike Mexico between 1970 and 1990, Malaysia aggressively implemented an economic growth with social equity policy as part of its industrial policy. In May, 1969 ethnic rioting by Malays against the Chinese forced the political elites to pursue an ethnic redistribution and restructuring policy----The New Economic Policy (NEP). Driven by Malay ethnic pressure, the NEP functioned as a redistribution mechanism that has preserved social peace so necessary for sustaining investment and economic growth. Fueled by the ethnic crisis and Malay nationalism, the NEP legitimated state intervention into all corners of Malaysia's economy and society. More importantly, the NEP reduced absolute levels of poverty from 49.3 percent to 15 percent by 1990. Among the Bumiputera (i.e., Malay) poverty was the highest at nearly two thirds of the population in 1970, but was reduced to 20.8 percent in Peninsular Malaysia by 1990 and has continued to fall to approximately 15 % today. Hence, analogous to land reform in Korea and Taiwan or the redistribution of land under Mexican president, Cardenas, the NEP successfully reduced peasant poverty, upgraded educational standards and, in effect, created a salaried middle and working class from the Malay peasantry. Viewed comparatively, the NEP represents a state-sponsored transformation of the Malay peasantry from agrarian to urban-industrial life without the serious conflict that so often accompanies this transition.

A second objective of the NEP was to restructure the ethnic division of labor such that ethnicity was no longer identified with occupation or sector. The government's 1991 evaluation of the NEP indicates that substantial progress was made by Malay state elites using trusts and other state agencies to restructure the ethnic division of labor. In practice the state provided well-positioned Malays with access to credit, employment quotas, contracting opportunities and innumerable other opportunities to become capitalists. The restructuring of corporate equity was a third objective of the NEP. This policy dealt more directly with the heart of peripheral capitalism and the ethnic division of labor. Best understood in the context of economic nationalism in the seventies throughout the world economy, the share of foreign owned equity declined from 63.3 percent to 25.1 percent of all equity holdings in Malaysia between 1970 and 1990. Turning to changes in the ethnic share of ethnic holdings, it is noteworthy that despite the lamentations of the Chinese population, and advocates of free competitive markets, the Chinese share of corporate equity actually increased from 32.3% to 46.2% between 1971-91; an increase of 43 in percentage terms and 6.2% above their original NEP target for equity holdings. The mostly Malay, Bumiputera (hereafter Bumi) share failed to meet the NEP target of 30%, reaching only 20.3%. Nonetheless this reflects a nearly tenfold increase from the 2.3% equity share Bumi's held in 1970. Moreover, if one adds the "nominee" share of equity, most likely belonging to the well-connected Malay political elite, the Bumi share rises to 29.1 %, a figure that nearly reaches the NEP's target for Bumis. However one interprets "rentier" accumulation represented by "nominee" equity, Malaysia's transfer of equity, poverty reduction and redistribution of income is extraordinary for an aspiring NIC. Comparatively, Malaysia's performance is far superior to Mexico's or that of Malaysia's Southeast Asian rival, Thailand. There the wealthiest 40 percent receive 77 percent of the income and the incidence of poverty was equal to Indonesia's, even though the per capita income was 2.5 times higher (FEER: 4 August 1994:38).

Malaysia: Industrial Growth, Firm Strategy and Linkages

Despite the rentier waste arising from state interventions on behalf of the Bumis, when Malaysia is compared to Mexico and or most other aspiring NICs, its economic and industrial performance is strong, even enviable. The real rate of GDP per capita growth was 4 percent/year between 1965-90; to put it an other way, this means that the GDP per capita grew from $ 281 in 1960 to over $ 4000 by 1997 (See Table 1). While endowed with abundant natural resources (oil, natural gas, timber, palm oil and rubber), the engine of growth driving the rise in per capita income was not agriculture nor energy, but manufactured goods produced in the export-oriented industrialization (EOI) sector. Though initially introduced to Malaysia through the first FTZ at Penang in 1972, merely to absorb surplus labor, electronics has mushroomed into Malaysia's

largest sector and source of export earnings. Functioning outside the control of the Malaysian state, the electronics sector numbers most of the world's largest and most technically advanced firms, competing on the cutting edge of innovation, now run by Malaysian engineers and managers. Indeed, the productivity and growth of the electronics sector has redefined Malaysia's industrial strategy as micro-electronically based and away from reliance on state-led autos and heavy industry.

Representing just 8.6 percent of GDP in 1960, manufacturing more than tripled by 1992 to 26.8 percent of GDP (Bruton:1992). Even more remarkable was the growth of manufactured exports: gross export revenues from manufacturing grew at an average of 24.1 percent/year between 1971-92. The share of manufacturing exports in total merchandise exports rose rapidly from 11.9% in 1970 to 68.5% in 1992, probably surpassing 70% in 1993 (EIU:No.1:1994:28). Nor is the rise in manufactures solely located in Free Trade Zones (FTZs). While EOI began in the FTZs in 1972, the FTZ's share of manufactured exports has declined to about 40% in 1989, down from 70% in 1980 (World Bank:1993:135). All of which illustrates how manufacturing linkages have moved beyond the enclaves of the FTZ and diffused within Malaysia's industrial economy as a whole. The main obstacle to growth is the shortages of manufacturing labor at all skill levels, leading to the recruitment of two to three million foreign workers in a labor force under 10 million. Rising family income and educational opportunity means former female recruits to manufacturing are now able to remain in school longer which, coupled with service sector opportunities and the surge in manufacturing, has created a labor shortage. Poor planning for human resources is forcing Malaysia's rush to upgrade skill, technology and value added in the electronics sector while, at the same time, not discouraging international firm investment. Since the early 1990s, state industrial policy has subsidized on site training by manufactures, encouraged vendor schemes and rewarded firms with incentives if they used 30% local content.

Penang: Regional Initiative and International Firm Strategy

In contrast to Korea and Taiwan, Singapore's assent to an East Asian NIC relied on servicing international firms and then absorbing knowledge, technology and capital from participation in global production networks. Within Malaysia and Southeast Asia, Penang is the premier example of a regional government that imitated the Singaporean strategy. Seizing the initiative, Penang constructed an alliance of regional actors and institutionalized a regional development agency (The Penang Development Corporation or PDC) to spearhead their regional development strategy. After the ethnic crisis of 1969, the chief minister of Penang State, Lim Chong Eu, forged an alliance with UMNO, one that brought his Gerakan party into the National Front at the federal level while, at the same time, allowing Lim to exercise relative autonomy in developing a regional development strategy for Penang. As a former Straits

Settlement, Penang has been integrated into the international economy at least since the 18th century, but by 1970 was in recession because of the loss of its' status as a free port. Unemployment was estimated at 17-18 % in 1972 when Lim established Malaysia's first Free Trade Zone Industrial Estate at Bayan Lapas. Given the ethnic crisis of 1969, absorbing surplus labor was his main objective in establishing a FTZ. Regionally, Fairchild Semiconductor had established a transistor assembly plant in Hong Kong by 1961 (Henderson: 1989). Drawing upon his knowledge of Hong Kong and Singapore's experience with electronics and free trade zones, largely gleaned from the social capital of overseas Chinese business networks, Lim visited Silicon Valley electronics firms in order to recruit them to his new FTZ. By the end of 1978, four of Malaysia's ten FTZs were in Penang State.

During this embryonic phase, Lim's leadership was pivotal. His skillful alliance with the federal center allowed him the space to build upon his control of the Penang state government. Penangites have a reputation for independence, for industry and commercial acumen and for responding to opportunities. As a participant in the overseas Chinese business network, Penang was rich in associational life, networks and business associations. It also had an industrial infrastructure of small-scale industries that serviced the port and the tin industry. Lim drew from this stock of social and industrial capital, convinced Penangites of the possibility of regional transformation and constantly promoted Penang as a dynamic center for international firms to locate to. Counter-intuitively, the effect of the NEP, an affirmative action program for the Malays, was to heighten the competitiveness and social solidarity of the Chinese in Penang across dialect groups. With Malay ethnic nationalism restructuring public institutions and equity markets, many Chinese felt that they were "on their own" and thus had to become more competitive, more open to global opportunities and less reliant on state employment.

The Model Regional Development Agency: The PDC as Facilitator

At the time of the formation of the PDC, each of Malaysia's 13 states also possessed a state economic development corporation. Most were inactive or functioned as agencies for rentier land speculation by political elites. Lim's innovation was to develop the Penang State Development Corporation (PDC) into a developmentalist agency that extended, rationalized and planned for the expansion of the electronics industry in Penang. To be sure, other industries such as textiles, plastics and metal working were recruited as well, but Penang's soon specialized in final stage processing, assembly and testing of semi-conductor components. Growth was quite rapid. By 1974, Motorola alone employed 8000 workers at Penang (Data-Chaudhuri:1984).

Total employment in the Malaysian electronics industry grew from 2764 in 1972 to 21,106 in 1973 and then to 70,658 in 1981 (Abdul Aziz: 1989).

Acting as an ideal regional development agency (RDA), the PDC purchased land, developed the industrial infrastructure, built factories, commissioned or arranged workers housing and assisted in the recruitment and training of labor. Currently, it conducts labor market surveys, publishes firm and industrial directories, informative newsletters and long term plans, promotes local producers at exhibitions and, in every possible way, actively plans the upgrading of Penang's firms and workers in the value chain. When shortages of skilled labor became a problem in the late eighties, the PDC spearheaded the formation of the Penang Skills Development Center which works with firms to train labor, upgrade technology among the SMIs and provides a world class credential program for skilling workers. New industrial techniques are diffused among supplier firms via the PSDC, and the leading global-regional firms such as Motorola and Intel strongly support the functions of the PSDC.

Part of the civic culture institutionalized by the staff of the PDC is an ethic of cooperation and common promotion of Penang as a specialized regional development center for electronics. When a Korean group endeavored to construct an enclave, their investment was rejected. It is important to stress that because the PDC controls land, plans infrastructure and actively recruits new firms according to priorities established in their public plan, international firms are confident about locating their production at Penang. Furthermore the PDC has consistently added innovations and responsibilities that include a technoplex, a Penang industrial council, producer associations and shopping, residential and housing development.

Global Production Networks: Assessing Local Gains from Global-Regional Firms

Beginning as a off-shore assembler of simple electronic and audio devices, with an unemployment rate of about 16% (1971) Penang soon became a major center for IC assembly, packaging, and testing for Japanese (Hitachi), American (Intel, AMD, HP, Motorola, National Semiconductor) and European (Siemens, Alcatel) international electronics firms. Both Penang's reputation for high quality, English speaking labor and the coordinating expertise of the PDC, brought sub-sectors of the electronics industry to Penang (Narayanan et al: 1989). Now hard disk drive (HDD) assembly (Seagate), heads for HDD (Read-Rite), media for HDD (Komag), telecommunications equipment, printed circuit boards, high end entertainment players and PCs are assembled at Penang (Dell, Packard-Bell). Virtually all of the components for a PC are now produced at some stage in Penang. Though delayed by the Southeast Asian financial crisis, IC fabrication plants are being built on the mainland at the adjacent federal science and technology city of Kulim. Over time, the international firms have taken advantage of the pool of

highly skilled technical labor and introduced more complex production processes including the design of semi-conductors, mobile radio telephones and other electronic devices.

Turning to the questions of local technical capacity and capital deepening, how does the recruitment of cutting edge firms that pursue a global-regional firm strategy benefit Penang's, workers, SMIs and contribute to the transformation of Penang as a specialized regional electronics center? The latter desire the highest value added process, the highest skilled work and the most advanced technological processes to locate in their region. Once integrated, a regional center becomes a unit in a competitive network of corporate subsidiaries and related firms.

Let us examine the effect of Penang's most technically advanced and highest value added firms: the IC component assemblers --- Intel, National Semi-Conductor, AMD and Hitachi. Even though the majority of the value added occurs in the design, masking and wafer fabrication stage, global-regional firms use integrated production systems, common industrial relations systems and encourage innovation at all levels of their production networks. Competition and innovation require capital and technical deepening, even if they began as labor intensive transistor assemblers. Accordingly, to maintain world quality production processes across different nodes in their production networks, engineers, managers, technicians and some technicians/operators receive a standard of training and certification that is firm wide, i.e. global skilling and credentialing. They also have access to the firm's technical support centers and electronic network-based support. Knowledge of process technology i.e. cutting, assembling, packaging and testing Pentium II micro-processors, and elements of the more innovative product technology, i.e. design, masking and production of IC devices, constitutes a massive, non-pecuniary transfer of knowledge-capital into the workers of Penang. Integration into a global-regional production network means that workers can and do spin off supporting and competitive firms because the knowledge and practical expertise has value independent of their relationship with the original firm. Even if innovation remains largely under the control of the international firm, the global-regional firm's preference for local managers and managing directors diffuses the technology and organizational knowledge throughout the regional economy as managers, engineers and technicians move from firm to firm.

Since competition in the micro-electronics industry is innovation-driven, productivity gains are extraordinarily high as measured by the declining price of more powerful PCs, memory and computing in general. First, the ability to put more transistors on a given space and to create faster micro-processors relies on miniaturization. The latter process eliminates the needs for large numbers of unskilled workers using microscopes for inspection or wire bonding of dies to lead frames. Miniaturization forced the invention of automated machines, programmed by

floppy disks, which now bond wires and inspects chips far more accurately than what women using scopes used to do formerly. Capital deepening, automation and miniaturization of the transistor means that Penang's workforce acquires greater skill levels due to the technical complexity of the automated production program and associated training embedded in flexible production systems. Secondly, automated, programmable production processes means that the proportion of workers with higher skills rises among the IC firms as the technical labor ratio rises, i.e. the proportion of the labor force that are technicians, managers or engineers. Intel, for example, reports employing the same number of workers in 1994 to produce four times the number of chips that it did in 1984, but further claims that the ratio of engineers to workers has increased from one engineer to 40 direct workers to one engineer for six direct workers during the same period, i.e. a shift from 40:1 to 6:1 (Wall Street Journal:30 September 94:1). In a nutshell, in order to produce world quality products in a multi-layered network of high tech firms, Penang's global-regional firms were forced to invest in their labor forces in order to maintain a global standard of quality. Regions within these networks benefit accordingly, regardless of wage differentials among the units.

Networks, Innovation, Technical Deepening and Decentralized Management

In the case of Intel, easily Penang's most prestigious and innovative global-regional firm, one observes how the space created by decentralized management practices and the energy contained within Penang's regional identity combined to burst barriers to technical innovation in this regional center. This is a long and complex story, the subject of a forthcoming book, that can only be summarized here. Unlike the Japanese firms that use vertically integrated administration, Japanese higher management and keiretsu-based supplier networks, i.e. the transnational firm strategy, most American semi-conductor firms promote from within their Malaysian management pool so that the managing directors of many firms are Malaysian. The Intel case provides a clear example of the space available for local managers of global-regional firms to diffuse technology to the benefit of firm and region.

Under the leadership of a visionary Malaysian managing director, who had spent time in Taiwan, Intel "fostered" a web of linkage and subcontracting relationships with local firms. Intel (but also other firms) nurtured machining and tool firms, sponsored computer machine assemblers, seconded engineers to assist local firms, while spun off subcontracting assembly firms absorb Intel managers and retain customers desiring lower end products. The director worked with the PDC and other local IC managers to nurture ancillary, supplier and subcontracting firms in metal working, plastics and machine tooling industries. These supplier and service firms have deepened their use of CAD/CAM technologies and some have plants in states within Southeast Asia. One has even founded a school for tool and die makers.

Rasiah's work on Penang in the 1970s and 1980s explains how rapid technical innovation in the global electronics industry as a whole forced the international IC firms to introduce flexible production systems of manufacturing (i.e., JIT, SPC, quality circles, cellular worksite, TQM, constant improvement as well as computer controlled and automated machinery). Much of this global quality innovation was absorbed by the leading machine tool and die, stamping, grinding and assorted metal working firms in the Penang region. Though no thorough enumeration exists, there are now four distinct levels in the metal working industries from the backyard shop with one machine to the international standard producers who employ CAD/CAM and CNC technologies. Several of the strongest firms now produce and assembly metal components for the HDD firms as well as machinery used in Penang's factories (Rasiah: 1995). Plastic technology firms, metal plating and other ancillary industries lag the more innovative tooling and die and metal working industries, but they are upgrading and entering subassembly as well. Because of rapid rates of specialization and differentiation among SMI firms and ease of entry at the bottom rung of the industry, the exact number of SMI firms is unknown. If one includes the backyard shops, they number in the thousands.

At this stage, the major constraint on Penang's expansion and technical deepening is neither capital nor opportunity, but virtually all categories of skilled and unskilled labor. Engineers are recruited from Bangalore India; operators from Indonesia, Philippines and Bangladesh. Recall that the original rationale for encouraging the electronics industry to locate in Penang was to absorb labor when the unemployment rate was over 16 percent. But now unemployment of locals is virtually unknown and tens of thousands of foreign workers must be recruited from abroad in order to meet production demands. While the labor shortage pressures firms toward technical deepening and discourages unskilled labor intensive firms, it also reduces the labor supply for local SMIs who must compete with the international firms.

Downstream Innovation

Seeking to develop downstream linkages, the visionary managing director of Intel invested the funds of the workers' credit union/cooperative to finance a printed circuit board assembly firm, an OEM audio manufacturing house and a subcontracting chip assembly and testing firm. Acting as the "godfather" of Penang's indigenous electronics industry, the visionary managing director rose to become an international vice president at Intel while transferring technology, sponsoring local firms and encouraging process and product innovation. His former subordinates now manage many of Penang's best electronics firms. The latter reported excitement, gratitude and awe of their mentor. Indeed, a taped group interview is easily mistaken for alumni gathering among graduates from an elite university discussing the "good old days" with their mentor. In this example, one observes how business networks, social

capital mobilization and global-regional networks combined to produce a dynamic, specialized regional production center.

Clearly, while other firms contributed to the development of ancillary and supporting industries, a list that includes plastic injection molding, packaging, PCBA firms and component subassemblers, Intel's impact on Penang's development can not be understated. By 1990 Penang had emerged as a competitor for Singapore's lower end and some higher end manufacturing activities. The disk drive industry is a case in point. And, of course, this pool of knowledge workers and supplier firms has attracted more technically sophisticated producers like the hard disk maker, Komag as well as the American computer maker Dell. To quote a PC assembler: "all of our suppliers are here so it makes sense for us to be in Penang". The visionary project of the former Intel manager was to locate all the necessary producers of high level computing in Penang and then to integrate local producers as much as possible. Table 2 describes the place of the electronics industry in Penang's manufacturing profile.

Table 2 The Growth of Electronics Employment and Companies in Penang

Employment in Penang									
	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1**
IC Sector	14056	17639	17889	21064	23274	22126	17682	16333	16
Electronics Sector	24330	28262	31802	43458	43988	64216	79455	91831	101
Penang Totals	54854	62076	64997	79974	82026	112323	146382	162363	177
Number of Companies in Penang									
	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1**
IC Sector	11	11	14	19	18	19	46	39	
Electronics Sector	36	35	37	58	52	77	139	144	
Penang Totals	279	281	213	219	217	281	630	638	

Source: Penang Development Corporation Annual Surveys; 1986-1994

Designing ICs: Technical Deepening and Regional Social Capital

Space limitations force a summary of the shift to designing and masking ICs at Intel. In the early nineties, under the leadership of the visionary general manager, Intel Penang's senior managers negotiated along with the Japanese, Arizona and Santa Clara business units to move the design, masking and business management of 8 and 16 bit micro-controllers to Penang. Descriptions of these negotiations, whereby Penang managers went to Chandler, Arizona to manage the shift of the design unit, convey an unmistakable regional pride, an expression of regional social capital albeit spun through the language of cyber-networks. The new design center also provided technical services to the Arizona subsidiary, a reversal of the conventional skill hierarchy. Why did Intel shift the world business center and design center for these commodity-level devices? The answer seems to be because so much of consumer electronics production is now already located in the world-region of Southeast Asia, coupled with the desire of designers to remain close to regional customers who use micro-controllers in their audio, video, appliance and auto products. Subsequently, the design center has moved on to designing chip sets and devices integral to Intel's microprocessor units. Additional IC firms have initiated design at Penang. This is an undisputed vote of confidence. The design engineers working at Intel Penang will sooner or later spin off design houses just as engineers have done in Singapore, Taiwan and Silicon Valley. Design will become increasingly important in Penang as the labor market tightens, salaries rise and design capacities become routinized in the workforce.

To summarize, Penang's success as a booming regional electronics center, employing over 100,000 electronics workers, rests upon the interaction of several distinct factors quite common within the contemporary world economy: (1) a distinct regional resource for creating cooperative networks and joint ventures based on, distinct socio-cultural identities (Penangites, and/or Hokkien Chinese networks), and thus establishing a foundation for trust based innovations such as joint ventures and downstream assembly funded by civic associations such as the Chinese Chamber of Commerce. (2) the pro-active dynamism of the managers and planners at the PDC, who constructed their vision by negotiating with foreign investors and encouraging linkage among international firms and local producers; (3) the strategies of international firms (mostly American and European) who favored the promotion of locals as managing directors, invested in local linkages and sought to maximize the regional innovative capacity of Penang as a whole; and (4) the concomitant response of Penang's small scale industrialists and supporting firms who seized the opportunities offered by the decentralized, subcontracting, JIT-oriented international firms.

Mexican Electronics from ISI to NAFTA: Shifting National Industrial Policies

The case of Mexico, in contrast to Malaysia, consists of radical shifts in national policy and missed opportunities for economic and social linkages at the regional level. Economic policies, rather than stemming from consistent long-term development plans that recognize the opportunities posed by micro-electronics, local SMI linkages and globalization, have tended to ricochet from crisis to crisis. Policies have often offered disincentives to the very opportunities that Malaysia has developed over time, limiting the electronics industry in Mexico to FDI created employment, little to no local knowledge transfer and few linkages to local firms. Warman, an authority on the Mexican electronics industry, stresses the long term effect exerted by dualism which emerged, quite early, between low tech, protected, ISI-oriented consumer sector and the high tech, international, export-oriented sector. Weak linkages between sectors would haunt Mexico when the national market was opened to international competition (Warman: 1994: 398-399). National electronics policy, by focusing almost exclusively on the short term needs of employment generation and balance of payments difficulties of the late 1960's, failed to promote the exports of local electronics firms or establish them as reliable and competitive suppliers to exporting transnational firms. Throughout the 1970's, companies continued to arrive seeking low cost labor and attracted by government incentives, but the industry remained an enclave with no local linkages. Warman states that "...the country closed itself to technological change instead of opening itself progressively..., and it was it precisely at this moment that the 'Eastern Tigers' began to differentiate themselves, since they understood technology as a central element of change" (1994:401). Unfortunately, from approximately 1973 onward, the lack of local linkages to the high-tech transnationals, the stagnant, nature of ISI development and the rigidity of the political economic system overdetermined the backward character of Mexico's electronics industry. The latter policies created no incentive for innovation, either in product innovation or production process innovation, and instead created bureaucratic obstacles when opportunities for innovation arose. Nonetheless, stagnation did not dampen demand from the upper income groups. Indeed, the Mexico's internal demand for high quality, high value added imports created tremendous pressure on Mexico's current account balance and foreign exchange reserves. Even in the area of basic consumer electronics, the lack of linkages and innovations proved fatal. It is estimated that in 1980, approximately 50% of the color televisions in the country were contraband, while 90% of black and white televisions were produced locally, and that 40% of radios and cassette recorders were contraband, while 100% of older models were nationally produced (Warman:1944:401).

Recognizing this problem by the early eighties, the federal Ministry of Commerce and Industrial Development (SECOFI) tried to force linkages in electronics between export-oriented international firms and local producers for the internal market. The *Programa de Fabricación*

de Computadoras sought to establish domestic content guidelines for all aspects of the computer industry, as well as fixing levels of revenues to be spent on local research and development. However, according to Warman, it was "a case of too little, too late" (1994:402). With the onset of the debt crisis of 1982, the crushing pressures exerted by the balance of payments deficit forced Mexico to open to international markets and global competition. By 1985, macro-economic policy eliminated the pursuit of R&D or linkage development, in order to pursue employment generation and export promotion (Borja: 1992: 85).

In 1985, another shift in industrial policy abrogated even the modest initial goals of the Computer Fabrication Program. First, 100% ownership was granted (up from 49%) to foreign transnationals who promised to meet export targets. In Guadalajara, Hewlett Packard and IBM benefited from the liberalization of ownership rules. Second, the government liberalized the import of parts and components, while maintaining control over the import of final assembled products. This created a network of final assemblers of computer systems selling to the domestic market using foreign components (Borja:1992:86-87). Thirdly, in order to service its external debt and maintain an export surplus, the federal government agreed to pay financial incentives by returning import taxes to exporting firms; this return reached 20 million dollars in 1993 (Warman:1994: 405). This shift, driven by external debt, is similar to the export promotion scheme for the auto industry as analyzed by Bennett and Sharpe . Briefly, foreign auto firms were "required to compensate their imports with exports" and to insure that new car models "would be self-sufficient in foreign exchange" (Bennett and Sharpe:1985:274). Furthermore, interviews with supplier firms of IBM-Guadalajara indicate a similar arrangement was brokered for IBM Mexico. In exchange for the foreign exchange costs of imported IBM mainframes, mostly to government and corporate centers in Mexico City, IBM-Guadalajara was authorized to import components as long as exports also covered the foreign exchange cost of IBM's mainframe imports.

Of course, the fiscal crisis, the export-promotion program and the liberalized economic policies forced SECOFI to reconsider its computer promotion program. For example, in the early 1980's, several computer manufacturers were denied import licenses if they failed to use a locally produced disk drive. But, lacking linkages and international quality standards, the poor quality of the drive threatened the competitive position of the final assembly computer firms. "This experience and other similar ones made government officials increasingly reluctant to come to bat for local components producers. Today, firms do not integrate if the cost and quality are not at international standards."(Warman and Miller:1988:37-38).

When industrial policy shifts radically in response to macro-economic mismanagement and external shocks, the coordination of sectors, linkages, human resources and industrial policy in

general falters. Warman correctly diagnosed the challenge for electronics in Mexico: "This price is political will, the capacity to concentrate public, industrial, financial and academic interest in an investment plan that is essentially long term (10 to 20 years) and transcends six year plans. It is not clear, although desirable, that Mexico will be able to do it" (Warman:1994:422). It is also clear that neither Mexico's state-centered nor neo-liberal policy prescriptions grasp the heart of the problem. Both are guilty of " 1) negligence in respect to technology, 2) concentration on the short term (the exact opposite of Korea, Taiwan and Singapore), and 3) believing that, once the process is initiated, market forces will condition the structure of productive groups" (Warman:1994:421).

Regarding the obstacles facing Mexico's small and intermediate industries and other ancillary industries that constitute linkage development, Warman's assessment of the limits of capital, infrastructure and technological remains prescient and valid today. First, there is a lack of venture capital and knowledge in financial circles of technology and industrial operations. "No project of intermediate or adapted technology is able to compete if the financial costs of the Mexican system are included" (Warman:1994:416-418)." Second, there are multiple infrastructure limitations, including a) land transport, both in cost and reliability, b) telecommunications, in cost and availability, and c) government procedure, both customs and fiscal, due to direct risks and corruption. The large transnational companies contain the resources to overcome these problems, but the small and median companies do not. A government audit or a shipment stopped in a port for a month can cripple beyond repair a small company. Thirdly, there are limits to each of the technology based development scenarios: A) Supply the world market through large transnational companies. This is the example of Taiwan and Singapore. But this means improved process technologies and quality control, which are the largest gaps for local producers. These entail coordinated efforts and not merely a reliance on market forces. B) Participate with new products on the world market. In a growing fragmented market such as electronics, where the investment cost to enter is still low, there are plenty of opportunities for new companies (Warman:1994:416-418). However, in all cases, whether state-centered or neo-liberal, coordinating institutions are indispensable for transforming Mexico's electronics industry and overcoming each of these structural limitations, both individually and collectively.

Before turning to Guadalajara as a regional center, let us summarize what is widely known about industrial policy under debt pressure in the eighties and nineties. Nationally, a bevy of export-promotion and assembly programs were promulgated which, while realizing the objectives of the maquiladora program, (i.e. employment and foreign exchange earnings), severely neglected the promotion and coordination of local linkages, technological deepening and higher valued added processes. Between 1988 and 1994, two liberalization policies--- ALTEX

and PITEX---not only eased custom crossings, reduced taxes by 100% for components and final products for export, but even allowed increased sales within the national customs area (Partida:1994:29). The federal government's mismanagement of macro-economic policy, i.e. the 1994-95 foreign exchange crisis, peso devaluation and deep recession, not only eliminated credit for linkage industries, but destroyed the initiative of small and medium-scale industrialists: financial survival required aversion to risk and innovation. After a battering by global competition, federal financial mismanagement and a loss of confidence in the feasibility of the "national economic project", Mexico's once powerful industrial planners were forced to accept the termination of nearly 50 years of innovative Mexican industrial policy, now symbolized by NAFTA. By 2009, when virtually all tariffs will be eliminated between Mexico and the USA, industrial policy makers will lack tariff protection, an indispensable lever for integrating a national electronics industry with global production processes.

Situating Guadalajara in the Mexican Electronics Industry

The electronics industry, despite the structural disarticulation described by Warman, is still one of Mexico's most dynamic, growing "at a faster rate, 6.9 percent, than any other manufacturing sector and even faster than the overall economy in the period 1986-91" according to a Bancomer survey. Yet "it accounts for only three percent of Mexico's manufacturing output." (Electronic News:1997:4) Most electronics consist of maquiladora assembly operations, while a few supply the automobile industry. But at least three firms fabricate or assemble semiconductors: Motorola fabs thyristors and assembles ICs at Guadalajara; Texas Instruments, with two plants, fabs and assembles at Aguascalientes; and Rockwell fabs and assembles at Mexicali (Electronic News: 1997:2, WSJ:7.9.98:A15). Within central Mexico, both the PRI and more recently elected (1995) PAN state administrations have hyped Guadalajara as the "Silicon Valley" of Mexico.

This claim rests upon the successful recruitment of many of the world's leading electronics firms to Guadalajara. Over the past 30 years, these firms include: Motorola, Unisys, Siemens, General Instrument-CP Clare, IBM, Hewlett-Packard, Wang, Tandem, Kodak, NEC, ATT-Lucent-Philips, Shizuki, Telectra, Mitel, Molex, SCI Systems, Solectron, Nat-Steel and Jabil. Local joint ventures and partners also emerged but their growth was stymied by macro-economic financial crises, credit crunches and the loss of protection due to NAFTA. Nonetheless, Guadalajara does have a significant industrial base in electronics and many regional advantages whose potential is hitherto unrealized.

Like Penang, Guadalajara is Mexico's second largest urban agglomeration, now approximately 3 million residents; it is also the capital of the State of Jalisco, the most important state of west-central Mexico. In terms of regional culture, Jalisco is renown for being

the most "Mexican" of all the regions in the nation, having given the world tequila, mariachi music and the 'Charro'. And while it is over one thousand miles from the US border, it has an international airport with links to all regions of the US, and major rail and freeway connections to the Pacific coast, US-Mexico border and Mexico City. With a total of 16 universities, Guadalajara has one of the top public universities as well as two of the outstanding private universities in the nation. Functioning as the regional commercial and industrial center of Western Mexico, its networks extend throughout the full length of the northern Pacific coastline, stretching from Tiajuana and Nogales in the north to Michoacan in the south. For Western Mexico, therefore, Guadalajara forms the commercial and industrial core, the heartland of a distinct regional cultural identity ("*los tapatios*") and the region chosen by central government industrial policy to be the Silicon Valley of Mexico.

Historically Mexico's corporate-authoritarian political institutions generated state centralization, assured the return of PRI administrations in Jalisco and, as a result of the latter, industrial planning initiatives flowed from the federal center. This is an important difference between our two case studies. Unlike Penang, where a regional Chinese-based political party mobilized local business networks and created a regional development agency (the PDC), Guadalajara's electronics industry was federally promoted industry in the region. Prior to promotion from the PRI-controlled federal center, electronics production began as a backward linkage to supply commercial networks in the regional market. In the late 1950's and early 60's, under Import Substitution Industrialization (ISI), a basic consumer electronics industry emerged in which local firms mainly produced radios and black and white televisions. "The first electronics companies in Guadalajara didn't have any connection to the international market, were small establishments, with local capital and local family or institutional structures, dedicated to the satisfaction of the local market" (Partida: 1994:24). While some of these firms (i.e. Electronica Zonda) would later attempt the transition to international or competitive markets, none of the local firms would play a direct role in the development of more advanced electronics production in Guadalajara.

Under "deep" import substitution industrialization, implemented at the end of the 1960's and beginning of the 1970's, large transnational companies began producing in Guadalajara for consumers and industry, in particular Telmex. Both Burroughs and Motorola (1968) responded to national incentives for export promotion, (i.e. the *Programa de Importación Temporal para la Exportación*). This program, better known as the policy that established the maquiladora industry, was limited to the border region at the time, and as such required Federal exemptions for both companies to operate under its provisions in the interior of Mexico. What was an exemption in 1968, became national policy as the export program was extended to the entire country in 1972 (Palacios: 1992: page: 11-12). Most electronics transnationals located in

Guadalajara after this extension: General Instrument arriving in 1974, IBM in 1975 and most others in the 1980's. Again, because of the highly centralized PRI controlled Jalisco State administration, and unlike Penang, local-regional actors took little initiative in shaping Guadalajara's electronics industry.

Fiscal incentives, distributed by the national government, also became essential to attracting foreign direct investment to Guadalajara. For example in 1969, three companies (Burroughs, Motorola, Industria Fotográfica Mexicana (Kodak)) were all granted ten year exceptions on the payment of any taxes. The tax incentive scheme of 1970-71 provide a clear illustration of how national policy incentives shaped regional development when the PRI ruled and distributed patronage in Jalisco. In 1971-72, through Presidential decree, special tax allowances were created in three specific zones: Guadalajara as zone 1, Tlaquepaque and Zapopan (suburbs of Guadalajara) as zone 2 and the rest of the country as zone 3. Each zone had as a minimum a 50% and up to 100% tax allowance on machinery, land, imported inputs, rent and capital goods, with the highest allowances being in zone 2 where today the majority of foreign electronics firms are located (Partida:1994: 27-28). At the same time, however important special tax allowances were in attracting international electronics firms, Guadalajara's comparatively high quality labor and low wages also attracted foreign investment. "In the case of Jalisco, we are speaking not only of cheap and abundant labor, but also of the characteristic of labor tranquillity, due to the efficient work of the labor bureaucracy through its two principle organizations, the CROC (*Confederación Revolucionario de Obreros y Campesinos*) and the FTJ (*Federación de Trabajadores de Jalisco*) (Medina and Rosales:1992:108). Not only is labor inexpensive, cooperative and abundant, it is also educated: Jalisco has a 90% literacy rate (US/Mexico Business: July/August,1998:47). All of these factors combined provide a strong environment for export oriented direct investment, even if they do not, in and of themselves, lead to a broader set of linkages that can signal a regional production network.

Global-Regional Firms in Guadalajara: Assessing Linkages and Local Capacity

While the gyrations of Mexico's macro-economic policies explain to some degree why Guadalajara's electronics industry has failed to fulfill expectations, it was not because international firms pursuing a global-regional strategy did not invest there. In fact, though lagging Penang now, Motorola invested in Guadalajara (1968) at least six years before Penang began assembling electronics products. Indeed, Motorola, IBM, Hewlett-Packard and ATT are ideal-typical examples of global-regional firms, so the differences with Penang can not be explained by the internal organization of the international firms. The problem, therefore, is to

explain what factors prevented Guadalajara from taking maximum advantage of the potential opportunities for linkages offered by the business strategies of global-regional firms.

If one examines training, quality control and human resource practices, the evidence indicates that the major international firms follow the same practices observed at Penang. Just in time (JIT) production methods are used in most of the companies in Guadalajara. IBM and Hewlett Packard use both internal and external JIT systems. Other manufactures (ATT, Motorola, Adetec, Pantera, C.P. Claire) run JIT systems on an internal bases with supplies from the United States and Asia. All companies use Statistical Process Control in terms of quality control. Total Quality Control (TQC) is not generally used given the lack of local sourcing of inputs (Partida:1994:31-33). Furthermore, work teams and quality circles are present in virtually all international companies. According to field researchers, from 1986 on, the industry began to restructure around "a new type of worker with a modern profile of a flexible worker that contained the following features: 1) the realization of a complete, variable and flexible job capable of responding to the most complex functions of conception, precision and foresight that the new computerized systems of production demanded, 2) formal levels of qualification, 3) two level salaries, fixed and according to performance (individual and collective), and 4) the development of a participative and active worker culture" (Partida:1994:26-27). The authors' field work confirms Partida's observations.

Global-regional firms are eager to extend their networks in the region by articulating with universities. According to the spokesperson at Hewlett-Packard "One reason we are in Guadalajara is because we have strong ties to the university there. It has a very good program" (Electronic News: 1997:2). Indeed, perhaps being more effective in upgrading education than in actual technology transfer or R&D, Hewlett Packard, IBM and Wang computers were essential in the bringing of a Masters program in Semiconductors and Integrated Circuits from Stanford University to the Autonomous University of Guadalajara. IBM, in conjunction with the National Polytechnic Institute, created the *Centro de Tecnología de Semiconductor* (the Center of Semiconductor Technology) in order to have a local semiconductor design center for IBM and its clients. The center has been successful, but all final manufacturing is done in the United States, because the production technology can not be sustained in Mexico (Ocampo:1993:41-42).

Motorola: The First Global-Regional Firm

As the only firm that combines fabrication of thyristors, a low tech semiconductor, and the assembly of more advanced ICs, Motorola merits serious attention. If the reader were to visit the factory lobby in 1995-6, one might be puzzled by the national flags attached to the silicon wafers in the display cases. The flags designate customers and rival semiconductor production sites within Motorola. The red and white flags were Malaysian, as was the general manager of

factory, Mr. Kanapathi. After entering Motorola as a line supervisor at a sister plant in Malaysia, Kanapathi received extensive training within Motorola, rising to become a factory manager in Malaysia, Philippines and now Guadalajara. His career provides additional evidence for the integration of firm networks in the electronics industry. Most important, his career illustrates how global-regional firms recruit managers from regional sites for local as well as other international positions, rather than recruit solely from the headquarters country as most vertically integrated companies tend to do. The key difference lies in the global-regional firm's effort to innovate within regions by reaching out to regional actors, decentralizing some decision making, empowering local managers and developing linkages among local firms via sub-contracting arrangements. Recall that the global-regional model combines centralized administration of finance, functional specialization and electronic monitoring of subsidiaries, together with decentralized control of regional operations, especially subcontracting and management of vendors.

Although she does not use the term, Patricia Wilson's study of maquiladoras in Guadalajara aptly describes Motorola as a firm pursuing a global-regional strategy (Wilson: 1992). Motorola began in 1969, employed 2440 production workers by 1988 of whom 70 % are female, and is clearly a post-fordist, flexible producer of fabricated wafers. That is, Motorola employs statistical process control (SPC), computer controlled machinery, just in time inventory control (JIT), continuous quality control and global quality worker programs: multi-skilling, quality circles, semi-autonomous cells and preventive maintenance of machinery. As a wafer fabricator, Motorola's backward product linkages are limited to buying industrial gases from a local producer (Union Carbide). However, Motorola has used several local productive services: tool and die, metal stamping, plastic molding, and metal plating. It helped create some of these local service providers, brought in a very high tech Japanese metal plating firm, and developed a very high quality tool and die shop, which eventually stopped supplying Motorola and other maquiladoras because of fluctuations in demand. It now supplies the local internal market. Motorola created some locally owned packaging companies to make dry ice and styrofoam and also created a chemical plant and electrical capacitors plant in Monterey to supply them (Wilson:1992:83).

Wilson concludes that Motorola is "one of the most aggressive foreign maquiladoras in Guadalajara to establish a local supplier network---not of chip parts, but of producer services and packaging materials" (1992:102). Finally, in support of our field observations and interviews, we note that Mexican researchers also confirmed the transfer of technology effected through "learning by doing": "A director commented to us: 'Motorola not only created a source of employment for more than 1000 people, but also became a school to teach almost unknown technology'" (Quoted in Medina and Rosales:118).

IBM: Subcontracting Networks as Regional Development Opportunity

Once the model of the vertically integrated firm that defined the frontier of innovation in computing, IBM erred by relying too heavily on mainframes and underestimating the potential demand of personal computers (PCs) and laptops. Even when IBM recognized the growth potential of PCs, its vertically integrated (i.e. transnational) organizational structure was too inflexible and too costly to compete with its rivals such as Dell, Compact, Gateway and Packard Bell. Several years ago, IBM's PC division had a billion dollar annual loss, effectively bankrupt if it were a stand alone public company (WSJ:3.12.98:B1). Cumulatively, these strategic errors forced IBM to restructure, downsize and, most importantly, to rely more on subcontractors rather than "in house" suppliers of components and assembly. Table 3 illustrates IBM's dramatic restructuring of its PC operations around networks of subcontractors.

Table 3 How IBM has cut the costs and the complexity of its PCs:

	1997	1994
Models assembled at IBM plants	150	3400
Available options	350	750
Types of major components	200	400
Variety of parts in inventory	15,000	56,000
Parts replenished daily by suppliers	62%	5%
Percent of U.S. PCs assembled by distributors	31%	0%
PC unit employees world-wide	9,241	10,000

Source: IBM (Wall Street Journal: 12 March, 1998:B1)

In addition to shifts in production organization, a large proportion of IBM's revenue derives from services, repairs and newer products (servers, PCs, laptops, and components), other than main-frames. The organizational crisis at IBM, together with its high sales volume and its variety of products, therefore, presents a region like Guadalajara with almost all of the training, subcontracting and other linkage opportunities associated with a global-regional model.

Established In Guadalajara in 1957, IBM began operations as typewriter firm. It shifted to the assembly of mini and mainframe components in 1982. Initial production centered on the "System34" and later the AS 4500, which soon became an industry standard. Driven by the debt crisis and the need to cover the foreign exchange costs of importing IBM's mainframes and services into Mexico, Guadalajara gradually diversified production for both exports and the

internal market. By 1986, they began to produce PCs (i.e. APTIVAs) for business, education and domestic uses. In 1989, Guadalajara expanded to assemble data storage products like hard disk drives, floppy drives and other data storage components. The latter processes required new investment in "clean rooms" and significant upgrading of technical capacity. In 1989, Guadalajara began producing magnetic disks subassemblies for IBM's Systems Storage Division, located in Rochester, Minnesota. Later they upgraded to producing subassemblies (suspensions) for the supercomputer market as well as assembling "magneto-resistive" heads that are on the cutting edge of storage technology.

Within the region of Guadalajara and the state of Jalisco, IBM is the largest electronics producer and exporter. Currently, IBM claims responsibility for 33 % of Jalisco's exports and the lion's share of Mexican computer production. The following figures illustrate IBM's export growth: 1986-$55m, 1988-$284m, 1991-$413m, 1994-$870m and 1997-$1.2 billion. Jalisco's total exports surpassed $3 billion in 1997. At least 60 % of all Mexican computers are produced in Jalisco. IBM managers estimate the Mexican market at $100m. Exports have increased dramatically to the USA, Germany, Japan, Singapore and Thailand. In the area of services, Guadalajara now has a software manufacturing center, a management consulting center, a Spanish translation center, a center for specialized laboratory and logistical services and a portable computer repair center. IBM intends to become a center for Spanish language software for the Latin American market.

In 1993, Guadalajara upgraded its technical competence in manufacturing when it began producing the Thinkpad line of laptops. Initially producing only the lower end models, they advanced to producing the premium and "Butterfly" versions of the Thinkpad in 1995. In 1996, according to local managers, IBM Guadalajara accounted for 80 % of American sales and 50 % of world wide sales. Approximately 98 % of laptop production is exported to the USA, Japan, Canada, Latin America, and Korea. In order to assembly premium laptops, like the Thinkpad, IBM's managers had to raise existing quality standards, retrain workers and invest in new testing equipment. The Thinkpad is representative of the most complex portable computer. Final stage production requires the assembly and testing of highly miniaturized versions of complex components: CD-ROMs, multi-gigabyte disk drives, fax-modems, intelligent batteries, audio, video and color displays. Notebooks are also repaired at Guadalajara: problems are serviced first via an "800" number; if necessary notebooks are sent via courier for repair in three or four days. By 1996, Guadalajara's combined PC and notebook production reached 1.3 million units destined for customers in 22 countries. Managers emphasized close customer relationships for maintaining quality, market share and insights for new product innovations. Overall, notebook production, marketing and service represents an indisputable transfer of technology and a true upgrading of Mexico's engineering and managerial capacity.

The Organization of Production Networks

As Table 3 indicates, IBM's firm strategy for its PC division conforms to the global-regional model, whereby subcontractor networks organized according to "Just in Time" inventory supercede "in house" production, once dominant in the vertically integrated firm. Accordingly, the number of models assembled at IBM plants has been reduced from 3400 (1994) to 150 (1997); parts replenished by suppliers has risen from 5% to 62 % from 1994 to 1997; and inventory and options have also been reduced significantly. Fearing elimination as IBM downsized, subsidiaries like Guadalajara were forced to compete with other units in order to increase their share of higher value added processes.

Both IBM's promotional literature and interviews with IBM-Guadalajara's managers in 1995 and 1997 document how Guadalajara implemented IBM's world wide restructuring strategy toward what we have called a global-regional strategy. Practically, IBM subcontracts out production and assembly activities while retaining "in house" the following core activities: research and development, design, procurement of inputs, logistics of material sourcing and final testing. "Core competencies" and leading technologies remain "in house", to be sure, but the latter are constantly changing and gradually transferred to suppliers in order to sustain quality and the competitive edge. Herein lies the source of the knowledge transfer. Depending on one's position in the subcontracting network, the global-regional strategy offers significant opportunities for local firms to upgrade by raising their share of value added, employee income and knowledge transfers within the world wide production chain. For IBM's vendors, a certification laboratory, which certifies the ISO 9000 standard, guarantees the quality of the final product.

In 1994, in response to the crisis of the PC division, Guadalajara began to restructure its subcontracting network into a series of "jetways". Each jetway was responsible for subassembly of products from over 120 vendors. Of the nine divisions in IBM world wide, Guadalajara participates in five. Each division has a procurement unit at Guadalajara. For PCs and notebooks, IBM directly takes responsibility for procurement, logistical organization and testing of the final product. Modeled on the "Toyota" continuous flow manufacturing system, the system uses JIT to limit inventory to a 30 day supply. For PCs and laptops, the system has four levels. The chain of production begins with IBM at Raleigh, North Carolina, flows to IBM Guadalajara and then to four main subcontractors which have their own inventory warehouses. The jetway subcontractors manage supplies from their vendors and IBM coordinates the final assembly, testing and shipping of the product to customers. Among the major subcontractors, specialized contract manufacturers who assembly components on printed circuit boards (i.e. SCI, Solectron, Jabil, Nat-Steel) are especially important for the success of the jetway system,

so they have access to the IBM plant, maintain warehouses and receive testing equipment on loan from IBM. Vendors are certified by IBM, submit competitive bids and receive a contract only after certification, a process usually taking a year. By devolving responsibility to the subcontractors at the jetway level, IBM conserves its capital, labor, space and other resources for higher valued added processes. As a result of re-engineering through the jetway systems, IBM managers report: continuous reductions in IBM employment, a rise in subcontracting employment, a decline in the number of direct workers (i.e. 5% in 1995), a concomitant rise in professional workers and greater attention paid to relations with customers to improve quality and gather information for future innovations. Finally, like HP and Motorola, IBM sponsors projects and supports research centers at local universities.

Regional Development: Promotion, Coordination and Linkages

Motorola and IBM clearly are pursuing a global-regional firm strategy as evidenced by their subcontracting networks, loaning of machinery and support for local industries, suppliers and technical universities. But the overall picture is much less rosy. A significant number of international firms have left Guadalajara or failed: Wang, Tandem, and Unisys. HP is reducing production of PCs in favor of using Guadalajara as a distribution center for Latin America. Quantum chose Penang over Guadalajara for disk drive assembly. Intel recently chose San Jose, Costa Rica over Guadalajara for its new assembly and testing operation. This was a major loss for Guadalajara given the knowledge transfers experienced by Penang. If compared to Penang, therefore, what seems to be missing in Guadalajara is a regional development agency (RDA) like the Penang Development Corporation with the authority to plan, promote, coordinate, and nurture local firms toward higher value added production. Key issues here concern fragmented responsibility for promotion and coordination, secure access to land and industrial estates, nurturing of component and service industries and support for upgrading human resources.

To be sure, the shift from the languid PRI to the pro-business PAN administration in Jalisco State in January 1995 made a visible difference with regard to the promotion of the electronics industry. Nonetheless, promotion and coordination is highly fragmented with no single agency possessing the authority to plan and manage recruitment, industrial estates, linkages development and human resource development. In addition to the *Secretaría de Promoción Económica* (Secretary of Economic Development or SEPROE), a number of other agencies have been engaged in promotion: the American Chamber of Commerce of Mexico, the Guadalajara Chamber of Commerce, the National Chamber of Electronics Industries (CANIETI) and the Jalisco Development Board (JIB). The JIB provides an example of the inconsistencies in the local planning structure. Originally funded in part by SEPROE and mostly by approximately

ten members of Guadalajara's traditional business elite in 1994, the JIB began promotion rather modestly under the PRI administration, even publishing a newsletter in 1995. Interviews with the top management in 1995 found that the JIB had a small staff (7), was informally linked to PAN networks and, most importantly, viewed the comparatively higher price of land as an obstacle to recruiting new industries to Guadalajara. By 1997, largely due to the devaluation and recession, the JIB had closed down and disappeared.

Just as one would expect from a PAN administration (Governor Alberto Cardenas Jimenez), the secretary of economic promotion has spearheaded a search for new investment with an unambiguous pro-business message. Many of the PAN administration as well as SEPROE's top officials formerly worked in business, including positions at IBM. Space limitations require only a partial listing of the most significant of the PAN initiatives: an economic development board was established under the secretary of economic promotion; an investment promotion law provides financial incentives to longer term investors that train workers; trade and investment missions have been launched to Western Europe, East Asia and North America; SEPROE now intervenes to facilitate permits and licenses for new investors; the governor hosts an annual promotion entitled "The International Week of Electronics in Guadalajara" (in October) as well as several public-private promotions jointly organized by SEPROE and local chambers of commerce (i.e. JalTrade, *Jalisco Nuestra Empresa*,); and finally, SEPROE has established a web site to inform future investors (www.businessgdl.com.mx) (Business Mexico:8, 4, April 1998) (Business Mexico:7/8, 12/1, 1998) (Interviews: SEPROE:2.16.97).

All the hype from the energized PAN administration renders more difficult a reliable evaluation of real changes in the electronics industry since 1994. The most visible change is the location and activity level exhibited by SEPROE. Formerly located in the basement of the state office building under the PRI, SEPROE is now occupies several floors of a main office building and the atmosphere has shifted from bureaucratic lassitude to pro-active enthusiasm. SEPROE now claims that, between May 1995 and August 1997, the electronics sector received $580 million in new investment, creating 20,000 new jobs and that 25 new firms were persuaded to locate in Guadalajara, i.e. Solectron, Jabil, Natsteel, Pemstar, Telect, Phoenix International, Alestra, Flextronics and Yamaver. By 1998 SEPROE's WWW page announced that Jalisco possessed 75 electronics firms, 60,000 direct employees, local value added worth $900 million (1996) and an average of 20% local content in its electronics products. Furthermore, the rise in exports under the PAN administration has been dramatic. "Electronics, telecommunications and software exports jumped from $1 billion in 1994 to $5 billion in 1997, and the 1998 figure is projected at $6 billion" (US/Mexico Business: July/August,1998:46). And while no new major international final stage producer firms like IBM, HP or Motorola have been recruited, existing internationals have reinvested and

expanded production. For example, the Philips-Lucent assembler of telecommunications products has reinvested, expanded production and increased employment from 1500 in 1991 to 7400 employees in 1997.

Software, according to field reports from researchers, has become a new and dynamic sector, one that has been incubated from the massing of skilled labor in the hardware industry. IBM, now refining itself as a "solutions" service provider worldwide, has invested in software at Guadalajara. Interviews with managers indicated that they hoped to become a hub for software development for Spanish-speaking Latin America. All of which makes economic sense given the shift in the frontier of innovation from hardware like microprocessors (i.e. Intel, AMD) creating communications networks which combine hardware and software (i.e. Cisco, Lucent). The expansion of the Internet into e-commerce will only strengthen the need for regionally based software firms.

Both state officials and industry managers rate human resources as Guadalajara's strong suite, one that, properly institutionalized by civil society groups, may be mobilized as a "social capital" resource to leverage higher value added processes. All sources agree that the educational standards, labor discipline and the stability of employment rank Guadalajara as superior to other regions such as the US-Mexican border. Whereas the annual turnover rate is as high as 80 to 100% for firms in the border region, and as such a serious obstacle for upgrading labor on the border, turnover is under 20% in Guadalajara (Sklair:1993:260; Gabayet: 1990). Together with an attractive climate desirable to high tech workers, described as "eternal Spring", the availability of university and technical educational opportunities enable local firms to attract and retain highly skilled personnel. Just like Penang, therefore, human resources figure as a prime asset and, more importantly, as a social capital resource for local actors to advance Guadalajara's position on the global value-added chain.

Less visible, and thus more difficult to assess, is the development of local, and especially Mexican-owned, firm linkages. While international contract manufacturing firms (i.e." board stuffers") have relocated as subcontractors to firms like IBM, HP, Philips-Lucent-ATT and Siemens, there is very little evidence of Mexican involvement, nor of a concerted effort by SEPROE to nurture Mexican subcontractors, vendors and linkages in general. Understandably, given the severity of the 1994-95 economic crisis and devaluation of the peso, interviews on this topic left no doubt that the SEPROE's defines its mission primarily to recruiting foreign investment, generating employment and overcoming Mexico's image among potential investors as politically unstable, financially chaotic and, worse still, an unreliable producer of quality products. Exceptions, however, do exist. IBM has a long list of local vendors, one of which is a former mattress company that now makes actuators for disk drives. Cumex, a joint venture of

American and Mexican capital makes printed circuit boards; and others assemble electronic components, i.e. Electronics Zonda, CP Clare. To their credit, CANIETI and SEPROE have prioritized the upgrading and expansion of supplier networks to the international firms. The Electronics Week Expo aggressively promoted local linkages and emphasized the requirements that local suppliers must meet: quality, delivery time (JIT) and price (Austin-American-Statesman: March 30, 1998). Not surprisingly, Mexican industrialists cite insufficient industrial financing, insecurity and weak coordination as obstacles to developing these linkages. The business press, moreover, cites the lack of reliable local suppliers in Guadalajara as a serious weakness.

If compared to Penang's development of backward linkages, metal working and plastic molding are underdeveloped in terms of price, deliver time and quality. Interviews with the head of the engineering department of a major international telecommunications producer cited the inability of local tool, die and molding support industries to compete with East Asian suppliers. Hence in 1995, the firm spent $4.5 to $5 million annually to metal working firms either in the USA or East Asia, mostly Singapore, Hong Kong and Thailand. In order to reduce inventory costs in line with JIT practices, his preference is to develop local suppliers and ancillary industries. But he was unable to develop a reliable, price competitive and high quality metal working network. This is an area where a regional development agency could strengthen linkages by upgrading, nurturing and training metal working firms to meet global standards. Finance and technical support are reported to be major obstacles to increasing the number and technical capacity of metal working firms. Managers suggested that the best metal working firms are already committed to the auto industry or to the firm like IBM that originally fostered them. The chamber promoting metal working firms should be encouraged to take advantage of the opportunities offered by the electronics expansion.

In addition to differences in the quality of backward linkages (metal working and components) and the role of locals in forward linkages (contract manufacturing), Penang's management of land, buildings and industrial estates clearly surpasses Guadalajara. The advantage arises from the power and coordination exercised by the Penang Development Corporation (PDC) over spatial planning: organizing industrial estates, leasing land, establishing infrastructure, siting test facilities and leasing buildings. The PDC has been able to site complementary industries and suppliers near each other, separate dirty and clean as well as higher tech from lower tech industries between Penang Island and the mainland and even refused to allow manufacturers from one Asian nation to ghettoize themselves as they wished. The power of coordination is vested in the PDC which has a clear strategy, a research department, a budget and professional personnel to carry out its mission. In Guadalajara, by contrast, regional authority has been subordinated to the federal center under the PRI, while

under the free marketeering PAN administration, reform is constructed so as to be hostile to the idea of a regional development agency. What this means is that land prices are comparatively high, land speculation is rampant, land tenure uncertain and site location of complementary industries is quite haphazard. The haphazard distribution of industry becomes an obstacle to JIT driven supplier networks. Currently SEPROE is promoting privately managed industrial estates (see their WWW site), a solution that creates local vested interests competing to market land. Combined with speculation and uncertain land tenure laws, the absence of a regional development agency with the power to regulate and distribute land and certify buildings and infrastructure has proved costly to Guadalajara. The following example is a cautionary tale and an argument for establishing a regional development agency.

Several years ago, one of the major international electronics producers contracted with a local builder and landowner to obtain land and construct buildings according to the standards required by the international firm. A number of sources confirmed that both the land transfer and the building failed to meet the agreed upon standard. When the courts failed to resolve the matter, accusations of corruption (i.e. bribing the judges) ensued and the image of Guadalajara among international firms suffered as a result. Subsequently, the authors had an opportunity to interview Intel managers regarding their decision to locate their new assembly and testing plant at San Jose, Costa Rica rather than Guadalajara which, understandably, was pursuing the estimated $400 to $500 million investment. Intel managers involved in making the decision reported receiving ambivalent assessments of Guadalajara from established firms regarding supportive industries, security and the ease of doing business. Most importantly, they were aware of several land and building disputes, cryptically commenting: “Generally, we only like to pay for our land and buildings once.”

Concluding Thoughts: Regional Development Opportunities Revisited

What differences explain why Penang has thrived on one hand, while Guadalajara’s growth and technical deepening has not met expectations despite close proximity to the USA, federal support and an earlier establishment? To make this comparison, one must hold Mexico's size, financial and political instability and its skewed income distribution problems constant so as to focus on the explanatory power of our key factors: regional differences, social capital, global-regional firm strategies and local production networks. Interestingly, Motorola’s presence in both Malaysia and Mexico allows one to assess the commonality of an integrated global-regional strategy and global production networks. Yet, Guadalajara’s inter-firm integration is weak, local suppliers are only now emerging and the triad of quality, price and delivery time haunts local producers. Consistent with Warman’s analysis of Mexico, Wilson focused on this problem

earlier: “While the foreign-based electronics industry is gradually networking among itself there is a growing endogenous electronics industry that continues to source almost all of its inputs from abroad. It is almost totally unlinked to the foreign based electronics industry in Guadalajara (Wilson:1992:86).” Unless Mexican producers are integrated into supplier and subcontracting networks, the impact of an innovative global-regional strategy merely reproduces a new mutation in the classical enclave model. While still dominated by foreign firms in comparison to Korea or Taiwan, Penang's indigenous firms are far more integrated into production networks than those of Guadalajara.

Of course, Penang is perceived by industry analysts as a successful specialized manufacturing center, one that meets the price, deliver time and quality standards, and Guadalajara has lagged expectations even when it was hyped as the Silicon Valley of Mexico. To repeat the evidence presented earlier, a major reason for the difference arises because Guadalajara lacks a regional coordinating agency, like Malaysia's Penang Development Corporation, to rationalize spatial resources, upgrade supplier firms, promote local producers, obtain credit and to raise the region's share of the global value chain. Under the PAN state government, the Secretariat of Economic Promotion's office has moved from the basement to a more prominent building but, still, it pales in comparison to the promotional and service functions provided by the PDC (See PDC WWW page). Industrial associations, local linkage efforts and the level of confidence enjoyed by Penang is absent in Guadalajara. Private capital drawn largely from the prominent industrialist families producing consumer and metal products did manage to create the Jalisco Development Board. But the economic crisis of 1994-95 and the debts of the JIB's sponsors appears to have forced the abandonment of the initiative. Therefore, SEPROE's main objective is employment generation and raising foreign investment rather than the incubation of local ancillary SMIs and other industrial linkages or services.

Overall, there does not appear to be a clear industrial planning initiative comparable to that pursued by the PDC, one that succeeded in aggregating the production and/or assembly of virtually all the components required for the personal computer. Compared to Penang, Guadalajara lacks a strategic plan and the efforts of the promotion agencies are much more fragmented and more reliant on market forces for growth and technical deepening. Because “reform” for the PAN means reliance on market forces, state initiatives like the PDC are off the planning agenda largely for ideological reasons. But planning pays off handsomely. Whereas Penang has attracted firms it required for an integrated computer industry, and numerous other electronic subsectors, Guadalajara has not attracted many major international firms since IBM shifted to computer assembly. Guadalajara's electronics output depends heavily and precariously on one firm, IBM, a dependence that reflects a narrow base and a fragile planning capacity.

Finally, compared to Penang, the levels of trust rooted in the local civic culture, so necessary for developing a vibrant foundation of social capital, are relatively weak in Guadalajara. The latter factor, together with ideological hostility to a state sponsored regional planning initiative (i.e. an RDA) render the upgrading of local capacity, major new international investments and overall technological deepening difficult at best. Nonetheless, should Jalisco or any other oppositionally controlled state administration such as the PRD in Zacatecas, invest in a regional development agency, mobilize social capital and incubate local supplier firms, then these states could expand on the potential regional economic benefits flowing from the deepening of political reform in contemporary Mexico.

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