

Comparative Analysis of Brain Drain, Brain Circulation and Brain Retain: A Case Study of Indian Institutes of Technology

ROLI VARMA & DEEPAK KAPUR

University of New Mexico, Albuquerque, NM, USA

ABSTRACT *The migration of students in science and engineering (S&E) is a global phenomenon that affects the economic, technological and social progress of societies and nations across the world. It has been conceptualized by the term “brain drain”, which symbolizes a one-way movement of students from developing to developed countries. The recent return of some migrants to their home countries has been conceptualized by the term “brain circulation”. Brains that fail to circulate back to home countries are considered “drains”. This paper points to the new emerging reality of brains being retained. A recent survey of nearly 260 undergraduate students from two out of the five original Indian Institutes of Technology (IITs) found that the majority of them have developed an increased interest in staying in India, rather than the decades-old trend of going abroad for education leading to work and permanent stay. Even if some of these students are interested in going abroad for higher studies, they expressed keen determination to return to India to pursue careers after completing their studies abroad.*

Introduction

International mobility of students in science and engineering (S&E) from developing to developed countries has been understood as a unidirectional phenomenon (Altbach 1991, 2004). Studies have shown that adverse conditions in developing countries “push” students out, while promising conditions in developed countries create a “pull” toward studying and possibly establishing residency and a career (Portes 1987; Khadria 1999). Scholars have differed on the importance of various reasons for push–pull, but have generally agreed that the loss of students in S&E from developing countries is a “brain drain” on them and “brain gain” by developed countries (Bhagwati and Hamada 1974; Gaillard and Gaillard 1997; Carrington and Detragiache 1999; Docquier et al. 2007).

Roli Varma is professor and 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, Asian immigrants in the science and engineering workforce, the management of industrial research, and professional ethics. 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). She served on the Association for Computing Machinery (ACM) Task Force on Job Migration in 2004–2005.

Deepak Kapur is a distinguished professor of computer science at the University of New Mexico, USA. He has conducted research in areas of automated deduction, induction theorem proving, term rewriting, unification theory, formal methods, program analysis, hardware verification, algebraic and geometric reasoning and their applications. In 2009 he received the Herbrand Award for distinguished contributions to automated reasoning. *Correspondence Address:* Roli Varma, University of New Mexico, School of Public Administration, Social Sciences Building, 3rd Floor, MSC05 3100 Albuquerque, NM, 87131-1216 USA. Email: varma@unm.edu

Other substitute terms for brain drain are “brain hemorrhage”, “brain overflow” and “brain transfer”.

In response to a recent shift in return migration, scholars are increasingly supporting the idea that brain drain is giving way to “brain circulation”. Emerging high-level opportunities in so-called developing countries are seen to be driving migrant students to return upon completion of studies in developed countries (Cao 1996; Johnson and Regets 1998; Docquier and Marfouk 2006). Many foreign-born scientists and engineers are returning to their home countries to capitalize on the dynamism of the emerging economy. Even when they do not return to their home countries, they serve as intermediaries linking the United States and their home country, facilitating scientific and technical cooperation between the two (Saxenian 2005). Other substitute terms for brain circulation are “brain exchange”, “brain mobility”, “brain pendulum”, “brain return” and “reverse brain drain”.

A question of importance is: as popular theories on the student migrant trend shifts from brain drain to brain circulation, do students from developing countries continue to seek educational and career opportunities in developed countries, particularly Canada, Europe and the United States? This paper investigates the applicability of the brain drain and brain circulation models to the Indian Institutes of Technology (IITs) in India. The paper focuses on IITs as they are prestigious academies established by the Indian government to address economic and technological challenges following India’s independence from England in 1947. An extremely competitive admissions process and rigorous curriculum have led IITs to produce world-class scientists and engineers highly sought-after by global high-technology companies and acclaimed graduate programs in the West (Varma and Kapur 2010). Furthermore, there has been a long history of former graduates of IITs migrating to Western countries for higher studies leading to eventual permanent residency. It is estimated that more than half of all the IIT graduates are living abroad (Leslie and Kargon 2006). The IITs have produced some of the most prominent executives, entrepreneurs and inventors in the world. According to one estimate, more millionaires per capita have come from the IITs than any other undergraduate academic institution in the world (Murali 2003).

The posits in this paper stem from a case study of nearly 260 students at two of the five original IITs in 2007 and 2008. The study finds four interesting trends. First, IIT students are beginning to show a proclivity toward staying in India rather than going abroad for education leading to work and permanent stay. Second, if IIT students are interested in studying abroad, they are holding stronger intentions of returning to India immediately for jobs and careers. Third, IIT students are inclined to get a job immediately after graduation rather than going for higher studies either abroad or in India. Fourth, if IIT students are interested in pursuing higher studies, it is not in their fields of study, such as chemical engineering, civil engineering, computer science, electrical engineering and engineering physics, but rather in management and/or finance. These trends suggest a significant shift in the preferences of IIT students.

The paper first presents the concept of brain drain, which is seen as evolving into brain circulation. It then provides basic information on engineering education at IITs and movements of their students abroad. This is followed by the details of the study, its findings, discussion and conclusions.

From Brain Drain to Brain Circulation

The mass emigration of technically skilled people from one country to another country has been referred to as “brain drain”. The word “brain” refers to the student (i.e. the mind being trained) and the professional (i.e. the mind has already been trained). The term “drain” refers to the loss of such people from the country of birth to another country. Though the term originated in the 1960s to describe large-scale immigration of British scientists to the United States (Royal Society 1963), it is commonly referred to as the movement of human capital from developing countries to developed countries. The United Nations viewed brain drain as a one-way movement, or an exodus that only covered migratory flows from the South to the North, from developing to developed countries, and only benefited developed countries (Gaillard 1991). Alam and Rahaman (2008) stated that brain drain or human capital flight is a large emigration of individuals with technical skills or knowledge, which is usually regarded as an economic cost to developing countries. Though there is a strong and active sentiment of return to the home country (Koshy and Radhakrishnan 2008), few actually returned in the past. Brain drain from developing countries has been viewed as “brain gain” by developed countries.

Brain drain has been viewed as affecting the economic growth of developing countries due to an outflow of much-needed technically skilled people (Bhagwati 1976; Bohning 1982; Commander et al. 2004). It has been proposed that with the reduction in the skilled labor force in developing countries, the productive capacity weakens which eventually leads to a decline in economic growth (Beine et al. 2001). The magnitude of economic decline is dependent on the size and skill of the emigrants. Additionally, brain drain has been seen as reducing government revenue since emigrants can no longer be taxed (Dumont and Lemaitre 2005) and they take their assets when leaving the home country (Faini 2007). Often, it is difficult to replace skilled emigrants since those who remain in the country lack such qualifications (Yang and Martinez 2005). Generally the productivity of those who replace the skilled emigrants is lower and to train them increases the cost of production (Saxenian 2005). Brain drain, therefore, is seen as affecting the welfare of developing countries.

Reasons for brain drain have been explained by a “push” element, consisting of an undesirable combination of economic, political and social hardships in developing countries, which drives students and professionals to be “pulled” toward the prospect of better education, careers, wages and living conditions, democratic regimes and personal freedom in developed countries (Portes 1987; Khadria 1999; Dumont and Lemaitre 2005; Chen 2009). It is proposed that due to low salaries, rigid regulations, bureaucracy leading to nepotism, as well as lack of career opportunities and institutions for advanced graduate studies and research, students and professionals from developing countries look for better opportunities (economic as well as educational) in developed countries. In addition, political instability and corruption in home countries make them look for those countries where there are stable governments and functioning democratic political systems. Better economic and political environment in developed countries are viewed as providing good prospects for improved living standards, not to mention the glamour of an easy, comfortable and prosperous life.

Though significant, push–pull factors do not completely explain the reasons for skilled migration. For instance, even with similar economic and political conditions, skilled people from some developing countries migrate to developed countries and not from others. Similarly, some developed countries have failed to attract skilled migrants from

developing countries. Changes in immigration laws, companies' policies for recruiting skilled workers from abroad and national security considerations are important factors in immigration. Equally important is immigrant social networks – interpersonal ties that bind immigrant and nonimmigrant people within a maze of mutual responsibilities that facilitate entry, employment and adaptation in the destination country (Portes 1995). Immigrant social networks provide special access to information that is not available to outsiders. Also, push–pull theories assume a unidirectional flow of immigrants from developing to developed countries; in reality, many developing countries are experiencing a reverse flow.

The globalization of economy has resulted in what can be termed as brain circulation – a cycle of study and work abroad is often followed by a return to the home country to take advantage of emerging high-level opportunities (Cao 1996; Johnson and Regets 1998; Wadhwa 2009). Saxenian (2005) showed that the same individuals who left their home countries for education and work abroad were returning home to establish business relationships or to start new companies. Many developing countries have been experiencing economic growth with liberalization of their economy and investment in high technology such as information technology, nanotechnology and biotechnology. They have been engaged in creating policies to lure and retain their technical talent with appealing remuneration packages, research and business opportunities, tax breaks, new education funds, family benefits and expansion of graduate S&E programs (Glanz 2001; Lieberman 2004). The discourse on brain circulation has led many to question whether the international movement of skilled personnel is affecting the welfare of developing countries.

It is argued that the return of migrants with new ideas, skills and ambitions tends to have a major positive impact on developing countries' economic growth and social structure (Appleyard 1989). Dumont and Lemaitre (2005) have suggested that migrants transfer money to their home countries, which, among other things, results in providing much-needed foreign exchange. Beine et al. (2008) have reasoned that with brain circulation, human capital increases in the home countries. Because individuals returning to their home countries often value education more highly, this can lead to an indirect but substantial investment in additional education and training in their home countries. Saxenian (2005) has argued that returned migrants have been instrumental in technology transfers from developed countries to their home countries. Wadhwa et al. (2007a) have gone one step further to claim that because of return migration countries like India and China are experiencing an entrepreneurship boom as they are learning to innovate just as Silicon Valley does. Arora and Gambardella (2005) have proposed that the growth of the software industry has contributed in a nontrivial way to the growth of India as a whole and has provided the basis for the growth of a new entrepreneurial model. Varma (2007) has shown that even without return migration, immigrant scientists and engineers are networking, communicating and collaborating with their peers at home.

Generally, visa stipulations and processing inefficiencies are seen as stunting the circulation of skilled manpower (Matthews and Lane 2009). Wadhwa et al. (2007a) have argued that the United States has admitted record numbers of international students and highly educated foreign workers on temporary visas, but did not convert their temporary status to permanent status, leading them to return to their home countries to explore opportunities there. US President Barack Obama in his State of the Union Address on January 25, 2011, stated:

Today, there are hundreds of thousands of students excelling in our schools who are not American citizens. ... [They] come here from abroad to study in our colleges and universities. But as soon as they obtain advanced degrees, we send them back home to compete against us. It makes no sense.

The *New York Times* columnist Thomas Friedman (2007, p. 23) has argued that “any foreign student who gets a Ph.D. in [the United States] – in any subject – should be offered citizenship” to “do their research and innovation here”, as a way to avoid them being attracted to their home countries.

To summarize, popular theories on student migrant have shifted from brain drain to brain circulation. Unlike the earlier notion of brain drain, which considered the negative effects of skilled immigration, the emphasis is now on the benefits and opportunities available to developing countries. Brain circulation is seen as a brain gain for developing countries and a loss for developed countries. One theory portrays one-way migration of students whereas the other shows two-way migration. This paper addresses a new trend: whether students from developing countries continue to seek educational and career opportunities in developed countries, particularly Canada, Europe and the United States.

A Case of the Indian Institutes of Technology

During British colonial rule, India had very little growth in engineering education (Sangwan 1990). After its independence in 1947, excellence in S&E education was seen as essential for India’s transformation from an economically poor and technologically backward former colony into a modern advanced nation. Among other schemes of national significance, the government of India founded the Indian Institutes of Technology to supply advanced education in S&E. Consequently, the five IITs were established; IIT Kharagpur in 1951, IIT Mumbai in 1958, IIT Chennai in 1959, IIT Kanpur in 1960 and IIT Delhi in 1961. In 1995 and 2002, IIT Guwahati and IIT Roorkee were established, respectively. Since 2008, the Indian government has opened nine additional IITs in some additional states without IITs.

Admission to an undergraduate program at the IITs is extremely competitive. Students must score high on the Joint Entrance Exam (JEE) to be admitted to the IITs. Prior to 2008, 200,000 to 350,000 students from all over India sat the JEE for nearly 4,200 places in seven IITs; the number of places has increased to nearly 10,000 with the opening of nine new IITs for which almost 500,000 students competed in 2012. JEE has been criticized as the need to “crack” (pass) it has spawned a massive private coaching industry. Good coaching schools are expensive and located in metropolitan cities; thus, they are beyond the reach of students from the lower and lower middle classes and from rural areas (Varma and Kapur 2010). Also, after 10th grade, students distance themselves from a normal adolescent life to go through up to six hours of training and homework at the JEE coaching schools daily, in addition to regular school classes.

Before 1973, students were admitted to the IITs solely based on their performance/rank in the JEE. Since 1973, a total of 22.5 per cent of places have been reserved in each IIT for students belonging to the scheduled castes or SC (they are considered to be lowest in the caste hierarchy) and the scheduled tribes or ST (they have functioned outside the mainstream of urban and rural life). Since 2008, 27 per cent of seats have been reserved for students belonging to the other backward castes or OBC (they are specified by the

central government on the basis of 11 social, economic and educational factors). India's reservation policy has been controversial. Critics argue that it does not promote merit, divides the society into caste lines, is against the fundamental right of equality for everyone, and is a populist measure used by political parties and politicians for electoral gains. Supporters see the reservation policy as a means to make up for historical neglect and discrimination against SC, ST and OBC (Kirpal and Gupta 1999; IIT Bombay Heritage Fund 2009). Given that the population of India is demographically diverse, it is critical that the IITs reflect such reality.

The Indian Institute of Technology Act of 1956 has declared the IITs to be "institute(s) of national importance". This translates into IITs receiving most of their funding from the central government, which is increasingly coming under criticism. It is argued that such institutions cater for less than 2 per cent of the students, but get 85 per cent of central funds for education. It is estimated that one-third of institutions of higher education do not get central funding at all, and of the remaining, only about half of them get some central funding (Agarwal 2007). The lack of funding has created a sharp increase in tuition fees in other engineering institutions. Stable funding from the central government and fewer students at the IITs translate into excellent education. The degrees awarded by the IITs are well recognized inside and outside India. At the same time, Indian industrial leaders N.R. Narayana Murthy (founder of Infosys) and B. Muthuraman (vice chairman of Tata Steel) have criticized IIT graduates for lack of analytical skills.

After finishing their undergraduate studies at the IITs, the majority of students are known to leave India to pursue a graduate degree in S&E in Western countries. Leslie and Kargon (2006, p. 118) have noted that, "As a common witticism in India holds, 'When a student enrolls at an IIT, his spirit is said to ascend to America. After graduation, his body follows'". A popular wisecrack is that, "One leg of an IITian is in India, the other in Air India". After obtaining their graduate degrees, many IIT graduates have settled abroad, as they were offered technical staff appointments by the multinationals or faculty positions by institutions of higher education (Varma 2006). According to a recent survey, the IITs have graduated about 200,000 students from the seven campuses. Of these, 40 per cent were from undergraduate programs and 60 per cent from graduate programs (PanIIT Alumni India 2008). It is estimated that about 125,000 are working or studying outside India (Leslie and Kargon 2006).

In the 1970s and 1980s, the departure of the IIT graduates was seen as a brain drain (Gaillard 1991). Their decision to remain overseas after finishing their studies was equated to the nonstop economic drainage endured by India to the advantage of the developed countries. It was suggested that brain drain deprived India of scientific and technical skills crucial for its economic growth, modernization and development. The 2001 Human Development Report of the United Nations Development Programme estimated that India's loss from the migration of software professionals, many of whom are IIT graduates, was as much as US\$2 billion a year (Murali 2003). India was seen as essentially subsidizing the growing affluence of developed countries.

Indeed, IIT graduates have been brain gain for developed countries. For instance, Indian immigrant scientists and engineers have become a major ethnic group in starting high-technology companies in the United States. Between 1988 and 1998, Indian immigrants held 7 per cent of technology businesses in the Silicon Valley (Saxenian 1999). Between 1995 and 2005, they founded 15.5 per cent of all Silicon Valley startups. Nationwide, they have founded 26 per cent of the engineering and technology companies

that were founded by foreign-born entrepreneurs (Wadhwa et al. 2007b). Most of these Indian entrepreneurs are from IITs. Certainly, US Congress (2005) specifically honored IITs for their contributions to the American society.

The brain drain of IIT graduates is now seen as brain circulation. It is argued that IIT graduates who had left India for better education and career opportunities are returning to India (Gentleman 2008). Though there are no hard data available on how many IIT graduates have migrated back to India, Wadhwa (2011) notes the trend to be accelerated dramatically over the past five years. From 1947 to 1990, India followed a state-controlled model of development, relying on extensive regulation, protectionism and public ownership. Consequently, economic growth was slow during this period. Since 1991, India has implemented a series of economic reforms to move toward a market-based system. It has emerged as one of the fastest growing economies, posting an average growth rate of more than 7 per cent since 2000. With these changes in economic environment and India's attempt to recover its scientists and engineers working abroad, some IIT graduates are returning to take advantage of emerging high-level opportunities.

Dr. Manmohan Singh, India's Prime Minister, has said that emigration from India "did not necessarily constitute 'brain-drain' but could actually create an international 'brain bank' that India could rely on" (Haniffa 2004: IA). So, even when IIT graduates choose not to return, they serve as conduits for the diffusion of new ideas and paradigms back to the Indian sphere (Kapur 2004; Varma 2007). Even without returning, they remain available as a valuable resource to India in the form of intellectual, monetary, trade and moral support.

Recently, some newspapers have reported that the numbers of IIT graduates going abroad either for higher education or work has dropped significantly. For instance, in the 2006 batch only 21 out of the 3,980 Bachelor of Technology graduates had moved abroad. Only three of IIT Kanpur's 273 Bachelor of Technology students and two from the five-year Master of Science integrated course left India. At IIT Delhi, of the approximately 1,000 graduates looking for jobs, only one student went abroad. At IIT Madras, only two students from the Bachelor of Technology batch went abroad (Chhappia 2007; also see Nachammai 2005). Yet there is little scholarly research on the mobility patterns of IIT students, which is the aim of this paper.

The Study

The paper examines the mobility patterns of students from the IITs to abroad, and, in particular, it addresses the question whether they want to go outside India for higher education leading to jobs and possible residency. The paper is based on a survey of undergraduate students conducted at two of the five original IITs (Kharagpur, Mumbai, Chennai, Kanpur and Delhi) in 2007 and 2008 by the authors. The reason for selecting from the five original IITs was because they have Bachelor's, Master's (including integrated Bachelor's and Master's) and PhD degree programs in several engineering disciplines, natural sciences, mathematics, computer science, as well as social sciences. Further, they have the most established comprehensive research and educational programs. Also, admissions to these IITs are in greater demand by the students in comparison to the other IITs. The two IITs studied are similar to the remaining three original IITs in terms of size, academic departments and composition of students.

The technique of survey was considered useful primarily because the purpose of the study was to acquire information on the attitudes of students, and it allowed the collection

of data from a large number of students in relatively short periods at low costs. Three classes at each of the two IITs were randomly selected and surveys were administered to all students before the classes began. A total of 259 surveys were completed. The participation was voluntary. None of the students declined to fill out the survey once given, though not all students answered every question.

The survey instrument consisted of 36 questions organized into six categories: (i) socioeconomic information about students and their families; (ii) schooling and coaching; (iii) infrastructural support and other support mechanisms at the IITs; (iv) satisfaction at the IITs; (v) future plans vis-à-vis jobs in India/abroad or higher education in India/abroad; and (vi) how well the IITs have served Indian society as a whole. This paper is based on the following seven questions, in addition to the demographic information:

1. What are your future career plans after you graduate from the IIT? Circle one: (i) higher studies in India; (ii) higher studies abroad; (iii) job in India; (iv) job abroad; (v) other, please specify.
2. If going for higher studies after graduation from the IIT, circle one: (i) it will be in the same discipline; (ii) it will be in a closely related discipline; (iii) it will be in a different discipline; (iv) undecided.
3. If going for higher studies not in the same or a closely related discipline, please state the discipline you would like to switch to after graduation from the IIT.
4. Why do you desire to switch discipline for higher studies after graduation from the IIT? Circle one: (i) change in interest; (ii) better placement opportunities; (iii) better salary; (iv) other, please specify.
5. If you decide to go abroad either for work or study, please tell how it would help the Indian society?
6. Do you feel you have the obligation to repay Indian society for all the resources it has spent so you could get IIT education? If yes, how do you plan to do so? If no, why not?
7. In your view, have IITs served India well? If yes, explain how? If no, explain why not?

Two independent coders coded the data to ensure consistency and objectivity. For the first five questions, data are presented by using descriptive statistics to show the strength of each response. For the last two questions, data are presented by students' comments since they are open-ended questions. Both subjects and their respective institutions are not identified in reporting the findings, to comply with the Institutional Review Board (IRB), which granted the permission to conduct the study.

Findings

Social Background

All of the students surveyed were young, unmarried between the ages of 19 and 22 years. Overwhelmingly, students identified themselves as Hindus (88 per cent), followed by Jains (4 per cent), Sikhs (3 per cent), Christians (2 per cent), Muslims (1 per cent), Buddhists (1 per cent) and others. Forty-three per cent of students categorized their caste as upper, 22 per cent as middle and 9 per cent as lower; the remaining 26 per

cent stated not applicable. Because the survey was conducted before the implementation of India's reservation policy (over a period of three years, starting with July 2008), students belonging to lower castes are not represented. Also, not all of the seats reserved for SC, ST and OBC have been fulfilled (IIT Bombay Heritage Fund 2009). Almost all of the students surveyed characterized their family background as middle class (52 per cent), upper middle class (38 per cent) and lower middle class (7 per cent). Though a few students (3 per cent) stated that they fit into upper class, no one said lower class. Their depiction is reflective of the occupations of the students' parents, especially their fathers, who were professionally employed. Another indicator was that 32 per cent of the sample had both parents working. Prior to attending IITs, most students attended private schools (71 per cent), followed by state government schools (23 per cent) and central government schools (6 per cent). The medium of instruction in these schools was English (91 per cent).

Career Plans

As evident from Table 1, after graduation from IIT about 54 per cent of students intended to stay in India (either for study or job), while about 47 per cent wished to go abroad (either for study or a job). Students were equally divided between their intention to take a job (either in India or abroad) or go for higher studies (either in India or abroad). Those going abroad expressed strong preference to pursue advanced degrees, while those staying in India were more likely to get a job. Of the four possible outcomes, students were most likely to get a job in India (33 per cent) and least likely to be get a job abroad (17 per cent). These findings suggest that a majority of IIT students had developed an interest in staying in India, rather than following the past trend of going abroad for education and/or career opportunities.

Table 2 shows that of those IIT students planning to go for higher study either in India or abroad, half of them did not want to seek a degree in their current field of study; instead, they wished to switch fields. Another 19 per cent of students were undecided on their future field of study. Only 30 per cent of students had plans to go for graduate study either in the field they were studying or to a closely related field. These findings suggest that a majority of IIT students no longer wish to follow the previous inclination of seeking graduate education in their current field or a closely related field.

Among those students who were not planning to seek a degree in their current field of study either in India or abroad, 79 per cent expressed a desire to switch to either business management (53 per cent) or finance (26 per cent). Only 12 per cent preferred to pursue an advanced degree in computer science; the remaining 9 per cent were considering going

Table 1. Future career plans after graduation from IITs

Future plans	Number of students	Per cent (%)
Job in India	75	33
Higher study abroad	68	30
Higher study in India	47	21
Job abroad	39	17
Total	229	101

Table 2. Link between current field and field for higher study after graduation from IITs

Future field for graduate studies with respect to current major	Number of students	Per cent (%)
Different	58	50
Same or closely related	35	30
Undecided	22	19
Total	115	99

Table 3. Preference for fields for graduate studies after graduation from IITs

Preferred fields	Number of students	Per cent (%)
Business Management	31	53
Finance	15	26
Computer Science	7	12
Others	5	9
Total	58	100

Table 4. Reasons for switching field for higher studies after graduation from the IITs

Reasons	Number of students	Per cent (%)
Improved placement opportunities	24	41
Better salary	18	31
Change in interest	11	19
Others	5	9
Total	58	100

for diverse fields including philosophy and cultural studies (Table 3). These findings reveal a new trend among IIT students to pursue advanced degrees in business management and finance; earlier, they rarely pursued graduate degrees in non-S&E fields.

As Table 4 shows, the intention of IIT students to switch from engineering to business management or finance is primarily inspired by the belief that it would improve placement opportunities (41 per cent) or result in a better salary (31 per cent). A small group of students (19 per cent) indicated a shift in their interest. These findings suggest that while the majority of students are still likely to be interested in engineering, they believed being an engineer alone was not likely to be enough for their careers and well-being; they felt that their careers would be advanced better by postgraduate education and training outside engineering, particularly business management and finance.

Impact on India from Mobility

As evident from Table 5, among IIT students who wished to go abroad either for higher study or a job, more than 30 per cent of them believed doing so would not benefit India in

Table 5. Benefits to India from going abroad

Benefits	Number of students	Per cent (%)
None	33	31
Give back financially	24	22
Bring knowledge back	19	18
Educate about India	11	10
Lure foreign investment	9	8
Others	11	10
Total	107	99

any way. The remaining students justified their desire to go abroad as helping/serving Indian society in many different ways. Twenty-two per cent of students opined that they would help financially by remitting money to India, whereas 8 per cent thought they would encourage foreign investment in India. Another 10 per cent mentioned spreading knowledge about India abroad and educating non-Indians about India. Responses of these 40 per cent of students suggest that they plan to stay abroad at least temporarily. Almost 20 per cent of students said they would return with additional knowledge, training and experience that would help India. The remaining 10 per cent mentioned other benefits to India after they return. Responses of these 30 per cent of students suggest that they plan to return. Overall, the majority of students were planning to remain connected with India while abroad.

A large number of students (213 out of 259) responded to the question of whether they have the obligation to repay Indian society for all the resources it has spent on them to get the excellent IIT education. Almost 76 per cent believed they should repay society; only 24 per cent of them were uncommitted about paying back. Most of the students believed that working in India would itself be their repayment to Indian society. Some students characterized repayment in terms of making financial contributions, starting a company, returning to India and helping the less fortunate in the society. Such responses suggest that due to the historical phenomenon of brain drain, working in India itself is believed as a way to repay society, without any need for additional actions. One also got the impression that getting a job or doing postgraduate studies in India, instead of going abroad for higher education or a job, is by itself considered as doing good for Indian society. The following are some quotes from students' responses:

“I will never go abroad. I have many things to repay to my country which has given me so many things”.

“The earlier graduates of IIT were not interested in serving India but the new generation of IITians is more interested to work for their homeland”.

“In the past, most of good students have settled abroad. They have led to brain drain. So, I am going to work in India and use the best of my resources for its development”.

“I would work for India and in India, and not abroad”.

“Best way is to live in country and you will automatically serve it”.

“By working in India, contributing to Indian economy, economy is the first step towards development”.

“By coming back to India after higher studies”.

“If I worked in India then giving contribution to industry here. If I go abroad then I would help by the investments that NRIs (non-resident Indians) do in India, giving foreign currency”.

“By helping the technical industry grow through my experience and education. I plan to return to my nation eventually”.

“I plan to start my own venture. I will create some employment opportunities for people”.

“By start-ups business, it would provide not only to me but to the whole country in terms of monetary gains”.

“I will shift my area of working to rural areas, so that people are directly benefitted by the growth of that workplace”.

“By employing people, needy people”.

A majority of students (227 out of 259) responded to the question of whether IITs have served India well. Most of them (69 per cent) reacted favorably, pointing to the creation of international recognition, a knowledge base and a better society/economy. As one student wrote, “It has raised Indian prestige and is the mark of Indian intellectual excellence in the world”. Another student noted, “It offers quality education and successful career to people”. Yet another student stated, “IITs create academic excellence and innovation for the society”.

A significant number of students (41 per cent), however, were not so optimistic about the role of IITs for India, mostly because of brain drain, but also due to lack of technical motivation among its students. As one student wrote, “Students from IITs serve the world, but not India”. Another student noted, “Most of the good students have settled abroad. They lead to brain drain”. A student observed, “Most of us go abroad. Those who are in India are not involved in technical work”. Another student remarked, “It is not really shelling out engineers the way I saw it. We are shelling out more managers”.

The New Trends: Brain Circulation and Brain Retain

Brain drain has been a popular model to explain one-way migration of the IIT graduates from India to Western countries, mostly to the United States. In the 1970s and 1980s, entire graduating classes of the IITs left for graduate studies in the United States (Chacko 2007). Furthermore, their education has been heavily subsidized by the Indian central government. This keeps the cost of education to IIT students low compared with the cost to engineering students elsewhere. After subsidizing education for IIT students, India has been losing its talent to foreign countries.

This paper finds that aspirations of a large portion of IIT students can no longer be explained by the so-called brain drain model. The paper points to an emerging new reality of brain retain in India as a majority of the IIT students do not express a preference to go abroad for higher education and/or work opportunities. Their decision to stay in India does not seem to be based on any altruistic desire to contribute towards India’s national development, but rather due to the new economic reality in India as well as abroad.

IIT students feel that there are new ample opportunities for them to work for multi-nationals within India itself as well as for big Indian companies. Some of them even expressed a desire to start their own companies. Even those wanting to pursue higher

education are more interested in switching to areas such as business management and finance. They further feel that they can get the best education in these areas in India itself such as at the Indian Institutes of Management. These preferences and career choices are being guided by their perception of what is best for them in the short as well as in the long run. This shows a partial support for economic push–pull factors for migration decisions. The study also finds that there is a stronger sentiment of Indian pride and an emerging feeling that going abroad is a disservice to their country. In this sense, qualitative data show anti-brain drain sentiment.

Since the mid-1990s, some of the IIT graduates are returning to India to take permanent or temporary appointments, which has been hailed as brain circulation. This paper shows some support for the brain circulation model. The paper finds that IIT students who aspire to go abroad for higher education and/or work have a strong desire to return to India, or help India from abroad if they choose to stay abroad. These new tendencies and preferences suggest that fewer and fewer IIT graduates are likely to settle abroad permanently in future decades in contrast to the past half a century.

In the past, IIT graduates went abroad for higher studies, before taking a job there. This paper, however, shows that IIT students now prefer to get a job in India rather than pursue higher education. They feel ready for a career and seek to head out to the job market immediately after acquiring a Bachelor's degree. IIT students seem to be using simple economics to make their decision to go for a job rather than higher education. The salaries offered to IIT graduates are quite high, from both multinational and Indian companies; furthermore, there are now opportunities to go abroad on assignments as well as being transferred to units abroad. This view seems to support the cost–benefit model, which states that students will enroll in graduate school if the cost of education is outweighed by the potential long-term benefit of a better job (Ehrenberg 1992). The cost–benefit model shows that enrollment is countercyclical – people are more likely to attend universities during difficult economic periods (Dellas and Koubi 2003). With IIT students, however, there is an important distinction. Lack of financial support for higher education is not a part of their calculation. They are likely to get scholarships or assistantships from universities in India and abroad if they choose to pursue an advanced degree. They have come to believe that getting a job in India will help to develop their country.

Interestingly, IIT students who wish to pursue higher education are more likely to switch from engineering to business management and finance. These students believe they will have better opportunities for placements and higher salaries by changing their fields. In the past, IIT students rarely switched their fields. They enrolled in graduate school to learn more about their field of study, and become an expert in it. Indeed, most IIT graduates came to the United States to pursue higher studies in S&E fields. Now, IIT students believe their careers will be improved by combining their engineering knowledge base with management skills. In India, students typically pursue a MBA (Master of Business Administration) after earning a Bachelor of Commerce, and not a Bachelor of Technology. In the United States, the MBA has been the traditional second choice of engineering majors (Astin and Astin 1992; Adelman 1998). However, the reasons for entering an MBA from an engineering major differ between the two countries. In the United States, students typically tend to switch their majors from engineering to business management if they believe they will not stick to engineering. In India, this issue does not cross IIT students' minds; they feel committed to engineering, but feel they need managerial skills which they are lacking.

Conclusions

This paper has shown some new trends in the aspirations of IIT students. There is no longer a strong trend toward going abroad either for jobs or for higher studies. Instead, most IIT students plan to stay in India and take a job immediately after attaining a Bachelor of Technology degree. Those who choose to pursue an advanced degree are most likely to switch from engineering to management. These trends show that the mobility of IIT students can no longer be explained by the variations of the brain drain model, including brain circulation. India seems to be succeeding in retaining its top brains without taking aggressive steps. If Indian students are going abroad for higher education, they are likely to be from institutions other than IITs.

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