India-Born in the U.S. Science and Engineering Workforce

SAGE

Roli Varma[1]

Abstract

With the intense debates over the extent to which foreign-born in the U.S. science and engineering (S&E) workplace displace U.S.-born, very few have focused on the work experience and professional activities of foreign-born in S&E. This article examines the extent to which India-born in the U.S. S&E workforce consider themselves professionally successful and/or facing institutional barriers, and their transnationalism between the United States and India. The article is primarily based on in-depth interviews conducted with different strata of scientists and engineers from India.

The United States' foreign-born (those who were not U.S. citizens at birth) represent 33.5 million, or 11.7% of the total population (Larsen, 2004). The country's 23 million foreign-born workers account for 15.3% of the total civilian workforce, age 16 and older (Bureau of Labor Statistics, 2007). Over the past decade, foreign-born in the U.S. science and engineering (S&E) workforce have grown dramatically. The number of foreign-born grew from 12% in 1994 to 16% in 2002 of all S&E workers, which is greater than the increase of all the foreign-born in total labor force from 10% to 13% for the same period (Commission on Professionals in Science and Technology, 2005). In 2003, of 21.6 million scientists and engineers (people who have at least a bachelor's degree in a science or an engineering field or an occupation in one of those fields) in the United States, 16% (3,352,000) were foreign-born (Kannankutty & Burrelli, 2007).

Foreign-born from India constitute less than 1% of the total U.S. population (Schmidley, 2001). Yet, a significant number of them are highly concentrated in the U.S. S&E workforce. In 2003, out of 3.3 million foreign-born scientists and engineers in the United States, 15.4% (515,000) were from India, followed by 9.7% (326,000) from China, 9.1%

[1]University of New Mexico, Albuquerque, USA

Corresponding Author:
Roli Varma, School of Public Administration, MSC05 3100, 1 University of New Mexico, Albuquerque, NM 87131
Email: Varma@unm.edu

(304,000) from the Philippines, and the remaining from a broad range of countries (Kannankutty & Burrelli, 2007). An increasing presence of foreign-born from India in the U.S. S&E workforce has resulted in their portrayal as the "model immigrant," which suggests that they need to take pride in being at the top of the curve (Wadhwa, 2006). They are portrayed as the model immigrant mostly because they have come to the United States with little money but nevertheless have succeeded because of their faith in education, a strong work ethic, and socio-cultural values that resonate with traditional American counterparts. Dinesh D'Souza, a celebrated conservative from India, has contrasted the success of Indians with the failures of African Americans; it is suggested that other minorities should emulate Indians to be successful in the United States. Even though the image of the model immigrant seems flattering, it is based on a monolithic perception of Indian immigrants that fails to recognize diversity among them.

This article delves deeper and studies India-born in the U.S. S&E workforce by dividing them into different groups—entrepreneurs, faculty and researchers, workers, and students—to examine variations in their work experience. Despite these variations, all these groups represent a technical class that is engaged in transnational activities between India and the United States, a new emerging trend within the global economy. The article shows that migration of India-born scientists and engineers cannot be studied solely from a country of origin (i.e., India) or a country of settlement (i.e., the United States) perspective.

The article is primarily based on in-depth interviews conducted by the author with different groups of India-born from 2004 to 2006. First, interviews were conducted with 82 India-born scientists and engineers in the United States. The sample includes 26 respondents from 24 academic institutions, 39 respondents from four high-technology industrial R&D laboratories, and 17 respondents from two national laboratories. A large majority of respondents had a PhD; only 19 had a master's as their highest degree. Most of them received their highest degree from the United States, some received their highest degree from India, and a few received them from Canada and Europe. Second, interviews were conducted with 38 Indian scientists and engineers, who received a doctorate in the United States and returned to India to work in three academic institutions and one government research organization. Third, interviews were conducted with two high-profile India-born entrepreneurs, one on the East Coast and the other on the West Coast. Both had a bachelor's degree from the Indian Institutes of Technology (IIT) and earned a master's and a PhD in the United States. Finally, interviews were conducted with 25 India-born who came from India on H-1B visas to work. They had a bachelor's degree from India and worked for two high-technology companies in the Silicon Valley. In addition, a survey was conducted by the author with almost 260 students attending two IITs in 2007-2008 on their future plans to study and/or work in the United States, among other things.

Immigration Background

Before 1965, Indians were either restricted or prohibited from entering the United States. The 1965 Immigration and Nationality Act eliminated the restrictive national origins

system in favor of a quota system. It established the allocation of all immigrant visas on a first come, first serve basis, subject to a tiered preference system. In addition to reuniting families, the 1965 act gives preference to professionals, scientists, and skilled and unskilled workers in occupations for which labor is in short supply. To address the problem of competition from immigrant workers, foreign workers are to acquire certification from the U.S. Department of Labor before obtaining visas. Employers seeking to hire foreign workers have to demonstrate that they are unsuccessful in recruiting U.S. citizens for the job in question and that they would pay the foreign workers at least the prevailing wage.

The 1990 Immigration Act introduced admission of 65,000 temporary "specialty occupation" workers (aliens entering under the H-1B nonimmigrant visa to fill jobs requiring a baccalaureate degree or equivalent work experience) per year. The temporary visas are issued for a stay of up to 6 years. The American Competitiveness and Workforce Improvement Act of 1998 increased H-1B visa quotas to 115,000 for each fiscal year from 1999 to 2001, before putting the quota back to 65,000. The American Competitiveness in the Twenty-First Century Act of 2000 increased H-1B visa quotas to 195,000 for each of three fiscal years (2001, 2002, 2003), and then back to 65,000. In 2005, federal officials made an exception in the form of an additional 20,000 visas for those who held a master's or higher degree from U.S. institutions.

The United States also allows foreign students to come on F-1 visas, which is for people who have been accepted into a program to study or conduct research at an accredited U.S. college or university. Once the degree is completed, they can apply for Optional Practical Training (OPT), which allows them to be a full-time employee for a year. They can be sponsored by their employer for an H-1B work visa, and immigration after 4 or 5 years of service.

Since 1965, the number of foreign-born from India living in the United States has increased dramatically, from about 51,000 in 1970 to about 1 million in 2000. It is estimated that 1,519,157 India-born were living in the United States in 2006 (Terrazas, 2008). A preference for the employment-based visas for skilled workers caused the immigration of S&E-trained Indians to grow after 1965 and accelerate rapidly in the 1990s.

Entrepreneurs

Indian immigrants have become the most dominant ethnic group in founding companies in the high-technology sector in the United States. A study of new immigrant entrepreneurs in the Silicon Valley revealed that Indian immigrants held 7% of technology businesses that started between 1980 and 1998 (Saxenian, 1999). Since the mid-1990s, Indian immigrant entrepreneurs have increased their percentage in starting engineering and technology companies. A recent study of engineering and technology companies founded between 1995 and 2005 showed that Indian immigrant entrepreneurs were key founders of 15.5% of all Silicon Valley start-ups (Wadhwa, Saxenian, Rissing, & Gereffi, 2007). Another study found that India, with 32 companies (22%), ranked first as the country of origin for immigrant-founded, venture-backed public companies (Anderson & Platzer, 2007). Indian immigrant entrepreneurs tend to launch

companies in cutting-edge fields such as software (46%), innovation/manufacturing-related services (44%), computers/communications (5%), semiconductors (2%), bioscience (2%), and environmental (1%). Their companies tend to be dispersed around the country, although they have sizable concentrations in California (26%) and New Jersey (14%) (Wadhwa, Saxenian, et al., 2007).

A profile of India-born entrepreneurs shows that they bring unique advantages in terms of human capital to the United States. Most entered the United States as graduate students in a science or an engineering field. Before coming to the United States, they had earned a bachelor's degree from the top Indian universities such as the IITs. They wanted to go to the cutting-edge schools for graduate degrees, and the United States offered the best educational system in S&E fields. In the United States, they graduated with master's and/or doctorate degrees from leading universities. After studies, they gained experience by working for renowned industrial research and development (R&D) laboratories and top institutions of higher education. After working for a decade or so, they believed that they possessed managerial and entrepreneurial capacities to start and manage their own companies.

Yet, India-born entrepreneurs, who came to the United States before the 1980s, were somewhat reluctant to launch and manage high-technology companies. Their main goal for coming to the United States was to acquire knowledge and not to start a business. As one chief executive officer (CEO) interviewed said, "My main interest was in teaching and being a professor. Business interest was purely on the periphery. In fact, I thought business was not a good thing to be engaged in." It seems that Indian immigrants were confident about their scientific knowledge and technical skills, but they lacked confidence beyond being a scientist or an engineer and becoming successful in the field outside their expertise. Most important, they lacked financial capital because they belonged to the middle class. They had to find seed money to finance their grand plan at a time when India-born entrepreneurs "were an untested commodity in the Silicon Valley" (Chang, 2000, p. 1). In the Silicon Valley, venture capital financing has often been tied to the requirement that non-Asian senior executives be hired (Saxenian, 1999).

In their employing companies or academic institutions, many India-born entrepreneurs were blocked from ascending to executive positions. There was a widely held perception among U.S. managers that Indian immigrants are not suited for top decision-making positions (Varma, 2006). Indian immigrants working in the industry knew that, in the United States, they could climb to be a chief-scientist or a group leader, but they could not become the head of a company or its CEO. Similarly, Indian immigrants employed in academia knew that they could not become a dean or a provost. Often, frustration with being trapped on a lower step of the promotion ladder, while having intense insight into the industry, made India-born entrepreneurs launch their own companies. As Narpat Bhandari, the founder of Aspen Semiconductor in 1986, said, "When I said I wanted to run the company, they said I was not qualified. That is when I asked myself, 'Why can't we Indo-Americans do something better for ourselves?' We want to be a part of the mainstream. We don't want to feel like second-class citizens"

(quoted in Chang, 2000, p. 1). One CEO interviewed explained, "I broke away from the rest of the crowd which was only focusing on making quick money by applying for cellular licenses. I knew what the next thing will be. So, I took my knowledge and harnessed that into coming up with software and processes which designed the real networks."

Since the mid-1990s, there has been a mental break among India-born scientists and engineers in the United States, and a new Indian entrepreneurial culture has emerged: "From you *can't* be an entrepreneur to you *can be* an entrepreneur," noted a CEO interviewed. Asa Kalavade, co-founder of Tatara Systems in 2001, declared, "We are serial entrepreneurs" (quoted in Anderson & Platzer, 2007, p. 31). Due to the emergence of new entrepreneurial culture, there are more high-technology companies founded or co-founded by India-born entrepreneurs since the 1990s. A significant number of India-born scientists and engineers have joined the class of multi-millionaires, whereas a few are billionaires.

Successful India-born entrepreneurs have taken important initiatives to assist other Indians in launching their own companies by forming business organizations. The Silicon Valley Indian Professionals Association (SIPA) was founded in 1987 to provide a common platform for young entrepreneurial expatriate Indians to contribute to cooperation between the United States and India in technology areas. The Indus Entrepreneur (TiE)—also known as the Indian Mafia—was founded in 1992 to foster entrepreneurship among South Asians by providing mentorship and resources that would help them succeed in the United States and establish links with India. These associations have provided South Asians with special access to resources and information, thereby improving their chances of success in the United States and elsewhere. Through these associations, Indians are able to exchange ideas and information, establish networks, build contacts to find investors, and acquire resources that otherwise are not available to them. For instance, TiE has assisted in funding at least 300 start-up companies including Brocade Communications, Exodus Communications, Juniper Networks, Cerent, and Versata. Such business networks are now playing a key role in the emergence of a new entrepreneurial culture among Indians (Saxenian, 2006).

Faculty and Researchers

A significant number of India-born scientists and engineers in the United States are faculty in academic institutions and researchers in industrial R&D laboratories and national laboratories. Most of these India-born came to the United States as foreign students to pursue a graduate degree in a science or an engineering field. After finishing their studies, they were offered jobs as faculty in academic institutions and researchers in industrial and national laboratories and, thus, got their student visas converted into permanent residency.

Because of rigorous training in mathematics from kindergarten to high school in India, India-born faculty and researchers tend to be mathematically minded, analytical, good at diagnosing technical problems, and able to solve such problems very quickly.

As one interviewee from industry said, "We all heard [President] Bush's speech when Vajpayee [then India's prime minister] came. Bush said that we all know that India's best export is brains." In addition, compared with other foreign-born Asians (e.g., Chinese, Vietnamese, Cambodians), "[India-born] tend to be proficient in English," noted an interviewee from academia. It is mostly because India has a long history of relying on English as a medium of S&E instructions. Furthermore, India-born faculty and researchers face different incentives compared with U.S.-born in the United States. The former bears monetary costs of moving, staying in touch with family, and financial obligations to those left in India, as well as nonmonetary costs such as loss of social and cultural milieu specific to India. As a consequence, India-born faculty and researchers work hard, get the job done, and put in long hours. An interviewee from academia believed, "We work very hard. Everyone knows that. . . . I do not believe Americans will volunteer such long hours the way we do."

Superior academic credentials translate into better employment opportunities for India-born faculty and researchers. Earning data suggest that very few experience job discrimination in terms of salary. In 1999 (the most recent year for which salary information is available), foreign-born scientists and engineers from India earned a median annual salary of $67,000, which is higher than the median annual salary earned by non-Hispanic White ($61,000), Hispanic ($55,000), and Black ($53,000) scientists and engineers (Kannankutty, 2005). However, it should be noted that the aggregate salary data do not show that a large majority of India-born scientists and engineers are geographically concentrated in those metropolitan areas where income (and cost of living) is high. The majority of interviewees believed that they were paid comparably to their colleagues mostly because they have to "out-perform their White colleagues to be at par" and employers, especially in the industrial sector, know that salary discrepancies would result in the loss of employees to other organizations.

Yet, once they have been recruited, India-born faculty and researchers face structural obstacles toward development of their careers. After they begin working, they are viewed as foreigners, outsiders, passive, unassertive, lacking higher level communication skills, and more equipped for technical rather than leadership work. Also, India-born faculty's and researchers' human capital rests largely in their higher education, training, and technical skills. They have little social capital as they remain outside the necessary social networks due to their nationality, race/ethnicity, language, and culture and, thus, miss crucial opportunities for further career advancement. Interviewees noted that they were unable to break into "the old boys club," a social network into which India-born faculty and researchers are seldom welcomed. They face the "silicon ceilings"—the barriers that block qualified Indian immigrants from moving forward to top decision-making positions within public and private organizations (Varma, 2006). The U.S. Census Bureau (2000) reveals that a higher percentage of Indians (58%) compared with the total U.S. population (34%) are in management, professional, and related occupations. However, they are heavily concentrated in professional (74%) rather than in management (17%) occupations.

According to the interviewees, India-born faculty and researchers are kept under the ceiling because of the "superior scientists, but inferior managers" label. In national

laboratories, as one interviewee said, "There is an established tradition that positions of power are generally held by White men." In industrial companies, "If there are symbolic promotions for Indians, they are at the first level of management, and nothing beyond that," noted an interviewee. The situation seemed worse in academia, as one interviewee believed that "academia does not accept race/ethnicity as they give impression of." Most important, it is believed that India-born themselves wish to remain as faculty and researchers due to their strong technical and quantitative skills rather than be managers due to their weak colloquial English and communication skills. Such perception frustrates those India-born faculty and researchers who wish to climb the managerial ladder. Unlike business associations undertaken by successful India-born entrepreneurs to assist Indians in launching their own companies, there are rarely Indian associations that could provide assistance to India-born faculty and researchers to move beyond the technical class.

High-Tech Workers

With the economic liberalization policies introduced by the Indian government in 1991, it is relatively easy for Indians with a bachelor's degree in S&E to find employment in the United States and elsewhere because their knowledge can be transferred across national borders and they have working knowledge of English. India has been taking the largest share of H-1B visas since the program was implemented in the United States. For instance, 118,520 (44%) of the H-1B petitions approved in the fiscal year 2005 were granted to individuals born in India (U.S. Department of Homeland Security, 2006). India-born coming to the United States on H-1B serve a role of *coolies*, a term originally applied to unskilled laborers mostly from China and India in the 19th and early 20th centuries (Behan & Linden, 2006).

Some India-born workers come to the United States on H-1B visas because they were working with subsidiaries of U.S. companies in India and at some point their work was needed in the United States. However, many India-born workers are recruited by "body shops" or manpower companies who can supply high-tech workers very quickly to the companies in the United States and elsewhere. The accepted practice is that the company, which hires high-tech workers, should pay recruiting agencies. However, while recruiting for the U.S. companies, many recruiting agencies take a cut for themselves from India-born high-tech workers. As one interviewee acknowledged, "I had to pay a hefty fee to [the recruiting agency] so they can cover the cost of all the paperwork they had done for me."

Many companies obtain high-tech workers from India at a discount from recruitment agencies. Increasingly, the H-1B visa program is used by Indian companies who outsource work to the United States (McGee, 2007). According to U.S. law, employers must pay H-1B workers either the same rate as other employees with similar skills and qualifications or the prevailing wage for that occupation and location. However, H-1B workers tend to earn significantly less (up to 25%) than their American counterparts (McManes, 2006; Miano, 2005). For instance, Syntel, which is run by Indians, in its operations in New Jersey, had willfully paid its India-born high-tech workers on

H-1B visas $34,000 per year rather than the prevailing rate of $41,000 required by law—underpayment of nearly 20% (U.S. Department of Labor, 1999). Phiroz Vandrevala, vice president of Tata Consultancy Services, declared in an interview, "Our wage per employee is 20 to 25 percent lesser than U.S. wage for a similar employee" (quoted in Singh, 2003, p. 1). Unlike India-born faculty and researchers who are able to command high salaries, India-born workers subject themselves to lower salaries. Most interviewees were somewhat reluctant to talk about their salaries, raises, and promotions. Often, it was hard for them to know whether their salaries are competitive in the United States. As one interviewee declared, "I have no clue how much people with my experience are supposed to be paid here." Another interviewee explained,

> We come here on a fixed contract for three years. So the only way to get better salaries is to change the company, which is not possible without the sponsorship from another company. So we are stuck with our salaries for some time.

There appeared to be some dissatisfaction with earnings because interviewees believed that they were drawing a salary somewhat lower than U.S.-born as well as some rationalization because they would not have gotten such salary in India in their 20s and 30s and experience in the United States.

U.S. federal law holds that benching—temporarily laying off an employee or putting the employee in nonproductive status without pay or with reduced pay during a period of no work—is illegal, and the employer must pay the workers what was stated on the H-1B visa petition. However, benching is a common practice among high-tech workers on H-1B visas (Cohn & Roche, 2000). India-born high-tech workers tend to be indentured to a company and, thus, they cannot switch jobs. Often, the recruiting company (body shop) makes them sign an employment contract under which a worker has to pay a significant sum in damages if he or she fails to stay with the company for a certain duration and to give the firm advance notice of quitting. This results in India-born high-tech workers feeling at risk of being sued or deported. As one interviewee declared, "I do not want my visa to be canceled. So, I have to do my best to keep [manager] happy."

Whenever there is an economic slowdown in the United States and India-born high-tech workers on H-1B visas lose their employment, they cannot find another job in a different company. It is because, according to the U.S. Immigration and Naturalization Service (INS, 2003), an H-1B worker is "out of status" when he or she has lost his or her job. The INS makes an exception if H-1B workers qualify under "extraordinary circumstances," a decision that is made on a case-by-case basis and can take more than 2 months (Stone & Conway, 2001). U.S.-born workers who are also laid off during an economic slowdown blame workers on H-1B visas who continue to hold jobs. There is a feeling that workers on H-1B visas are spared layoffs because they make less than U.S.-born workers do and are easier to be bossed around. As one interviewee resented, "We pay taxes like everyone else. We are not going to get these taxes back. Still, we are told to be causing economic problem for Americans."

Young India-born men dominate high-tech workers on H-1B visas. Their wives come with them on an H-4 visa. It allows wives to stay in the United States as dependents of H-1B visa holders but does not allow them to work even though they may be qualified to work on specialty occupations. In the end, they are unable to use their education and training until they return to India. In addition, there have been several incidences of wives on H-4 visas being physically and emotionally abused by their husbands. These wives cannot leave their husbands in the absence of the primary applicant, which gives their husbands complete control over their wives' lives (Devi, 2002). If divorced on an H-4 visa, women are immediately considered deportable.

Students

India has largely retained a Western model of S&E education and training. Indian universities rely on modern S&E knowledge and scientific methods. An undergraduate S&E degree from the 15 campuses of IIT is generally considered the equivalent of an undergraduate degree from prestigious U.S. institutions of higher education such as Cal-Tech, Harvard University, MIT, or Stanford University. The United States, as the center of graduate education in S&E fields, has been pulling students from India. After China and Taiwan, India is the major country of origin for foreign doctoral graduate students in the United States, with approximately 90 million in its college age cohort. Between 1985 and 2005, students from India have earned more than 18,500 S&E doctoral degrees at U.S. universities mainly in engineering, biological sciences, physical sciences, and computer sciences (National Science Board, 2008).

In general, Indian graduate students are supported by assistantships, which allow them to participate in the instruction, advising, and evaluation of undergraduate students. Several interviewees indicated that American undergraduates found them to be very thorough with the course content but complained about their language and communication skills. Interviewees felt that they were not prepared by the department or given any guidelines to take teaching assignments soon after their arrival from India. As one interviewee said, "After we arrived, we participated in two orientations, one conducted by the international program and the other by the department. Then, we got our teaching schedule. Nobody told us what to do in the classroom." Another interviewee believed that "leaving us alone to teach was neither productive for us nor for undergraduates. We were extremely concerned about our teaching skills, which we did not have. We studied English in India, but we were not sure if students understood us." Some interviewees found American students to be so fixated on the Indian accent that they did not make any distinction between those who were fluent in English and those who were not and considered every Indian poor in English. Overall, interviewees were very conscious of the fact that "Americans make fun of the Indian accent."

Increasingly, scholarships from U.S. universities are shrinking whereas cost of education is going up. Indian students who come without or with partial assistantship must find work to support their studies and living expenses. These students become frustrated with limited job opportunities; they are only allowed to work on the campus. Often,

they have to support themselves from personal and family sources. According to a study commissioned by the State Department, in the 2006-2007 academic year, foreign students accounted for more than $20 billion in spending, about half on tuition and fees and half on living expenses (Lewin, 2007).

Some Indian students are married and their spouses come on F-2 visas, which allow them to stay in the United States as dependents of F-1 visa holders but do not allow them to work even though they may be qualified to work in specialty occupations. This leads to boredom and frustration for spouses. As one interviewee said, "My wife could not do anything in U.S. other than watching television. She is an intelligent person, with a master degree. Here she is working full-time and happy. There she was not working and extremely frustrated."

Earlier, the dream of most Indian students was to come to the United States for graduate studies (Varma, 2006). This attraction to go to the United States for higher education seems to be changing among Indian students from top institutions for multiple reasons. A survey conducted by the author with Indian students at two IITs showed that they prefer not to go for higher studies, because they find ample job opportunities in India and elsewhere. Earlier, it was rarely the case that Indian undergraduates would be hired in India for jobs in India and abroad. Now, students graduating from top institutions are sought after by Indian companies as well as U.S. and European multinationals for filling positions. The job packages are extremely lucrative. So, the economic reasons for coming to the United States and hustling through graduate studies for 6 or 7 years are becoming less attractive for IIT students.

Furthermore, surveyed IIT students who would like to go for higher studies showed a preference for the management field. They believed that they will have an edge by combining undergraduate engineering with graduate management degrees, which shows their entrepreneurship spirit. Venture capital is available within India by Indian entrepreneurs abroad. Many venture capitalists from the United States are also visiting India trying to woo entrepreneurs there. The United States provides little financial support for master's students from India, especially in the field of management.

Transnationalism

Migration of people from India to the United States has been seen as brain drain—a one-way movement, or an exodus, that involves the movement of highly skilled personnel from the developing to the developed countries and that benefits only the developed (host) countries (Mahanti, Krishna, Haribabu, Jairath, & Basu, 1995). Although it was rare for India-born in the U.S. S&E sector to cut their links with India completely, very few returned in the past. Now, some people are returning to India (either by choice or without choice) after acquiring education and/or training in the United States, which has become a highly desired asset in India. Those who do not return to India offset some negative effects of their departure by maintaining and building professional connections with the S&E community in India.

India-born entrepreneurs facilitate S&E cooperation with India and other countries including Pakistan (Saxenian, 2006). In the past, only large Western corporations were able to grow internationally. Since the early 1990s, technopolies have materialized in several Indian cities like Bangalore, Gurgaon, Hyderabad, and Madras. Many India-born entrepreneurs in American technopolies are increasingly linking U.S. companies with Indian technopolies. They have a distinct advantage because they are bilingual and bicultural; they speak the same language and share the work culture of both countries. It is progressively more common for Indians who have become successful in the United States to export their knowledge and skills back to India. Because there are very few "angel investors" (who invest in a start-up that is unable to raise venture capital) in India, India-born entrepreneurs provide funds and support to start-up companies. They have become "a significant force for change in India," noted K. B. Chandrasekhar, founder of Exodus (quoted in Luce, 2001, p. 12).

Most India-born faculty and researchers also tend to smooth the progress of international cooperation between India and the U.S. S&E enterprise, although not at the financial level like India-born entrepreneurs. The communication revolution seems to have brought India closer to the United States for India-born faculty and researchers. In the past decade, systematic linkages between national and expatriate faculty and researchers have accelerated, mostly due to the growth of electronic networks inside India. In addition, India-born faculty and researchers in the United States make periodic visits to India, attend conferences and workshops, give talks and short courses at Indian institutions, collaborate on projects, and give advice on economic, scientific, and technical issues. Many have come to view themselves as "global citizens" rather than Indian citizens or U.S. citizens (Varma, 2007).

Because they are supposed to be in the United States temporarily, India-born high-tech workers and students keep a close relation with India through information and communication technologies. India-born high-tech workers regularly send remittances to the family members left in India. Most important, they are closely connected with the Indian S&E sector through employment in U.S. companies in the United States, which also have subsidiaries in India, as well as in Indian companies outsourcing to the United States (Aneesh, 2006).

Increasingly, these international connections are being institutionalized, which allows expatriates and nationals to participate in a global economy. As both communities exchange information, share work, and allocate resources, they actively contribute to an emergent global reality where the borders containing India-born people in the fields of S&E are increasingly virtual and beyond the control of any country (Varma, 2007). This suggests that "brain drain" has increasingly become "brain circulation" for India.

Lately, the term *brain drain* is increasingly being used with respect to the reverse flow of skilled immigrants from the United States to their home countries. It is argued that highly skilled foreigners are returning home due to immigration red tape (Wadhwa, Jasso, Rissing, Gereffi, & Freeman, 2007). To prevent this, Thomas Friedman (2007), *New York Times* columnist and celebrated author of the book *The World Is Flat*, has argued that foreign students receiving a doctorate from U.S. institutions should get

permanent residency status immediately to encourage them to do their research and innovation in the United States rather than in their home countries.

Some India-born return to exploit new opportunities emerging in India, whereas others return due to the restrictions imposed by U.S. immigration. Most important, Indian students and high-tech workers have multiple other places to go to beside the United States. Canada, the European Union, the United Kingdom, Australia, and New Zealand are aggressively recruiting the world's best and brightest students by streamlining higher education. For instance, from 2002 to 2004, the number of foreign students increased by 21% in Britain, 23% in Germany, and 28% in France ("Survey," 2005). Many non-English-speaking European countries have begun to offer graduate classes in English to attract foreign students. Similarly, these countries are pursuing high-tech workers to compete successfully in the global economy. For instance, the European Union is attempting to provide a fast-track immigration program known as the "blue card" to bring an additional 20 million workers from developing countries over the next 20 years (Broache, 2007). In addition to issuing the card within 1 to 3 months of their arrival, the European Union plans to offer all social benefits.

The United States no longer enjoys the monopoly it has had since World War II as the place for higher studies and work in S&E fields. Yet, the reverse brain-drain argument is increasingly used by the industrial spokespersons for the United States to open its border and relax immigration restrictions. In reality, a large majority of returning Indians (e.g., temporary workers) are unlikely to be inventors or co-inventors of patents. Also, the prestige of the United States in S&E still keeps a large majority of India-born inside the country. Nonetheless, the United States needs to reexamine its immigration policies to keep talent inside the country.

Conclusion

This article has shown that the conceptualization of India-born as the model immigrant is problematic. Its proponents seldom examine what happens to different strata of India-born once they enter the U.S. S&E workforce. India-born are recruited to work mainly in those S&E roles that are noncompetitive with the dominant Whites (e.g., faculty, researchers). Such occupations grant India-born people a higher socioeconomic status, as reflected mainly by higher salaries, when compared with others. But, most positions of authority and power (e.g., high level managers, deans, provosts) seem to be reserved for others. If they are CEO or head of a company, it is often because they founded or co-founded it themselves. Seeing themselves as outsiders to the mainstream, they use ethnic networks that allow them to get around structural shortcomings in the U.S. S&E sector, on one hand, and facilitate mobility for the next generation of Indians, on the other hand. Most important, a large number of India-born are high-tech workers; they are brought to the United States to assist the country's economic standing in the global market and deal with its high-tech labor shortage problems. They subject themselves to body shops in India, perform duties that are not commensurate with their qualifications, earn less money than their American counterparts,

and cannot switch jobs in accordance with necessity. They remain indentured workers in the United States. Visa-related matters also put a number of restrictions on Indian students' job opportunities. With the new opportunities available to IIT students inside India, fewer students from IITs and more students from second-tier institutions are likely to come to the United States.

The article further shows that transnational migration of India-born is taking place within virtual and social spaces that are continually modified through their professional and economic activities in India and in the United States. The flow of people, money, ideas, and professional activities has transformed India-born scientists' and engineers' lives in the United States as well as the lives of those left behind. This article has focused mostly on the workforce dimension of India-born in the S&E sector; there is a need to study informal and formal cultural, economic, political, religious, and social activities to understand transnationalism of India-born in the United States.

Acknowledgments

Declaration of Conflicting Interests

Funding

References

Anderson, S., & Platzer, M. (2007). *American made: The impact of immigrant entrepreneurs and professionals on U.S. competitiveness*. Arlington, VA: National Venture Capital Association.

Aneesh, A. (2006). *Virtual migration: The programming of globalization*. Durham, NC: Duke University Press.

Behan, R. P., & Linden, M. (Eds.). (2006). *Coolies, capital and colonialism: Studies in Indian labour history*. Cambridge, UK: Cambridge University Press.

Broache, A. (2007, October 27). U.S. firms fear Europe will snatch up foreign tech workers. *C/Net News*, p. 1.

Bureau of Labor Statistics. (2007). *Foreign-born workers: Labor force characteristics in 2006* (USDL 07-0603). Washington, DC: U.S. Department of Labor.

Chang, J. (2000). Indian Americans' powerful tech presence. *Asian Week*, *21*(34), 1-5.

Cohn, G., & Roche, W. F. (2000, February 21). Indentured servants for high-tech trade. *Baltimore Sun*, p. 4.

Commission on Professionals in Science and Technology. (2005). *The foreign-born in science and technology*. Washington, DC: Author.

Devi, S. U. (2002). Globalisation, information technology and Asian Indian women in US. *Economic and Political Weekly*, *370*, 4421-4428.

Friedman, T. L. (2007, May 23). Laughing and crying. *The New York Times*, p. 23.

Kannankutty, N. (2005). *Special unpublished tabulation. 1999 SESTAT*. Arlington, VA: National Science Foundation.

Kannankutty, N., & Burrelli, J. (2007). *Why did they come to the United States? A profile of immigrant scientists and engineers* (Info Brief, NSF 07-324). Arlington, VA: National Science Foundation.

Larsen, L. J. (2004). *The foreign-born population in the United States: 2003* (Current Population Reports, P20-551). Washington, DC: U.S. Census Bureau.

Lewin, T. (2007, November 12). Foreign students contribute a lot to U.S. economy. *International Herald Tribune*, p. 1.

Luce, E. (2001, February 28). India lures the high-tech expat dollar. *Financial Times*, p. 12.

Mahanti, S., Krishna, V. V., Haribabu, E., Jairath, V. K., & Basu, A. (1995). *Scientific communities and brain drain: A sociological study*. New Delhi: Sage.

McGee, M. K. (2007, May 17). Who gets H-1B visas? Check out this list. *InformationWeek*, pp. 1-3.

McManes, C. (2006). Reports, studies shatter myth that H-1B visa holders are paid same wages as U.S. citizens. *EurekAlert*. Retrieved January 26, 2008, from http://www.eurekalert.org/pub_releases/2006-09/i-rss090606.php

Miano, J. (2005). *The bottom of the pay scale: Wages for H-1B computer programmers*. Washington, DC: Center for Immigration Studies.

National Science Board. (2008). *Science and engineering indicators* (NSB-08-1). Arlington, VA: National Science Foundation.

Saxenian, A. L. (1999). *Silicon Valley's new immigrant entrepreneurs*. Berkeley: Public Policy Institute of California.

Saxenian, A. L. (2006). *The new argonauts: Regional advantage in a global economy*. Cambridge, MA: Harvard University Press.

Schmidley, A. D. (2001). *Profile of the foreign-born population in the U.S.: 2000* (Current Population Reports, P23-206). Washington, DC: U.S. Census Bureau.

Singh, S. (2003, June). U.S. visas are not a TCS-specific issue. *BusinessWorld* (India), p. 1.

Stone, B., & Conway, F. (2001, May 14). Laid off, with no place to call home. *Newsweek*, pp. 36-40.

Survey: Higher education wandering scholars. (2005, September 10). *The Economist*, pp. 1-15.

Terrazas, A. (2008). Indian immigrants in the United States. *Migration Information Source*. Retrieved August 1, 2008, from http://www.migrationinformation.org/USfocus/print.cfm?ID=687

U.S. Census Bureau. (2000). *Census 2000 summary file 4 (SF4)–sample data*. Retrieved April 24, 2005, from http://factfinder.census.gov/servlet/DTTable

U.S. Department of Homeland Security. (2006). *Characteristics of specialty occupation workers (H-1B): Fiscal year 2005*. Washington, DC: U.S. Citizenship and Immigration Services.

U.S. Department of Labor. (1999). *The triennial comprehensive report on immigration: Part II economic impacts*. Washington, DC: Government Printing Office.

U.S. Immigration and Naturalization Service. (2003). *Statistical yearbook of the immigration and naturalization service, 2001*. Washington, DC: Government Printing Office.

Varma, R. (2006). *Harbingers of global change: India's techno-immigrants in the United States*. Lanham, MD: Lexington Books.

Varma, R. (2007). Changing borders and realities: Emigration of Indian scientists and engineers to the United States. *Perspectives on Global Development and Technology*, *6*(4), 1-18.

Wadhwa, V. (2006, September 14). Are Indians the model immigrants? *Business Week: Small Biz*, n.p.

Wadhwa, V., Jasso, G., Rissing, B., Gereffi, G., & Freeman, R. B. (2007). *Intellectual property, the immigration backlog, and a reverse brain-drain: America's new immigrant entrepreneurs*. Durham, NC: Duke University, School of Engineering.

Wadhwa, V., Saxenian, A. L., Rissing, B., & Gereffi, G. (2007). *America's new immigrant entrepreneurs*. Durham, NC: Duke University, School of Engineering.

Bio

Roli Varma is a professor and a Regents' Lecturer in the School of Public Administration at the University of New Mexico, Albuquerque. Her research focuses on women and minorities in information technology, new immigrants in the science and engineering workforce, the management of industrial research, and professional ethics. Her research is supported by the National Science Foundation and the Sloan Foundation. She is the author of *Harbingers of Global Change: India's Techno-Immigrants in the United States* (2006, 2007) and *Managing Industrial Research Effectively* (2006).