Silicon Valley's New Immigrant High-Growth Entrepreneurs

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This article examines the economic contributions of skilled Asian immigrants in Silicon Valley—both directly, as entrepreneurs, and indirectly, as facilitators of trade with and investment in their countries of origin. Skilled immigrants account for one third of the region's engineering workforce and are increasingly visible as entrepreneurs and investors. Two thirds of the region's foreign-born engineers were from Asia. Chinese and Indian immigrants in turn accounted for 74% of the total Asian-born engineering workforce. In 1998, Chinese and Indian engineers were senior executives at one quarter of Silicon Valley's technology businesses. These immigrant-run companies collectively accounted for more than $26.8 billion in sales and 58,282 jobs. The region's most successful immigrant entrepreneurs rely heavily on ethnic resources while integrating into the mainstream technology economy. The challenge for policy makers will be to recognize these mutually beneficial connections between immigration, investment, trade, and economic development.

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We know little about the economic contributions of highly skilled immigrants, particularly in an increasingly global economy. This study explores the extent to which highly skilled immigrants create jobs and wealth for the California economy—both directly, as entrepreneurs, and indirectly, as facilitators of trade and investment linkages to their countries of origin. The analysis suggests that policy makers need to recognize the changing relationships between immigration, trade, and economic development in an increasingly global economy.

Debates over the immigration of scientists and engineers to the United States focus primarily on the extent to which foreign-born professionals displace native workers or on the existence of invisible barriers to mobility, or "glass ceilings," experienced by non-native professionals. Both approaches assume that the primary economic contribution of immigrants is as a source of relatively low-cost labor, even in the most technologically advanced sectors of economy (McCarthy & Vernez, 1997). The view from sending countries, by contrast, has historically been that the emigration of highly skilled personnel to the United States represents a significant economic loss, or "brain drain," depriving their economies of their best and brightest.

Neither of these views is adequate in today's global economy. Debates over the extent to which immigrants displace native workers overlook evidence that foreign-born scientists and engineers are starting new businesses and generating jobs and wealth for the state economy at least as fast as their native counterparts (Borjas, 1994, 1995; Friedberg & Hunt, 1995; Smith & Edmonston, 1997). Similarly, the dynamism of emerging regions in Asia and elsewhere means that it is no longer valid to assume that skilled immigrants will stay permanently in the United States. Recent research suggests that the brain drain may be giving way to a process of "brain circulation," as talented immigrants who study and work in the United States return to their home countries to take advantage of promising opportunities there (Johnson & Regets, 1998). Advances in transportation

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and communications technologies mean that even when these skilled immigrants choose not to return home, they still play a critical role as facilitators, linking businesses in the United States to those in geographically distant regions.

There is widespread recognition of the significance of immigrant entrepreneurship in traditional industries, ranging from small-scale retail to garment manufacturing. We have only anecdotal evidence of a parallel process in the newer, knowledge-based sectors of the economy (Hing & Lee, 1996; Waldinger, Aldrich, & Robin Ward Associates, 1990). Yet, it is in these dynamic new industries that immigrants with technical skills and strong connections to fast-growing overseas markets have the potential to make significant economic contributions. Not only are skilled immigrants highly mobile, but the technology industries in which they are concentrated are California's largest and fastest-growing exporters and leading contributors to the state's economic growth (Kroll, Jaffee, Bardhan, Kirschenbaum, & Howe, 1998).

This study examines the entrepreneurial contribution of skilled immigrants—in this case, immigrant scientists and engineers—to the Silicon Valley economy. As the center of technological innovation as well as the leading export region in California, Silicon Valley serves both as a model and as a bellwether for trends in the rest of the state.

The aims of this study are fourfold. First, it quantifies immigrant engineers' and entrepreneurs' presence in and contribution to the Silicon Valley economy. Second, it examines the extent to which skilled Chinese and Indian immigrants are organizing ethnic networks in the region such as those found in traditional immigrant enterprises to support the often risky process of starting new technology businesses. Third, it analyzes how the engineers are building long-distance social and economic networks to their home countries that further enhance entrepreneurial opportunities within Silicon Valley. Finally, it explores the implications of these findings for the Silicon Valley and California economies and for public policy.

METHODOLOGY

This study employs a mix of research methods and strategies to address the challenges of limited data availability. It relies on the following three primary sources: Data on immigrants' education, occupations, and earnings are drawn from the Public Use Microdata Sample (PUMS) of the 1990 Census (U.S. Bureau of the Census, 1992). The decennial census provides the only comprehensive data on immigrants by industry and occupation in the United States. Unfortunately, they are dated. There is ample evidence suggesting that the Asian presence in Silicon Valley increased significantly during the 1990s, but industrial and occupational detail is not available.

The analysis of immigrant-run businesses is drawn from a customized Dun & Bradstreet (1998) database of 11,443 high-technology firms founded in Silicon Valley between 1980 and 1998. Immigrant-run businesses were identified as all the companies that had chief executive officers (CEOs) with Chinese and Indian surnames. Although this group includes Chinese and Indians born in the United States, it appears unlikely that this is a large source of bias because the great majority of Asian engineers in the region are foreign-born. It is important to note, however, that I used immigrant-run businesses as a proxy for immigrant-founded businesses in the absence of direct data on firm founders.

The findings reported in the balance of this article are based on more than 100 in-depth interviews with engineers, entrepreneurs, venture capitalists, policy makers, and other key actors in Silicon Valley. These interviews typically lasted at least 1 hour and were conducted between January 1997 and January 1998. An additional 67 interviews were conducted in the Taipei and Hsinchu regions of Taiwan (25) during May 1997 and the Bangalore, Bombay, and Delhi regions of India (42) during December 1997. The interviews in Asia included national and local policy makers as well as representatives of technology businesses.

TABLE 1
Silicon Valley Workers, 1990

	Total Workforce		*High-Technology Workforce*		*Scientists and Engineers in High-Technology Workforce*	
	Number	*%*	*Number*	*%*	*Number*	*%*
Foreign born						
Asian	205,603	11	50,608	18	12,237	21
Other	241,360	13	31,233	11	6,261	11
Native	1,359,270	75	192,494	70	38,997	68
Total[a]	1,806,233	100	274,335	100	57,495	100

SOURCE: U.S. Bureau of the Census (1992).
a. Totals may not sum to 100% because of rounding.

IMMIGRATION AND ENTREPRENEURSHIP IN SILICON VALLEY

Skilled immigrants are a growing presence in Silicon Valley, accounting for one third of the engineering workforce in most technology firms and emerging as visible entrepreneurs in the 1980s and 1990s. This section documents the growing contribution of skilled Chinese and Indians to the Silicon Valley economy as entrepreneurs as well as engineers.

The New Asian Immigrants

The Hart-Cellar Act of 1965 allowed immigration to the United States based on both the possession of scarce skills and on family ties to citizens or permanent residents. The act created significant new opportunities for foreign-born engineers and other highly educated professionals whose skills were in short supply, as well as for their families and relatives. The great majority of these new skilled immigrants were of Asian origin, and they settled disproportionately on the west coast of the United States. By 1990, one quarter of the engineers and scientists employed in California's technology industries were foreign-born—more than twice as many as other highly industrialized states such as Massachusetts and Texas (Alarcon, 1997). The Immigration and Naturalization Act of 1990 further favored the immigration of engineers by almost tripling the number of visas granted on the basis of occupational skills.

One third of all scientists and engineers in Silicon Valley's technology industries in 1990 were foreign-born. Of those, almost two thirds were Asians, with the majority of Chinese and Indian descent.

This transformation of the immigration system coincided with the growth of a new generation of high-technology industries in Silicon Valley. As the demand for skilled labor in the region's emerging electronics industries exploded during the 1970s and 1980s, so too did immigration to the region. Between 1975 and 1990, Silicon Valley's technology companies created more than 150,000 jobs—and the foreign-born population in the region more than doubled to almost 350,000 (Saxenian, 1994). By 1990, 23% of the population of Santa Clara County (at the heart of Silicon Valley) was foreign-born.

Table 1 shows that although one quarter of the total Silicon Valley workforce in 1990 was foreign-born, 30% of the high-technology workforce was foreign-born. These immigrants were concentrated in professional occupations: One third of all scientists and engineers in Silicon Valley's technology industries in 1990 were foreign-born. Of those, almost two thirds were Asians, with the majority of Chinese and Indian descent. In fact, according to the 1990 Census, 5% PUMS (U.S. Bureau of the Census, 1992), nearly three quarters of the Asian-born engineers in the region were of Chinese (51%) or Indian (23%) origin, with the balance including relatively small numbers of Vietnamese (13%), Filipinos (6%), Japanese (4%), and Koreans (3%).

The disproportionate representation of Chinese and Indian engineers in Silicon Valley's technology workforce explains the focus on these two groups in this article. As Table 2 shows, 71% of the Chinese and 87% of the Indians working in Silicon Valley high-technology industries in 1990 arrived in the United States after 1970, and 41% of the Chinese and 60% of the Indians arrived after 1980. Asian immigration to the region almost certainly accelerated during the 1990s, particularly among highly educated professionals.

TABLE 2
Immigration of Indians and Chinese Into Silicon Valley High-Technology Industries, by Year

	1980-1989		*1970-1979*		*Before 1970*		*Native*	
	Number	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
Indian	4,367	60	1,963	27	803	11	162	2
Chinese	7,921	41	5,697	30	2,491	13	3,109	16

SOURCE: U.S. Bureau of the Census (1992).

TABLE 3
Percentage of Science and Engineering Degrees Granted by the University of California, Berkeley to Chinese Immigrants, by Place of Origin, 1980 to 1997

	1980-1985	*1986-1991*	*1992-1997*
Singapore	3	3	2
Hong Kong	20	10	9
People's Republic of China	10	35	53
Taiwan	67	52	35

SOURCE: University of California, Berkeley Graduate Division (personal communication, July 1997).

Table 3 shows that by the mid-1990s, more than half of the science and engineering degrees from the University of California, Berkeley (53%) were granted to students from China, compared with 35% in the late 1980s and only 10% in the early 1980s. The number of graduate degrees granted can be seen as a leading indicator of labor supply in Silicon Valley, as most graduates find jobs in the region's technology companies.

National trends in graduate science and engineering education mirror these trends closely and provide insights into the changing composition of the Silicon Valley workforce. Between 1990 and 1996, the number of doctorates in science and engineering granted annually by U.S. universities to immigrants from China more than tripled (from 477 to 1,680), and those to Indian immigrants doubled (to 692), whereas those to Taiwanese remained stable (at about 300). These three immigrant groups alone accounted for 81% of the doctorates granted to Asians and 62% of all foreign doctorates in science and engineering granted in the United States between 1985 and 1996 (Johnson, 1998). Moreover, California's universities grant engineering degrees to Asian students at more than twice the rate of universities in the rest of the nation. In short, we expect the 2000 Census to show a dramatic increase in the number of mainland Chinese and Indian engineers in the Silicon Valley workforce since 1990.

Not surprisingly. Silicon Valley's Indian and Chinese workforce is highly educated. In 1990, they earned graduate degrees at significantly greater rates than did their White counterparts: 32% of the Indian and 23% of the Chinese employed in Silicon Valley in 1990 had advanced degrees compared with only 11% of their White colleagues. Table 4 shows that the superior educational attainment of these groups is even more pronounced among workers in technology industries: 55% of Indian and 40% of Chinese technology workers held graduate degrees compared with 18% of Whites in technology fields.

The superior educational attainment of Silicon Valley's Asian immigrants is only partially reflected in occupational status. Table 5 reveals that Indians and Chinese working in the region's technology sector were better represented in professional and managerial occupations than their White counterparts, with 60% of Indians and 57% of Chinese employed as professionals and managers compared with 53% of Whites. However, these groups were significantly more concentrated in professional than in managerial occupations.

Many Chinese and Indians in Silicon Valley believe that there is a "glass ceiling" inhibiting their professional advancement. This is consistent with the finding that in technology at least, Chinese and Indians remain concentrated in professional rather than managerial positions despite superior

TABLE 4
Education Level of Indians, Chinese, and Whites in Silicon Valley High-Technology Industries, 1990

	Indian		*Chinese*		*White*	
	Number	*%*	*Number*	*%*	*Number*	*%*
Master's of science to Ph.D.	4,043	55	7,612	40	34,468	18
Bachelor of science	1,581	22	5,883	31	59,861	31
Some university	792	11	3,551	19	64,081	34
High school graduate	600	8	1,002	5	23,488	12
Less than high school	279	4	1,170	6	9,319	5

SOURCE: U.S. Bureau of the Census (1992).

TABLE 5
Occupations of Indians, Chinese, and Whites in Silicon Valley High-Technology Industries, 1990

	Indian		*Chinese*		*White*	
	Number	*%*	*Number*	*%*	*Number*	*%*
Managerial	1,122	15	3,086	16	49,463	26
Professional	3,249	45	7,834	41	50,977	27
Technical	818	11	3,027	16	23,999	13
Semiskilled	1,418	19	3,411	18	27,913	15
Administrative	688	9	1,860	10	38,865	20
Total[a]	7,295	100	19,218	100	191,217	100

SOURCE: U.S. Bureau of the Census (1992).
a. Totals may not sum to 100% because of rounding.

levels of educational attainment. It is notable, however, that those surveyed attributed these limitations less to "racial prejudice and stereotypes" than to the perception of an "old boys' network that excludes Asians" and the "lack of role models" (Asian Americans for Community Involvement, 1993).

The New Immigrant Entrepreneurs

During the 1980s and 1990s, Silicon Valley's immigrant engineers increasingly followed the career trajectories of native engineers by starting technology businesses. In contrast to traditional immigrant entrepreneurs, who are concentrated in low-technology services and manufacturing sectors, these new immigrant entrepreneurs are a growing presence in the most technologically dynamic and globally competitive sectors of the Silicon Valley economy. At least 37 public technology companies in the region were started by Indians. The existence of so many immigrant-run publicly traded companies suggests a significantly larger population of private, immigrant-founded companies. *The Directory of Taiwan/Republic of China Companies in North America* (1995), for example, lists more than 300 high-technology companies based in Silicon Valley alone, a11 of which have Taiwanese founders or CEOs.

Of the 11,443 high-technology firms started during this period, 2,001 (17%) were run by Chinese and 774 (7%) by Indians. In 1998, these companies collectively accounted for more than $16.8 billion in sales and 58,282 jobs.

In 1998, close to one quarter (24%) of Silicon Valley's technology firms had Chinese or Indian executives in a Dun & Bradstreet database of technology firms started since 1980. Of the 11,443 high-technology firms started during this period, 2,001 (17%) were run by Chinese and 774 (7%) by Indians. In 1998, these companies collectively accounted for more than $16.8 billion in sales and 58,282 jobs (see Table 6).

These data indicate that the rate of Chinese and Indian entrepreneurship in Silicon Valley increased significantly over time and that their businesses are creating large numbers of jobs and wealth in the region. Chinese and Indians were at the helm of 13% of Silicon Valley's technology

TABLE 6
1998 Sales and Employment of Silicon Valley High-Technology Firms Led by a Chinese or Indian CEO

	Number of Firms	*Total Sales (in $millions)*	*Total Employment*
Indian	774	3,588	16,598
Chinese	2,001	13,237	41,684
Total	2,775	16,826	58,282
Share of Silicon Valley high-tech in %	24	17	14

SOURCE: Dun & Bradstreet (1998).
NOTE: Statistics are for firms started by Chinese or Indians between 1980 and 1998.

TABLE 7
Chinese- and Indian-Run Companies as Share of Total Silicon Valley High-Technology Start-ups, 1980 to 1998

	1980-1984		*1986-1989*		*1990-1994*		*1995-1998*	
	Number	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
Indian	47	3	90	4	252	7	385	9
Chinese	121	9	347	15	724	19	809	20
White	1,181	88	1,827	81	2,787	74	2,869	71
Total	1,349	100	2,264	100	3,763	100	4,063	100

SOURCE: Dun & Bradstreet (1998).

companies between 1980 and 1984, but they were running 29% of the region's high-technology companies started between 1995 and 1998 (see Table 7).

Chinese and Indian firms remain small relative to the technology sector as a whole, with an average of 21 employees per firm compared to 37 employees per firm industrywide. However, the relatively smaller size of the firms may indicate that they were founded more recently. Although these immigrant-run firms employ fewer people, they appear to be at least as productive: Chinese-run firms have sales of $317,555 per employee, and Indian-run firms have sales of $216,100 per employee compared to $242,105 sales per employee for all technology firms in the Dun & Bradstreet database.

SILICON VALLEY'S ETHNIC NETWORKS

Silicon Valley's immigrant entrepreneurs—like their native-born counterparts—rely on a diverse range of informal social structures and institutions to support their entrepreneurial activities. During the 1970s and 1980s, Asian immigrants in Silicon Valley saw themselves as outsiders to the region's mainstream technology community, and they created social and professional networks among themselves on the basis of shared language, culture, and educational and professional experiences.

This section describes how Silicon Valley's immigrant engineers rely on local social and professional networks to mobilize the information, know-how, skill, and capital needed to start technology firms. In so doing, they have enhanced their own entrepreneurial opportunities as well as the dynamism of the regional economy.

Table 8 lists the professional and technical associations organized by Silicon Valley's Chinese and Indian immigrant engineers during the 1980s and 1990s. These organizations are among the most vibrant and active professional associations in the region, with memberships ranging from several hundred in the newer associations to more than 1,000 in the established organizations.

TABLE 8
Indian and Chinese Professional Associations in Silicon Valley

Name	*Year Founded*	*Number of Members*	*Description*
Indian			
Silicon Valley Indian Professionals Association (SIPA)	1991	1,000	Provides forum for expatriate Indians to contribute to cooperation between United States and India. Web site: www.sipa.org
The Indus Entrepreneur (TiE)	1992	560	Fosters entrepreneurship by providing mentors and resources. Web site: www.tie.org
Chinese			
Chinese Institute of Engineers (CIE/USA)	1979	1,000	Promotes communication and exchange of information among Chinese engineers and scientists. Web site: www.cie-sf.org
Asian American Manufacturers Association (AAMA)	1980	More than 700	Promotes the growth and success of U.S. technology enterprises throughout the Pacific Rim. Web site: www.aamasv.com
Chinese Software Professionals Association (CSPA)	1988	1,400	Promotes technology collaboration and facilitates information exchange in the software profession. Web site: www.cspa.com
Chinese American Computer Corporation (NBI)	1988	270 corporations	Mid-technology cluster of PC clone system sellers, majority from Taiwan. Web site: www.killerapp.com/nbi
Monte Jade Science and Technology Association (MJSTA)	1989	150 corporations, 300 individuals (West Coast)	Promotes the cooperation and mutual flow of technology and investment between Taiwan and the United States. Web site: www.montejade.org
Silicon Valley Chinese Engineers Association (SCEA)	1989	400	Provides network for mainland Chinese engineers to promote entrepreneurship and professionalism among members and establish ties to China. Web site: www.scea.org
Chinese American Semiconductor Professionals Association (CASPA)	1991	40 corporations, 1,600 individuals	Promotes technical, communication, information exchange, and collaboration among semiconductor professionals. Web site: www.caspa.com
North America Taiwanese Engineers Association (NATEA)	1991	400	Promotes exchange of scientific and technical information. Web site: http://natea.org
Chinese Information and Networking Association (CINA)	1992	700	Advocates technologies and business opportunities in information industries. Web site: www.cina.org
Chinese Internet Technology Association (CITA)	1996	600	Provides forum and network for Chinese Internet professionals and entrepreneurs to incubate ideas, learn from each other, and form potential partnerships. Web site: www.cita.net
North America Chinese Semiconductor Association (NACSA)	1996	600	Promotes professional advancement in semiconductor sector, interaction between the United States and China. Web site: www.nacsa.com

NOTE: Information in this table is based on more than 100 in-depth interviews by the author between January 1997 and January 1998.

These organizations combine elements of traditional immigrant culture with distinctly high-technology practices. They simultaneously create ethnic identities within the region and facilitate the professional networking and information exchange that aid success in the highly mobile Silicon Valley economy. They are not traditional political or lobbying organizations. With

the exception of the Asian American Manufacturers Association (AAMA), the activities of these groups are oriented exclusively toward fostering the professional and technical advancement of their members.

It is notable that the region's Chinese and Indian immigrants have organized separately from one another—as well as from Silicon Valley's mainstream professional and technical associations, such as the American Electronics Association, the Institute of Electrical and Electronic Engineers, and the Software Entrepreneurs Forum. They join the mainstream organizations, to be sure, but appear to be less active in these than they are in the ethnic associations. There is virtually no overlap in the membership of Indian and Chinese professional associations, although there appears to be considerable overlap within the separate communities, particularly the Chinese, with its multiplicity of differently specialized associations. Yet, there are ethnic distinctions within the Chinese technology community. The Monte Jade Science and Technology Association and the North American Taiwanese Engineers Association, for example, speak Mandarin (Chinese) at many meetings and social events, which excludes not only non-Chinese members but even Chinese from Hong Kong or southeast Asia who speak Cantonese.

An older generation of successful immigrant engineers and entrepreneurs in both the Chinese and Indian communities now plays an active role in financing and mentoring younger generations of coethnic entrepreneurs.

Many of these associations have become important forums for cross-generational investment and mentoring as well. An older generation of successful immigrant engineers and entrepreneurs in both the Chinese and Indian communities now plays an active role in financing and mentoring younger generations of coethnic entrepreneurs. Individuals within these networks often invest individually or jointly in promising new ventures, acting as "angel" investors who are more accessible to immigrants than is the mainstream venture capital community and who are willing to invest smaller amounts of money. The goal of the Indus Entrepreneur (TiE), for example, is to "foster entrepreneurship by providing mentorship and resources" within the South Asian technology community. Similarly, both the AAMA and the Monte Jade Science and Technology Association now sponsor annual investment conferences aimed at matching potential investors (often from Asia as well as the Silicon Valley) with promising Chinese entrepreneurs.

The Benefits of Local Ethnic Networks

I cannot definitively establish the economic benefits of these immigrant networks. However, the proliferation of ethnic professional associations in Silicon Valley during the l980s and 1990s corresponded with the growing visibility and success of Chinese- and Indian-run businesses. The entrepreneurs themselves give the networks much credit. According to Mohan Trika (personal communication, June 1997), a CEO of an internal Xerox spin-off called inXight,

> Organizations like TiE create self-confidence in the community. This confidence is very important. . . . It provides a safety net around you, the feeling that you can approach somebody to get some help. It's all about managing risk. Your ability to manage risk is improved by these networks. If there are no role models, confidence builders to look at, then the chances of taking risk are not there. That's what we are saying: "Come with me. I'll help you." This quickly becomes a self-reinforcing process: You create 5 or 10 entrepreneurs and those 10 create another 10. I can approach literally any big company, or any company in the Bay Area, and find two or three contacts. . . . Through the TiE network, I know so-and-so in Oracle, etc.
>
> This networking creates value, Trika said.
>
> Because we are a technology-selling company for the next generation of user interface, every major software company or any software company must have at least two or three Indians or Chinese in there. . . . And because they are there, it is very easy for me, or my technical officer, to create that bond, to pick up the phone and say: "Swaninathan, can you help me? Can you tell me what's going on?" He'll say, "Don't quote me, but the decision is because of this, this and this." Based on this, you can reformulate your strategy, your pricing, or your offer. . . . Such contacts are critical for start-ups. (S. Gupta, personal communication, May 29, 1997)

The increased visibility of successful Chinese and Indian entrepreneurs and executives in Silicon Valley in the 1990s has transformed their image in the native-born community as well. Some Asians today suggest that although the glass ceiling may remain a problem in traditional industries or in old-line technology companies, it is diminishing as a problem in Silicon Valley.

Sources of capital for Asian entrepreneurs are proliferating in part because of the growing flows of capital from Taiwan, Hong Kong, and Singapore in the 1990s. Several new venture-capital firms dedicated primarily to funding Asian immigrants were also started in the region during the 1990s: Alpine Technology Ventures, for example, has focused on Chinese companies, whereas the Draper International Fund specializes in financing Indian technology ventures. Other firms, such as Walden International Investment Group and Advent International, explicitly link Silicon Valley-based entrepreneurs to Asian sources of funding. Some of the major venture-capital firms are even said to he hiring Asian American partners to avoid losing out on deals going to foreign-born entrepreneurs. In addition, Silicon Valley's immigrant entrepreneurs may now be advantaged relative to their mainstream counterparts by their privileged ties to Asian sources of capital, markets, and manufacturing capabilities. The next section describes how the region's Chinese and Indian engineers are extending their networks back to their home countries and building translocal networks that benefit both Silicon Valley and growing regions in Asia.

THE GLOBALIZATION OF SILICON VALLEY'S ETHNIC NETWORKS

At the same time that Silicon Valley's immigrant entrepreneurs organized local professional networks, they were also building ties back to their home countries. The region's Chinese engineers constructed a vibrant two-way bridge connecting the technology communities in Silicon Valley and Taiwan; their Indian counterparts became key middlemen linking U.S. businesses to low-cost software expertise in India. These cross-Pacific networks represent more than an additional "ethnic resource" that supports entrepreneurial success; they also provide the region's skilled immigrants with an important advantage over their mainstream competitors who often lack the language skills, cultural know-how, and contacts to build business relationships in Asia.

These cross-Pacific networks . . . provide the region's skilled immigrants with an important advantage over their mainstream competitors.

The traditional image of the immigrant economy is the isolated Chinatown or "ethnic enclave" with limited ties to the outside economy (Sassen, 1988). Silicon Valley's new immigrant entrepreneurs, by contrast, are increasingly building professional and social networks that span national boundaries and facilitate flows of capital, skill, and technology. In so doing, they are creating transnational communities that provide the shared information, contacts, and trust that allow local producers to participate in an increasingly global economy (Kao, 1993; Kotkin, 1992; Portes, 1996).

As recently as the 1970s, only very large corporations had the resources and capabilities to grow internationally, and they did so primarily by establishing marketing offices or branch plants overseas. Today, by contrast, new transportation and communications technologies allow even the smallest firms to build partnerships with foreign producers to tap overseas expertise, cost savings, and markets. Start-ups in Silicon Valley today are often global actors from the day they begin operations: Many raise capital from Asian sources, others subcontract manufacturing to Taiwan or rely on software development in India, and virtually all sell their products in Asian markets.

The scarce resource in this new environment is the ability to locate foreign partners quickly and to manage complex business relationships across cultural and linguistic boundaries. This is particularly a challenge in high-technology industries in which products, markets, and technologies are continually being redefined—and where product cycles are routinely shorter than nine months. First-generation immigrants, such as the Chinese and Indian engineers of Silicon Valley, who have the language and cultural as well as the technical skills to function well in both the United States and foreign markets are distinctly positioned to play a central role in this environment. They are creating social structures that enable even the smallest producers to locate and maintain mutually beneficial collaborations across long distances and that facilitate access to Asian sources of capital, manufacturing capabilities, skills, and markets.

These ties have measurable economic benefits. Researchers at the University of California, Berkeley (Bardhan & Howe, 1998) have documented a significant correlation between the

presence of first-generation immigrants from a given country and exports from California. (For every 1% increase in the number of first-generation immigrants from a given country, exports from California go up nearly 0.5%.) Moreover, this effect is especially pronounced in the Asia-Pacific region where, all other things being equal, California exports nearly 4 times more than it exports to comparable countries in other parts of the world.

As Silicon Valley's skilled Chinese and Indian immigrants create social and economic links to their home countries, they simultaneously open the markets, manufacturing, and technical skills in growing regions of Asia to the broader business community in California. Firms in traditional as well as technology sectors, for example, now increasingly turn to India for software programming talent. Meanwhile, California's complex of technology-related sectors increasingly relies on Taiwan's speedy and flexible infrastructure for manufacturing semiconductors and personal computers, as well as their fast-growing markets for advanced technology components (Borrus, 1997; Dedrick & Kraemer, 1998). It is particularly striking that these advantages are now equally accessible to entrepreneurs such as Ramp's Mahesh Veerina, as well as to more established corporations. In short, although these new international linkages are being forged by a relatively small community of highly skilled immigrants, they are strengthening the entire economic infrastructure of California.

CONCLUSION

Skilled immigrants are an increasingly important—but largely unrecognized—asset for the California economy. During the past decade, Chinese and Indian engineers have started hundreds of technology businesses in Silicon Valley. These new immigrant entrepreneurs generated jobs, exports, and wealth for the region, and they have simultaneously accelerated the integration of California into the global economy. The long-distance social and economic linkages they are constructing contribute at least as importantly to the region's economic dynamism as does the more direct job and wealth creation. A transnational community of Taiwanese engineers coordinates mutually beneficial ties between technology producers in Silicon Valley and the state-of-the-art manufacturing and design expertise of the Hsinchu region (Tseng, 1995, 1997). Their Indian counterparts simultaneously have facilitated the growth of outsourcing between Silicon Valley and software developers in regions such as Bangalore and Hyderabad.

These emerging global ties allow start-ups and established firms in Silicon Valley to continue to flourish in spite of growing labor shortages at home. They have also accelerated the industrial upgrading of regions in India and Taiwan. The challenge of economic development in coming decades will increasingly involve building such transnational (or translocal) social and professional linkages. The rapid growth of Israel's technology industry, for example, has been coordinated by transnational networks of returning Israeli engineers and venture capitalists and parallels the Taiwanese experience in many respects (Autler, 2000). It is also striking to note that Taiwan has performed significantly better than have its other Asian neighbors in the recent economic crisis. The region's flexible industrial infrastructure and its strong ties to Silicon Valley are undoubtedly an important element in this resilience ("The Flexible Tiger," 1998).

This research underscores important changes in the relationship between immigration, trade, and economic development in the 1990s. In the past, the primary economic linkages created by immigrants to their countries of origin were the remittances they sent to those left behind. Today, however, a growing numbers of skilled immigrants return to their home countries after studying and working abroad, and even those who stay often become part of transnational communities that link the United States to the economies of distant regions. The new immigrant entrepreneurs thus foster economic development directly by creating new jobs and wealth, as well as indirectly by coordinating the information flows and providing the linguistic and cultural know-how that promote trade and investment flows with their home countries.

Scholars and policy makers need to recognize the growing interrelationships between immigration, trade, and economic development policy. The economic effect of skilled immigrants, in particular, is not limited to labor supply and wage effects. Some of their economic contributions, such

The strength of the California economy has historically derived from its openness and diversity, and this will be increasingly true as the economy becomes more global.

as enhanced trade and investment flows, are difficult to quantify, but they must figure into our debates. The national debate over the increase of H1-B visas for high-skilled immigrants, for example, focused primarily on the extent to which immigrants displace native workers. Yet, we have seen here that these immigrants also create new jobs and economic linkages in their role as entrepreneurs. Economic openness has its costs, to be sure, but the strength of the California economy has historically derived from its openness and diversity, and this will be increasingly true as the economy becomes more global. The experience of Silicon Valley's new immigrant entrepreneurs suggests that California should resist the view that immigration and trade are zero-sum processes. We need to encourage the immigration of skilled workers while devoting resources to improving the education of native workers.

The fastest-growing groups of immigrant engineers in Silicon Valley today are from Mainland China and India. Chinese, in particular, are increasingly visible in the computer science and engineering departments of local universities, as well as in the workforces of the region's established companies. Although still relative newcomers to Silicon Valley, they appear poised to follow the trajectory of their Taiwanese predecessors. Several have started their own companies, and they are already building ties back home, encouraged by the active efforts of Chinese bureaucrats and universities—as well as by the powerful incentive provided by the promise of the China market. Ties between Silicon Valley and India also will almost certainly continue to expand. Reversal of the brain drain is not yet on the horizon, but a younger generation of Indian engineers now expresses a desire to return home, which distinguishes them from many of their predecessors. Local organizations such as TiE have begun to expand their collaboration with Indian policy makers as well.

Whether the emerging connections between Silicon Valley and regions in China and India generate broader ties that contribute to industrial upgrading in these nations—and create new markets and partners for Silicon Valley producers—will depend largely on political and economic developments within those nations. Whatever the outcome, the task for California's policy makers remains to maintain open boundaries so that regions such as Silicon Valley continue to build and benefit from their growing ties to the Asian economy.

REFERENCES

Alarcon, R. (1997, January). *From servants to engineers: Mexican immigration and labor markets in the San Francisco Bay Area* (Working paper, California Policy Seminar, 4[3], pp. 1-28). Berkeley: University of California.

Asian Americans for Community Involvement. (1993). *Qualified, but . . . A report on glass ceiling issues facing Asian Americans in Silicon Valley.* San Jose, CA: Author.

Autler, G. (2000). *The globalization of high tech: The Silicon Valley-Israel Connection*. Unpublished master's thesis, University of California, Berkeley.

Bardhan, A. D., & Howe, D. K. (1998, February). *Transnational social networks and globalization: The geography of California's exports* (Working paper no. 98-262). Berkeley: University of California.

Borjas, G. J. (1994, December). The economics of immigration. *Journal of Economic Literature*, *32*(4), 1667-1717.

Borjas, G. J. (1995, spring). The economic benefits from immigration. *Journal of Economic Perspectives*, *9*(2), 3-22.

Borrus, M. (1997). Left for dead: Asian production networks and the revival of US electronics. In B. Naughton (Ed.), *The China circle: Economics and technology in the PRC, Taiwan and Hong Kong* (pp. 139-163). Washington, DC: Brookings Institution.

Dedrick, J., & Kraemer, K. L. (1998). *Asia's computer challenge: Threat or opportunity for the United States and the world*. New York: Oxford University Press.

Directory of Taiwan/Republic of China Companies in North America. (1995). New York: CCNA Investment and Trade Office & Monte Jade Science and Technology Association.

Dun & Bradstreet. (1998). Retrieved from Dun & Bradstreet Corporation database.

The flexible tiger. (1998, January 3). *The Economist*, 73.

Friedberg, R. M., & Hunt, J. (1995, spring). The impact of immigrants on host country wages, employment and growth. *Journal of Economic Perspectives*, *l9*(2), 23-44.

Hing, B. O., & Lee, R. (Eds.). (1996). *The state of Asian Pacific America: Reframing the immigration debates*. Los Angeles: Leadership Education for Asian Pacifics & UCLA Asian American Studies Center.

Johnson, J. M. (1998, November). *Statistical profiles of foreign doctoral recipients in science and engineering: Plans to stay in the United States* (NSF 99-304). Arlington, VA: National Science Foundation, Division of Science Resources Studies.

Johnson, J. M., & Regets, M. C. (1998, June 22). *International mobility of scientists and engineers to the United States—Brain drain or brain circulation?* (Issue Brief NSF 98-316). Arlington, VA: National Science Foundation.

Kao, J. (1993, March-April). The Worldwide Web or Chinese business. *Harvard Business Review*, *71*, 24-36.

Kotkin, J. (1992). *Tribes: How race, religion, and identity determine success in the new global economy.* New York: Random House.

Kroll, C., Jaffee, D. M., Bardhan, A. D., Kirschenbaum, J., & Howe, D. K. (1988). *Foreign trade and California's economic growth* (California Policy Seminar Research Report). Berkeley: University of California.

McCarthy, K. F., & Vernez, G. (1997). *Immigration in a changing economy: California's experience*. Santa Monica, CA: RAND.

Portes, A. (1996, March-April). Global villagers: The rise of transnatiorial communities. *American Prospect*, *25*, 74-77.

Sassen, S. (1988). *The mobility of capital and labor: A study in international investment and labor flows*. New York: Cambridge University Press.

Saxenian, A. (1994). *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.

Smith, J. P., & Edmonston, B. (Eds.). (1997). *The new Americans: Economic, demographic, and fiscal effects of immigration*. Washington, DC: National Academy Press.

Tseng, Y.-F. (1995). Beyond "Little Taipei": The development of Taiwanese immigrant businesses in Los Angeles. *International Migration Review*, *29*(2), 33-58.

Tseng, Y.-F. (1997, May 9-10). *Immigration and transnational economic 1inkages: Chinese immigrants and internationalization of Los Angeles*. Paper presented at the Institute of European and American Studies, Academia Sinica, Taipei, Taiwan.

U.S. Bureau of the Census. (1992). *Census of population and housing, 1990: Public use microdata samples U.S.* [Machine-readable data files]. Washington, DC: Author.

Waldinger, W., Aldrich, H., & Robin Ward Associates. (1990). *Ethnic entrepreneurs: Immigrant business in industrial societies*. Newbury Park, CA: Sage.