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Brain Drain from India to the U.S. during the Cold War: Focus on Technology Transfer and the Development of Highly Skilled Talent

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What led India to produce highly skilled people during the Cold War? Why did some "brain drain" into the United States? During the Cold War, private foundations and universities worked with the U.S. government to develop a systematic technical assistance policy based on industry-academia-government cooperation. The diplomatic intention was also to bring India, which had maintained non-aligned neutrality, into the Western camp. U.S. technical assistance led to the establishment of the Indian Institute of Technology Kanpur, the "MIT of India," and the training of Indian scientific and technical personnel proceeded smoothly. However, India did not have the industrial infrastructure to absorb such highly skilled talent. On the other hand, the United States has faced a serious shortage of human resources in critical fields that are crucial to national defense. As competition with the Soviet Union intensified during the Cold War, it became critical to attract young scientists and engineers from home and abroad became critical. The imbalance in the supply and demand of high-level human resources between the U.S. and India, along with changes in U.S. immigration policy, has resulted in the incorporation of many highly skilled Indian talents into the U.S. scientific and technological community.

Introduction

The presence of Indian immigrants in the modern U.S. economy is large. Especially in high-tech sectors such as Information Technology (IT), Asian immigrants are remarkably active, and many Indian engineers work for GAFAM (Google, Amazon, Facebook (now Meta), Apple, and Microsoft), big tech companies that are taking the world by storm. They are highly skilled, specialized, well-educated, and well-paid, leading to the name "model minority." In the past, there was a one-way brain drain from India to the United States. In recent years, however, there has been a growing trend of "brain circulation," where outgoing brains return to India and generate profits for the Indian economy, and "brain retention," where the brain stays in the country as the Indian economy develops. Thus, the "brains" from India that have driven the U.S. economy are no longer easy to secure. Given the global talent competition, there is great research interest in whether the United States

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will continue to attract highly skilled talent from abroad.[1]

Why has the number of highly skilled immigrants from India increased? One of the reasons for India's emergence as a repository of highly skilled human resources was the influence of development and technical assistance from Western countries on developing countries. During the Cold War, the United States positioned South Asia as a bulwark of democracy. India, in particular, has gained strategic importance, partly because of the expectation that it would become the world's largest democracy. With the establishment of the People's Republic of China and the outbreak of the Korean War, strengthening economic ties through economic aid and technology transfers to India became an important diplomatic issue in halting the expansion of the communist bloc. Technical assistance, mainly through the exchange of people and technology, was seen as a cheap and effective way to create an environment in which private capital could enter the country. The amount of aid to India increased from $89.8 million in 1958 during the late Eisenhower administration to $194.6 million in 1960 and to $465.5 million in 1962 during the Kennedy administration.[2] Large private foundations, multinational corporations, and universities cooperated with the U.S. government to develop a systematic technical assistance policy. Ramnath was positive about the influence of Western technical assistance, arguing that the training of Indians in American companies and the training of engineers in India by Western experts as career engineers in companies supported the "birth of the profession in India."[3] Kumar emphasized the great influence of the soft power of the giant American foundations that played a role in introducing the U.S. education system in India, which replaced the British system after World War 2.[4] Western governments were involved in the establishment of the Indian Institutes of Technology (IITs) to increase their influence, and the United States supported the establishment of IIT Kanpur to create the "Massachusetts Institute of Technology (MIT) of India," envisioned by President Nehru. It was a national project under the Foreign Assistance Act of 1961, with the U.S. Agency for International Development (USAID) playing a central role in providing support. Thus, with the support of western countries, numerous IITs and other institutions of higher learning for highly skilled personnel have been established. Western-style systems of education and research, as well as advanced science and technology, have been introduced in India. However, India lacked the industrial infrastructure to absorb these highly skilled human resources, and some opted for a brain drain, seeking to use their skills and careers in the U.S.

U.S. immigration policy provided the institutional basis for the absorption of these "brains." When the Immigration Act of 1965 opened the way for permanent residences in the United States, many Indian scientists and engineers, including IIT graduates, were absorbed into the American scientific and technological community.[5] Thus, there was a demand on the U.S. side that controlled the brain drain, including a favorable research environment and high wages in the United States, changes in immigration policy, and declining birth rates.[6]

However, brain drain from the Third World has rarely been discussed regarding new immigrants in the study of immigration history.[7] According to immigration historian

[1] Widener [2019] pp 35–40.
[2] Merrill [1990] pp. 3-5.
[3] Ramnath [2017].
[4] Kumal [2019].
[5] Bassett [2009] pp. 803-804.
[6] Sukhatme [1994] pp. 48-52.
[7] Suga mentioned the impact of brain drain in analyzing the congressional debate on immigration reform, but there are few such studies. Suga [2002] pp. 274-275.

Zolberg, lawmakers did not anticipate that the influx of Asians would be so large and that non-Europeans would become so dominant and a majority.[8] According to Economist Timothy J. Hatton, the elimination of the country-of-origin quota system by the 1965 Immigration Act, the use of quota caps, an increase in the number of immediate relatives through family-based petitions, and an increase in the number of refugees and illegal immigrants were unexpected.[9] The increase in Asian and Mexican immigration and demographic changes was not anticipated by Congress at that time.

However, given the state of U.S. science and technology at the time, there is no coincidence that the United States revised its immigration policy in 1965 to increase the priority quota for highly skilled personnel. In *"Science-The Endless Frontier,"* Vannevar Bush, director of the Office of Scientific Research and Development and a professor at MIT, warned that the United States would enter the postwar period with a serious shortage of trained scientists.[10] A decisive blow came in 1957 with the Sputnik Shock. Once the United States fell behind the Soviet Union in terms of science and technology, the training of scientists and engineers became a national project. To establish U.S. dominance in science and technology, the budget for the development of science and technology related to national defense was significantly increased, beginning with the passage of the National Defense Education Act in 1958. The recruitment of young scientists and engineers, both at home and abroad, became a critical issue in the United States to survive the competition between the United States and the Soviet Union during the Cold War.

This paper highlights the critical importance of the U.S. brain drain from India in the supply and demand of scientists and engineers in the United States and abroad in the 1950s and the 1960s. This paper specifically focuses on IIT graduates from India, which has produced a large number of scientists and engineers. In doing so, it illustrates the impact of the brain drain from India to the United States and the steady supply of highly skilled immigrants from Asia in the U.S. economy.

1. The Cold War and the U.S. manpower situation

How did the U.S. deal with the shortage of scientific personnel during the Cold War? Before entering this discussion, it is important to understand that the shortage of human resources in science and technology became a national issue during World War II and that measures to address this issue have been sought ever since. As scientific expertise and technological innovation have become more closely linked to national security, there has been growing interest in improving science education in the United States. In response to the shortage of engineers, chemists, physicists, and production supervisors during World War II, the development and training of students for national defense became an urgent issue. In 1940, the "Engineering Defense Training" program was launched. In 1942, it was expanded into the Engineering, Science, Management War Training (ESMWT) program under the supervision of the U.S. Department of Education. Union College faculty and consultants from General Electric created a variety of courses to meet the needs of wartime production, including drafting, tool design, and radio communication. More than 1.5 million men and women took courses in the program from 1940 to 1945 to prepare for

8 Zolberg [2008] pp. 337-338.
9 Hatton [2015].
10 Bush [1945].

scientific and technical work in war-related industries.[11] The Department of Education invested $60 million in this program to expand the armed forces and provide vocational and technical education.

Vannevar Bush, who had emphasized the importance of federal support for scientific research since World War II, proposed to President Roosevelt at the end of the war the development of a scientific and technological workforce and a new vision for a federal scientific organization to maintain U.S. scientific superiority. This led to the establishment of the National Science Foundation (hereafter NSF) in 1950. The U.S. scientific and technological community has been clamoring since the war for public funding to strengthen basic research, create scientific knowledge, and nurture talented young scientists. The postwar U.S. economy saw a significant increase in science and engineering employment, reflecting advances in electronics, jet aircraft, space technology, guided missiles, and communications, as well as a growing demand for engineers and skilled workers in these fields. Nevertheless, the education and training of domestic scientists and engineers have been lagging. The 1952 NSF Annual Report contains the opinions of representatives of 16 major industries employing scientific and engineering personnel, who expressed concern about a serious shortage of scientific and engineering personnel, with only 36 percent of the needed scientific and engineering personnel available. The report also noted that government agencies, including the Department of Defense and Atomic Energy Commission, faced similar challenges, and that the shortage of scientific and technical personnel forced serious changes in future expansion plans. According to the report, the number of engineers with engineering degrees in the United States declined each year and was expected to fall to 15,000 by 1955, approximately half the desired level of 30,000 per year. In the Soviet Union, the number of engineering graduates was expected to increase from less than 9,000 in 1943 to nearly 50,000 in 1955. The low birth rate during the Great Depression and the loss of tens of thousands of science Ph. D.s during World War II were the main reasons for the shortage of scientific and technical personnel in the United States.[12] Although the Soviet economy had always been slow to industrialize, in 1928, under Stalin's leadership, the First Five-Year Plan was launched to train engineers. By the 1950s, the Soviet Union was producing more scientists, engineers, and specialists than the United States, with more than twice as many graduates in these fields each year.[13]

The Sputnik Shock of 1957 made the development of human resources in American science and technology a major national issue beyond the scientific community. In fact, on October 4, 1957, just hours before the launch of Sputnik I, a presidential commission released its "Report on Soviet Scientific Superiority," which revealed that the Soviet Union not only had more professional engineers than the United States but was also actively providing technical assistance to developing countries. The Soviet Union built technical institutes in Bombay (now Mumbai), India, and Rangoon, Burma (now Yangon, Myanmar), each with 1,000 students and faculty. In addition, by 1957, there were 1.3 million science university graduates in the United States, compared to 1.5 million in the Soviet Union. Furthermore, 15,000 students from China and Soviet satellites were studying in the Soviet

11 Armsby [1946].

12 *National Science Foundation* [1952] *The Second Annual Report of the National Science Foundation*, Washington, D.C.: GPO, pp. 25-27.

13 Scientific and Technological Manpower News ROUND-UP, National Committee for the Development of Scientists and Engineers, Vol. 1. No. 14, December 1, 1957, p. 2 (hereafter only title, volume, number, and date), Records of the National Science Foundation, Record Group (hereafter RG) 307, Box 1, Office of the Director, Records of the President's Committee on Scientists and Engineers, 1956-58, Records of National Record Administration (hereafter NARA) .

Union, while 12,000 foreign students were studying in the United States.

Many intellectuals were concerned about the increase in Soviet scientific and technological capabilities. Edward Teller, a Hungarian-Jewish nuclear physicist famous for developing the hydrogen bomb, declared in 1957 that the Soviet Union had been leading the United States in scientific talent for a decade and that the Soviet Union would be the world's leader in science for the next decade.[14] Among them, the United States was most concerned with Soviet intercontinental ballistic missile (ICBM) technology. By August of the following year, it had reached a level where the Soviets had launch capabilities.[15] How was the Soviet Union able to build a modern nuclear weapons system at such an astonishing rate almost a decade after the start of the Cold War? One of the reasons for the Soviet Union's advantage over the United States in missile development was the massive recruitment of German experts, the "spoils of war" from Germany. Ichikawa, the leading Japanese historian of science, pointed out that the process of jet aircraft development involved a huge scale of "plunder of technology" by a victorious nation from a defeated nation.[16] Consequently, the Soviet Union successfully produced rockets, jet planes, and nuclear weapons.[17] The Soviet Union also took advantage of the brain drain from Germany to rapidly increase its scientific and technological capabilities, and the United States and the Soviet Union engaged in a large-scale competition to develop and acquire human resources during this period.

The Soviet Union also seems to have better prospects than the United States in science and technology. Washington columnist Robert Spivak, writing in the *New York Post*, highlighted the gap between American scientific and technological capabilities. Only 25 percent of American students majored in science, compared to 60 percent in the Soviet Union. During the previous decade (1950–60), the Soviet educational system produced 1.2 million qualified engineers and scientists, compared to 900,000 in the United States. Between 1929 and 1954, the Soviet Union's growth rate was 1,300 percent, dwarfing the growth rate of the United States by 225 percent. Spivak pointed out that the shortage of engineers in the United States would continue until 1965, given the "lean generation" of the 1930s, which had a particularly low birth rate.[18]

The federal government's painful experience of falling behind the Soviet Union in science and technology led to the promotion of science and technology education. The development of highly qualified human resources in science and technology had become part of a national project. An example of this focus is the "National Defense Education Act" of 1958, enacted the year after the Sputnik Shock. The purpose of the law was to increase the number of students in science, technology, mathematics, foreign languages, and other fields of study; to provide technical education important to national defense; and to affirm the superiority of the United States, especially in the fields of science and technology. Title VIII of the National Defense Education Act, through its Regional Occupational Program provisions, intended to train students to work in "highly skilled technical occupations" essential to the defense of the nation and requiring scientific knowledge. The number of students enrolled in Title VIII technical occupation programs

14 ROUND-UP, Vol. 1. No. 3, March 1, 1957, p. 1.

15 ROUND-UP, Vol. 1. No. 13, November 15, 1957, pp. 1-3.

16 For further information, see especially chapter 4 of Ichikawa [2018].

17 Meanwhile, the U.S. was devoting financial and human resources to the production of high-speed computers that would lay the foundation for today's computer technology. Ichikawa [2018] p. 7.

18 Robert Spivack, "Sputnik Underscores U.S. Shortage of Scientists," Records of the National Science Foundation, RG 307, Box 1, Office of the Director, Records of the President's Committee on Scientists and Engineers, 1956-58.

increased from 48,000 in 1959 to 148,426 in 1962. By discipline, reflecting the development of computer technology and the demand for trained engineers in this field, electronics accounted for nearly half of all programs, followed by mechanical and electrical engineering. Together, these three fields account for 75 percent of the total.[19]

As we have seen, the results of this professional training were certainly accumulating, it was not always possible to ensure a stable supply of scientists and engineers who could compete with the Soviet Union. For example, according to the 1961 Bureau of Labor Statistics estimate of the demand for scientists and engineers in the civilian economy, the growth rate of scientists and engineers was about four times that of the labor force as a whole, with a 75 percent increase from 314,000 to 548,000 between 1959 and 1970 for scientists and a 90 percent increase from 782,000 to 148,000 for engineers. The total number of scientists and engineers was expected to increase by about 85 percent, from approximately 1,096,000 to 2,032,000.[20] A second study by the Bureau of Labor Statistics, which produced more detailed and accurate demand projections, arrived at the same conclusions as the first study, with minor differences in numbers. Between 1960 and 1970, fewer than 765,000 new scientists and engineers were available to fill more than one million job openings, and the shortage that was evident in the 1950s and the early 1960s may have worsened, according to the Division of Labor Statistics.[21] While the demand for scientists and engineers continues to increase owing to space exploration and economic growth, the supply of scientists and engineers remains insufficient. Many were retiring or changing jobs, and 14 percent of engineering graduates found jobs in other fields. Therefore, the need to recruit not only new graduates with bachelor's degrees in science and engineering but also those with degrees in other fields as well as non-college graduates working in technical occupations had to be met by any means possible. Indeed, within a few years of the enactment of the National Defense Education Act, it was not possible to fully meet these manpower requirements. Therefore, the government has begun to serious search for foreign scientists and engineers.

2. Global technology transfer and high-level talent development network

This section describes the process of developing a workforce from Asia, especially India, that could compete with the Soviet Union, which occurred concurrently with the development of scientific and technological human resources.

During the Cold War, the United States positioned South Asia as a bulwark of democracy and implemented aggressive development and technical assistance policies. India, in particular, gained strategic importance, partly because of the expectation that it would become the world's largest democracy. The Soviet Union's involvement in India's economic development since the mid-1950s and private diplomacy were instrumental in supporting and promoting socialist modernization. On the Indian side, the Soviet Union was also seen as a key player in India's security against the Chinese Communist Party and pro-U.S. Pakistan.[22] From this Indo-Soviet cooperation, large private foundations, corporations, and universities worked with the U.S. government to develop a systematic

[19] U.S. Department of Health, Education, and Welfare, *Education for a Changing World of Work*, Appendix I Technical training in the United States, Washington, D.C.: GPO, 1963.
[20] Michael [1962] p. 420.
[21] Stambler [1963] p. 1282.
[22] Dyakonov [2023] p. 90.

technical assistance policy. U.S. technical assistance to developing countries was primarily the work of private companies and foundations. There was a reason why government officials placed so much emphasis on private organizations in their economic assistance activities abroad. Foreign governments were more receptive to the advice of private organizations, which were unofficial ambassadors of the United States abroad than to official representatives of the U.S. government.[23] In an attempt to strengthen mutual understanding with other countries without jeopardizing strained international relations, the role of private contractors in local relationships and personal networks was important. In this way, private organizations played an important complementary role in U.S. diplomacy by establishing good relationships with foreign governments and local private organizations before U.S. government foreign assistance began in earnest.

The Ford Foundation, which played a major role in providing development assistance to the Third World on behalf of the government, was a prime example of the impact of private organizations. IIT Kanpur and the Indian Institutes of Management in Ahmedabad, Calcutta, and Bangalore were established with support from the Ford Foundation. This investment, the foundation believed, was necessary not only to support India's domestic future (e.g., combatting poverty) but also to expand the free world, including the promotion of democracy and incorporation into the Western camp. However, the introduction of American-style elite education was intended to foster the production of an Indian scientific and technological elite that would support an anti-Soviet and pro-American stance in non-aligned and neutral India. With this in mind, in August 1965, the Ford Foundation awarded a two-year grant of $1.45 million to the Massachusetts Institute of Technology (MIT), a world-renowned leader in basic and applied science and engineering, to support the Birla Institute of Technology (BITS). This grant was used to build an international system of expertise with MIT at the helm. During the decade of support from the Ford Foundation and MIT, more than 3,000 undergraduate and 1,000 graduate students were trained.[24]

The Kanpur India-U.S. Program (1962-1972) is a prime example of U.S. science diplomacy during the Cold War. IIT Kanpur was established in 1960 by Prime Minister Jawaharlal Nehru with support from the Ford Foundation to promote Indian science and technology. In 1962, nine American universities (MIT, California Institute of Technology, Carnegie Institution of Technology, Princeton University, University of Michigan, University of California, Purdue University, Ohio State University, and Case Institute of Technology) agreed to provide technical assistance to develop the IITs, "Institutes of National Importance." This program aimed to promote individual freedom and growth by creating an intellectually open environment for both students and faculty that could not be achieved within the rigid hierarchical structure of the traditional Indian university system. Many intellectual and psychological conditions for IIT Kanpur were present in U.S. technical education and thus welcomed U.S. collaboration. Funding was provided for U.S. personnel, in-service training for Kanpur faculty from the consortium institutions, and the purchase of equipment, teaching materials, and books not available in India. The program also provided comfortable housing on the IIT campus for U.S. faculty and their families and attracted many talented young researchers.[25] The program was unique in that young faculty members under the age of 40 were hired to facilitate student advising, and up to 25

[23] Jerome Jacobson Associates, The Use of Private Contractors in Foreign Aid Programs, Special Committee to Study the Foreign Aid Program, U.S. Congress, Senate, 85th Congress 1st Session, Washington, D.C.: GPO, 1957, pp. 34-59.

[24] Leslie and Kargon[2006] p. 122.

[25] Sukhatme [1994] p. 70.

American staff members provided Indian students with an interdisciplinary research program that met high international quality and research standards. After taking common courses for the first three years, students were divided into specialized areas of study. By 1972, Kanpur had become a leading center in India for the education of engineers and scientists, both undergraduate and graduate, and for research in engineering and science. However, it has been suggested that these interactions with American researchers contributed to the brain drain from India to the United States. At this point, Prime Minister Nehru's vision of building an 'Indian MIT' and developing a highly skilled workforce for India's future has been betrayed.

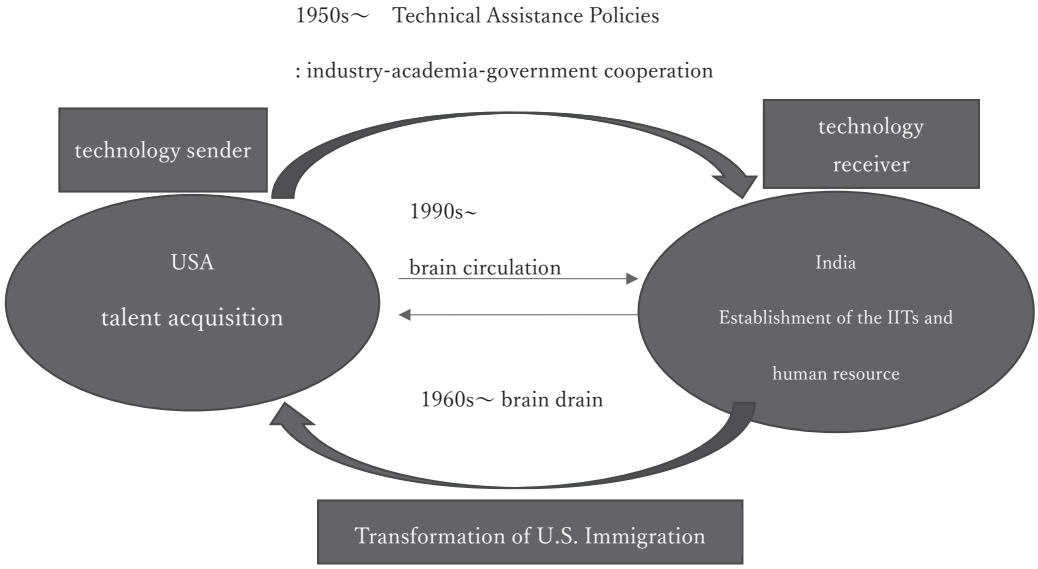
Thus, the Ford Foundation contributed significantly to the development of human resources in science and technology in India and India's economic independence. At the same time, however, the number of students studying in the United States also increased rapidly from 10 to 15 per year before the war to 800 by 1955. The Ford Foundation's role in fostering human networks between the United States and India has also had a significant impact on the international movement of highly skilled human resources.[26]

Figure 1 illustrates this discussion. Since the 1950s, the United States, as a technical sender has made significant contributions to the establishment of higher research and educational institutions and the development of highly skilled human resources in India through active development assistance and technology transfer. This was because the U.S.-Soviet rivalry was not only about military power but also about socio-economic achievements, such as living standards, levels of industrialization, and cultural and educational development.[27] In other words, India and other Third World countries were involved in technical assistance competition between the U.S. and the Soviet Union. These activities were mainly carried out by private foundations, corporations, and universities, and academic and cultural exchanges between the U.S. and India stimulated international labor migration. As a result, some Indians trained through U.S. technical assistance were "brain drained" to the United States, following a change in U.S. immigration policy in the 1960s. India, as the recipient of the technology transfer that should have taken place, consequently experienced a loss of human resources. Thus, technology transfer to Asia eventually became a means for the United States to acquire highly skilled human resources.

26 Ford Foundation, *Annual Report*, 1956, p. 102.

27 The IITs, designed to educate advanced, world-class scientists and engineers, were supported by several countries: Kharagpur was jointly established by the United Kingdom, the United States, Germany, and the Soviet Union; Bombay was supported by the Soviet Union; Madras (now Chennai) was supported by West Germany; and Delhi was supported by the United Kingdom. See Yokoi [2022] Chapter 8.

Figure 1. Technology transfer and brain drain of highly skilled personnel



U.S. immigration policy has been one of the key factors facilitating brain drain in developing countries. After World War II, U.S. immigration policy prioritized highly skilled and knowledgeable individuals. The Immigration and Nationality Act of 1952 marked the beginning of the practice of selecting immigrants based on their individual skills. The Act placed skilled immigrants at the top of the immigration quota priority list and created the H visa, which opened the door to the legal admission of temporary labor immigrants. In addition, the Immigration Act of 1965 established a new standard for selecting immigrants who would contribute to the development of the United States. It required all immigrants to obtain labor certifications issued by the Department of Labor for occupations in high demand in American society and established a mechanism for allowing short-term employment for those with special skills that were useful and essential to the United States. This change in the law was motivated by the need for workers in fields that could not be supplied domestically because of the remarkable growth of various industries, including national defense, and the increased demand for scientific, technical, and other professional workers after World War II. While the Department of Labor consistently supported the issuance of immigrant visas to a wide range of qualified scientists and engineers due to nationwide labor shortages, these decisions were based on the prospect of high long-term demand for workers. Demand for workers is expected to grow at an even higher rate in the following decade.[28]

Secretary of Labor W. Willard Wirtz was a leading advocate for increasing the number of highly skilled immigrants through immigration reform. During the 1965 immigration bill debate, Wirtz cited the shortage of doctors, nurses, scientists, and other important professionals in the United States during the 1950s and 1960s, arguing that the new

[28] United States Congress, House of Representatives, *The Brain Drain into the United States of Scientists, Engineers, and Physicians*, Washington, D.C.: United States Congress, House of Representatives. GPO, 1967, p. 13 (hereafter cited as *The Brain Drain*, 1967).

immigration legislation would increase supply in these and other areas. He argued that facilitating the entry of immigrants with particularly useful skills would encourage an inflow of highly skilled immigrants and also serve the interests of American labor demand and welfare, especially in filling positions in industries in which labor was in short supply. In addition, Wirtz further articulated his expectations for addressing skill shortages. In summary, of the approximately 97,600 annual quota immigrants who entered the country between 1959 and 1962, up to 48,600 entered the U.S. labor market. It was positive that the new immigration law would increase the number of admitted immigrants, especially those with higher education and exceptional skills with special experience to fill labor shortages. Under the current law, approximately 8,800 professional and technical workers enter the labor market annually as quota immigrants. Between 1952 and 1961, 14,000 physicians, surgeons, and 28,000 nurses helped alleviate shortages in the medical field. In addition, 4,900 scientists, nearly 1,100 physicists, 12,000 engineers, 9,000 machinists, 7,000 tool and die makers, and other skilled immigrants were admitted to the United States, which was crucial because of the short supply of such professionals.[29] Wirtz recognized the significant contribution of highly skilled immigrants to the U.S. economy in the past, and he intended to bolster supply through immigration reform.

3. Brain Drain from India – IIT as a Case Study

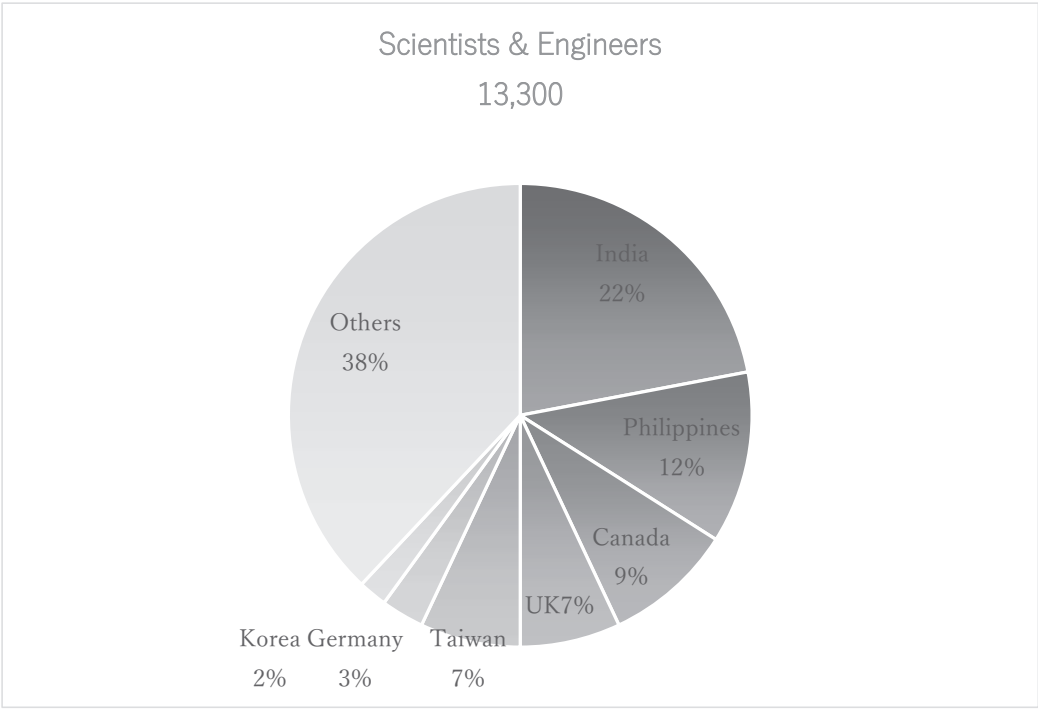
The postwar U.S. immigration policy moved away from earlier race-based criteria and relied on priority criteria based on the recognition that individual knowledge and skills are an important source of national strength. As a result, immigrants of Asian origin were welcomed to fill the shortages of highly skilled workers. In 1966, for the first time in U.S. history, immigrants from developing countries accounted for more than half of all immigrants (51%). By 1970, this amount had exceeded 60 percent. This increase was particularly significant for Asian immigrants, increasing from 16,622 (5.7% of total immigrants) in 1965 to 88,418 (23.7% of total immigrants) in 1970. While the Philippines sent the largest total number of immigrants, the largest jump was in Indian immigration, which increased more than 17-fold, from 582 in 1965 to 10,114 in 1970.[30]

From 1956 to 1966, the number of scientists, engineers, and physicians who immigrated to the United States as immigrants nearly doubled, from 5,373 to 9,534. In 1966, the number of Indian immigrants was 896, more than double that of Filipino immigrants, 397. Indian immigration continued to grow, and by 1970, Indian immigrants accounted for 22 percent of all scientists and engineers entering the United States (see Figure 2).

[29] Statement of W. Willard Wirtz, Secretary of Labor Before the Subcommittee on Immigration and Naturalization Senate Judiciary Committee on S. 500 General Records of the Department of Labor, Office of the Secretary of Labor Records of the Secretary of Labor W. Willard Wirtz, 1962-1969, RG 174, Box 278, Immigration and Naturalization 1965, NARA.

[30] Friedman [1973] pp. 39-40.

Figure 2. Percentage of Immigrants by Country of Origin of Scientists and Engineers Entering the United States, FY1970



Source: National Science Foundation [1972] *Scientists, Engineers, and Physicians from Abroad: Trends Through Fiscal Year 1970*, Washington, D.C.: GPO, p. 3.

Not only does the number of immigrants increase, but so does the number of temporary residents, including foreign students, on student visas. By 1970, about 40 percent of temporary residents in professional occupations, such as scientists, engineers, and doctors, had changed their status to permanent residences and chose to remain in the United States. Of the 13,372 working in the category of scientists and technicians, 62 percent (8,294) were from Asia, and up to 53 percent of them had a change of status. Another important indicator in the non-immigrant category was the number of aliens who received doctorates in science and engineering from U.S. universities. Between 1960 and 1970, Asian PhDs increased from 44 to 49 percent of the total, with Chinese and Indian PhDs accounting for 70 percent of this increase.[31] This provided a channel for people of Asian descent to obtain work opportunities without entering the United States as immigrants. Gregory Henderson, a senior research officer at the United Nations Institute for Training and Research, described primary and student visas as "launching pads for immigration."[32] For example, Asian students studying at American universities remained in the United States after

[31] Library of Congress, Foreign Affairs Division, *Brain Drain: A Study of the Persistent Issue of International Scientific Mobility: Prepared for the Subcommittee on National Security Policy and Scientific Developments of the Committee on Foreign Affairs*, Washington, D.C.: GPO, 1974, p. 66 (hereafter cited as *Brain Drain, 1974*).
[32] *The Brain Drain*, 1967, p. 15.

graduation, representing a large knowledge-based industrial workforce.[33]

Why did so many Indians leave the United States? One reason is that neither Indian government research institutions nor domestic industry had an adequate industrial base to absorb advanced human resources. According to India's 1961 Census, the overall unemployment rate for scientists and engineers was 10.4 percent, and 18.6 percent were employed in jobs outside their field of expertise. Developing countries' inability to offer attractive compensation to highly skilled personnel weakened their bargaining power, and they lost their brains to richer countries offering higher wages. *The Times of India*, an English-language newspaper in India, described the brain drain to the United States as a "subtle neocolonialist robbery" and reported on the gravity of the situation.[34] Since the 1960s, many Indian white-collar workers and professionals have emigrated to English-speaking countries including the United Kingdom, Canada, and the United States. Research has found that 76% of 1.8 million Indians aged 16 years and above in the U.S. and 45% of the same age group among 847,000 Indians in the UK were engaged in high-skilled occupations in 2019.[35] The brain drain of white-collar jobs from India to the West during the Cold War was one of the origins of the Indian diaspora, which continues to this day.

IIT graduates were at the center of the brain drain, as they produced a large number of highly skilled human resources. Although IITs were established to make India self-reliant, many IIT graduates chose to take their careers and skills to the United States. For Kanpur's brightest students, the IITs were only a step toward graduate school in the United States. For IITs, competing with American universities with financial and research resources for Ph.D. students had become a major challenge. Due to Kanpur's close ties with American engineering universities, its graduates went on to work at the forefront of American computer development.

Although it is difficult to quantify the size and impact of brain drain from IIT, a study that followed the path of graduates from 1973 to 1977 found that of the 1,262 graduates, 30 percent had a bachelor's degree, 14.7 percent had a master's degree, and 14.7 percent had a PhD, with the primary destination being the United States.[36] For electrical engineering graduates, the percentage was even higher, with over 40 percent of the graduates migrating abroad. The majority of graduates who remained in India were also willing to enroll in American universities if financially supported, and international labor migration to developed countries was inevitable because of the desire for better working conditions, economic treatment, and guaranteed opportunities for growth as scientists and engineers. The decline in the U.S. birthrate and the oversupply of professional jobs in South Asia, the fact that India's wage levels were one-fifteenth to one-twentieth of those in the United States until the 1990s, and the lack of demand for qualified scientific and technical personnel in the Indian private sector also contributed to the brain drain.[37]

Brain drain has been identified as a more serious problem for developing countries because, compared to developed countries, they do not have a rich pool of human resources at home and lack the institutional means, including financial resources, to retain them.[38]

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33 Biradavolu [2008] p. 9.

34 *Times of India*, April 17, 1969, p. 8.

35 Potnuru, Thakur and Kumar [2023] pp. 2-3.

36 Sukhatme [1994]. There are no exact data with which to compare Kanpur, but it is believed that a similar percentage is likely.; Bassett [2009] pp. 803-804.

37 Sukhatme [1994] pp. 51-52.

38 On the other hand, brain drains are not as serious for developed countries because they can offset them by using their abundant financial resources to bring back human resources or by increasing the domestic supply of human resources. The U.K. and Canada have been able to cope with brain drain to the United States by accepting

The 1967 U.S. Congressional Report on Brain Drains described severe brain drains in developing countries. While the United States provides millions of dollars in financial aid to developing countries, it casually robs the seeds of future leaders in science, medicine, and technical knowledge. Developing countries are reluctant to send their human resources, which are more valuable than food and machinery, to other countries.[39]

Nevertheless, advocates of highly skilled immigration in the United States have some points. The United States could not weaken its economy to discourage immigration and should not reinstate discriminatory immigration restrictions, which facilitated brain drain in the United States. According to a brain drain report, an attempt to correct the injustice of the discriminatory quota system (the Immigration Act of 1965) paradoxically created a new problem. This is because the Immigration Act of 1965 provided a powerful incentive for professionals from developing countries to migrate to developed countries, thus depriving them of their required talent.[40]

How has the brain drain from developing countries benefited the United States? According to *The Brain Drain*, 1967, based on an estimate of about $20,000 per scientist for education and training, a total of 4,390 scientists, engineers, and physicians from developing countries came to the United States in FY1966, contributing about $88 million to the United States. Of these, 2,563 were scientistic professionals from 13 countries that are major recipients of U.S. aid programs, which alone contributed more than $50 million to the United States. This more than offsets the $40,285,000 disbursed in U.S. aid funds, effectively reversing U.S. efforts to help developing countries. This is called "reverse foreign aid."[41] Using India as an example, U.S. economic aid (debt and loan approvals) to India in FY1972 was $428.5 million, but India's cost of educating professionals to emigrate to the U.S. was $107.4 million, and the estimated cost of education saved by the U.S. was $279.2 million.4[42]

The number of Indians immigrating to the United States in the technical and professional workers category rose from 54 in 1965 to 1,750 the following year.[43] The number of Indian students also tripled between 1958 and 1968, from 2285 to 8221, with 35 percent of them seeking permanent residence in the United States. In particular, IIT graduates accounted for 40 percent of all Indian engineering students who immigrated to the United States between 1960 and 1985, and in some fields, this percentage exceeded 60 percent. Thus, IIT graduates were absorbed in the American engineering community and incorporated into the American-dominated science and technology empire. [44]

Conclusion

Many highly skilled individuals who emigrated from India to the United States during the Cold War continued to thrive in the U.S. economy. Many Indian immigrants were scientists, engineers, doctors, and other professionals who entered high-tech fields, such as aircraft,

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many professionals from the Third World. *The Brain Drain*, 1967, p. 4.

39 *Brain Drain*, 1974, p. 2.

40 A study on professional migration in Iran, Pakistan, and Turkey found that 50 percent of scientists trained abroad have not returned home, and Argentina has lost 5,000 engineers to migrate in recent years. *Brain Drain*, 1974, p. 35.

41 *The Brain Drain*, 1967, p. 7.

42 *Brain Drain*, 1974, p. 250.

43 Bassett [2016] p. 288.

44 Yokoi [2022] p. 287.

electronic communications, software, and computer development. In the early 1970s, the average per capita income of the Indian community was higher than that of other ethnic groups.[45] IIT graduates have been particularly active in the U.S. business community, including Sundar Pichai, CEO of Google's parent company, Alphabet; Nikesh Arora, former vice president of Softbank Group; and Parag Agrawal, former CEO of Twitter (now X). This economic power and social status have also fueled political activity, and today the Indian community is part of a powerful political lobby, with a strong network of political leaders and parties in their home country.

As this paper shows, the current success of Indian immigrants in the United States is grounded in the development of highly skilled human resources through U.S. technical assistance policies during the Cold War and the change in U.S. immigration policy to accept such human resources. Looking at the domestic situation in the U.S., there was a severe shortage of scientific and technical personnel after World War II, and for the U.S. to survive the Cold War with the Soviet Union, it was necessary to actively accept highly skilled human resources from India and other Asian countries. From the U.S. perspective, the foundation for becoming the world's leading scientific and technological power has much to do with promoting the acceptance of highly skilled human resources from Asia during the Cold War.

These times have changed; however, countries around the world now have preferential admission policies for advanced talent from abroad. Recently, IIT graduates are increasingly doing business in India rather than studying or working in the United States, and the career paths of advanced Indian talent are changing. Brain drain in the United States is no longer as obvious as it was in the past. In contrast, the possibility of brain drain from the United States is now being considered for the first time in U.S. history.

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[45] Sahay [2009] p. 11.

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