Chapter VI

OBSERVATIONS

Migration of manpower resources across national boundaries has been a characteristic phenomenon from time immemorial. However, the nature and course of international migration have undergone tremendous changes from time to time. Although the origin of international migration, in its modern sense, could be traced to the industrial revolution in Europe, a distinct qualitative and quantitative transformation in its course was discernible in the 20th century and particularly during the post-War period.

The characteristic feature of the post-War international migration, compared to its previous phases, has been an overwhelmingly excessive outflow of qualified and trained manpower resources from developing countries. The destination of the outflow has been, invariably, industrially and technologically advanced western countries. The process which all began in the 1950s gathered tremendous momentum during the 1960s and 70s. The excessive outflow posed severe challenges to most developing countries, as it aggravated the asymmetry in the technological capabilities and levels of socio-economic development.

The asymmetry was most marked in the stock of science and technology personnel, as also in the stock of qualified and trained manpower resources. While developed countries accounted for major chunk of the technological capabilities and resources in the 1950s, it was practically non-existent in the newly independent countries. The efforts of developing countries to train and develop the same met with severe resistance.
The nature and extent of the disparities were so glaring that world nations gradually began to be categorised into technological haves and have-nots. Ever widening disparities in the socio-economic fields on the one hand and huge imbalance in the technological capabilities on the other, coupled with the excessive outflow of scarce qualified and trained manpower resources emerged as critical issues in the 1960s and 70s. In turn, the issue of reverse transfer of technology began to occupy the central position in the development agenda.

A cursory examination of the nature and pattern of post-War international migration reveals that the US emerged as the most prominent destination of HQM resources during the post-War period, replacing many of its traditional rivals. On the other hand, developing countries as a whole accounted for major share of the outflow. Among the developing countries, Asian Countries and India in particular experienced the severe-most drain. Obviously, a study on the reverse transfer of technology from India to the United States merits serious attention.

We began our study with an examination of the divergent perspectives that would offer a theoretical explanation to the problem. It was soon realised that the very issue of reverse transfer of technology lacked conceptual clarity. Moreover, it was also found that wide disagreements existed on the very definition, the types of personnel to be included in the categorisation and the length and duration of stay of the migrant.

Hence, we resolved to use the term 'reverse transfer of technology' synonymously with brain drain and to define the term in its general sense so as to include qualified and trained personnel such as scientists, engineers and medical professionals as well as such other personnel who have received specialised training and experience. It was also felt necessary not to make much distinction between the HQM categorisation employed in the UN sources and the PTK categorisation as used in the US sources, although marginal differences exist.
We began our study with a review of the theoretical debate on reverse transfer of technology. Our examination reveals that four major approaches exist on the issue—nationalist approach, internationalist approach, push-pull approach and the world systems approach. The internationalist and nationalist approaches were found to concentrate on the welfare effects of reverse transfer of technology. According to the proponents of internationalist approach, brain drain simply reflects the operation of an international market for human capital. Like its physical counterpart, human capital would tend to move to those regions where its productivity is high. Therefore, the international migration of human capital based on free choice results in the optimisation of individual productivity and therefore world welfare.

Conversely, the nationalist approach perceives the problem of reverse transfer of technology in terms of national welfare and development. The principal criteria was, service to the nation. It regards a minimum amount of human capital as indispensable to a country’s economic development and if migration causes the nation to fall below this minimum, it will jeopardise the growth potential of all combined resources in the country. In order to realise the growth aspiration of developing countries that pay the highest social cost for the loss of their skilled manpower, nationalist approach suggests some interference analogous to the protection of infant industries against premature competition.

Although internationalist and nationalist approaches concentrate on the ‘loss’ or ‘gain’ considerations, the magnitude of the problem as experienced by the developing countries was not adequately considered in both these approaches. Moreover, these approaches also failed to analyse the root causes of HQM migration in its totality.
The push-pull approach, on the other hand, focuses on the causative factors that propel emigration (push factors) and attract immigration (pull factors). The push factors originating in the emigrating countries include general economic backwardness of the country, low salaries, unsuitable institutional setting, lack of manpower planning, political instability etc. and the latter which originate in the immigration countries include growing demand for talented professionals, lure of higher standard of living, income differentials, better research facilities etc. Although the push and pull factors have been adequately stressed in this model, it does not give adequate consideration to the global structure within which push and pull factors operate as well as the interdependence of both.

On the other hand, world systems approach was found to examine the issues involved in the international migration leading to reverse transfer of technology in its totality and in a socio-historical perspective. World systems approach traces the origin of reverse transfer of technology with the modern technological revolution. Modern science and technology demands more expensive physical facilities and equipment than before and quite naturally the core nations play the dominant role in the production and dissemination of advanced knowledge and technology. The periphery countries simply do not have the capacity to do so and they are destined to a state of technological dependence which has historical roots related to the development of capitalism.

Historical pattern of dependence from the colonial to the post-colonial period has been distinguished as colonial dependence, financial-industrial dependence and technological-industrial dependence. Technological dependence is of particular importance in relation to brain drain since it is the hierarchical nature of international science and technological system that has resulted in the migration of high level manpower from developing to developed countries. According to world systems approach, structural asymmetry resulting from the concentration of science
and technology and R&D activities in industrialised countries generate strong pull for S&T manpower in underdeveloped countries, thereby inducing them to migrate.

The push factors result primarily from the hierarchical nature of the world order. Heavy dependence on western technology in order to satisfy the distorted consumption pattern had a devastating impact on the indigenous R&D structure in developing countries. Dependence on western technology results in the lack of demand on the science and technology system in these countries, which in turn would lead to the alienation of scientific institutions from production activities. Since there is no demand for indigenous science and technology, there is no incentive for the indigenous science and technology system to produce; and in turn the science and technology system in the developing countries proved to be incapable of generating any significant amount of indigenous technology. In such an atmosphere characterised by the delinked nature of research and industry, the science and technology personnel had little to contribute to technological and industrial development of the nation, thereby inducing them to migrate.

The dependence on western technology was further reinforced by the reorientation of national education system with western bias. As a consequence, maintains world systems approach, scientists and technologists trained in such institutions were more acquainted with the development issues in western countries and had little insights into development needs at home. Imbalances in the educational system and its inability to relate the science and technology with prevalent socio-economic realities made the highly educated unemployed or under-employed. Employment difficulties along with their alienation from the domestic environment induce scientists and technologists to migrate. Further, developing country manpower trained in developed countries is most often irrelevant or unsuitable to the particulars conditions of developing countries, and they can pursue a carrier in their chosen field only in advanced countries.
The foregoing discussion reveals that relative neglect of indigenous R&D system, inability to link the R&D, in whatever little form it used to exist, with industry and socio-economic realities, inadequacy in the manpower planning etc. are integrally linked with the international system. Imbalances in the national educational system and its dependence on western methods and models provided further stimuli for the asymmetric flow of trained and qualified manpower resources from developing countries. Technological changes having created a new international division of labour, it will lead to an international market for HQM. Hence, international market for HQM characterised by both emigration and immigration is a reflection of the hierarchically structured global science and technology order. This perspective as outlined in the world systems theory undoubtedly offers a distinct conceptual and theoretical framework for the problem under examination.

It is with this perspective in mind, that we proceeded with the examination of the pattern and trends in international migration in general and reverse transfer of technology in particular. Our analysis of the historical trends in international migration, as discussed in Chapter II, shows that there has been a qualitative and quantitative transformation in the course of international migration from time to time. However, the post-War phase of the phenomenon was distinctively different compared to earlier phases.

The advent of large-scale international migration coincided with qualitative changes in capital accumulation stimulated by technological changes. Specifically, it was the technological innovations that precipitated colonising migrations, the first huge international migration in history. It ceased to exist with the end of colonisation and incorporation of the world into a single capitalist economic system. In the present century, migration take place in various forms. However, labour migration has established itself as a dominant form of international migration.
As world systems theory rightly argues, it followed directly from the globalisation of the market economy and was a natural outgrowth of the disruptions and dislocations that occurred in the peripheral countries as a consequence of capitalist penetration. In other words, it was colonisation that heralded modern international migration. In contrast to colonisation, which was the movement of ‘advanced’ populations settling ‘backward’ lands, post-War international migration was characterised by an excessive outflow of scarce HQM from developing countries.

Another major feature of post-War international migration as illustrated in our analysis has been the increasing restrictions imposed by host countries. Governments now regulate migration strictly according to national interests and migration has become an important and selective part of government policies. As labour shortage is no longer a serious problem in many of the traditional receiving countries, there has been a marked trend in these countries towards a closing door policy. Migration for permanent settlement was found to be strictly restricted in most developed countries and labour migration takes place mainly under contract labour programmes made through agreements between the governments of sending and host countries. Notwithstanding the strict control over migration, developed countries encouraged the immigration of the highly qualified scientific and technical personnel during the post-War period, especially since the mid-1960s.

An overview of migration statistics revealed that almost all the countries of the world participated in the migration net work, but their position in the system varied widely. Our examination of the pattern and trends in post-War international migration reveals that migration of high quality manpower or reverse transfer of technology followed certain pattern and its direction was mainly to the technologically and economically most developed countries. This was manifest in the case of the US, Australia and Canada, which were the largest receivers of
HQM. Other western countries, which were not so developed also received smaller quantities of high level manpower. Stated otherwise, magnitude of migration of HQM to a country reflects its position in the international division of production, which is defined in part by the level of technological capability of countries. The disadvantageous position of developing countries in the international system is revealed through the loss of their high quality manpower to the developed countries. Almost all countries in Asia, Africa and Latin America experienced loss of their high quality manpower resources.

It was also observed that changes in immigration policies was the most important factor that accelerated the immigration of skilled manpower to the recipient countries. In major recipient countries like the US, Australia, Canada and the UK, immigration policy that favoured the immigration of high level personnel were enacted in the post-War period, particularly since mid-1960s. The enactment of immigration policies that encouraged the immigration of HQM coincided with the qualitative change in the capital accumulation process, which was facilitated by a continuous series of technological innovations along with the post-War resurgence of economic development in the developed countries.

Concentration of technological progress in the developed countries generated increasing demand for highly qualified and skilled labour in these countries. However, it was also observed that the output from educational institutions in these countries was not in proportion to the domestic needs. To meet their increasing demand for high quality science and technology personnel, developed countries resorted to attract high quality manpower from developing countries through immigration. And they reviewed their immigration policies in such a way so as to facilitate the inflow of required manpower. In turn, the policy changes in these countries tremendously increased the immigration of HQM to these countries.
Earlier immigration laws in the US, Canada and Australia favoured European immigrants and the non-Europeans were restricted or prohibited from entering these counties. However, progressive abolition of ‘discrimination based on national origin’ and its replacement with ‘discrimination based on education and skill’ led to a sharp rise in the immigration of HQM from developing countries, especially from Asia and Africa. As a result, Asia replaced Europe as the major source of highly skilled immigrants in the post-War period.

In brief, migration of high quality manpower resources from developing countries to developed countries emerged as the most important feature of international migration during the post-War period. And immigration policies acted as the most powerful instrument in the hands of developed countries that accelerated the migration of high quality manpower from developing countries.

The significance of the immigration policy occurs because the state is a territorial unit as well as a political and economic unit within the world system. Regardless of the economic, political and social forces that may propel and attract migration, actual immigration is shaped by the immigration policies of the recipient country. In turn, formulation of the immigration policy of a nation is generally influenced by a host of domestic and international factors, which are economic, technological, political and demographic in nature. Generally, countries formulate their immigration policies in such a way that the same maximises their gains from immigration.

Given the decisive significance of immigration policy in shaping the inflow of manpower, an examination of the immigration policy in relation to the complex factors involved in its formulation was found very important to understand the changing nature and pattern of migration to a particular country. Hence, we made a detailed examination of the US immigration policy in Chapter III. Our analysis of the United States’ immigration policy shows that, four main elements figured
prominently in the formulation of immigration policy: economic, racial, nationalistic and foreign policy considerations. These four main determinants sometimes acted in harmony with one another, reinforcing each other in their impact on policy. At other times, they acted in conflict with each other as contending forces seeking to determine the primary thrust of immigration policy.

Until 1882, immigration to the United States was almost unrestricted. The Act of August 1882, which excluded certain categories of persons who may become a public charge, is considered the first general immigration law. It was followed by a series of Acts that placed restrictions on who could enter the US based mainly on racial consideration and personal characteristics. Concern over the impact of unrestricted immigration upon the US economy and labour market was the major reason behind the enactment of these laws. Chinese Exclusion Act of 1882, "Gentleman's Agreement of 1907 with Japan were two major laws based explicitly on racial considerations, but the implicit aim was the protection of US labour. The creation of the 'Asiatic Barred Zone' in 1917 completely banned the Asian immigration, thereby removing the 'Asian threat' to the US labour and ethnic make-up.

Growing considerations over massive immigrant flow in the first two decades of the 20th century resulted in the National Origin Quota Acts of 1921 and 1924 which restricted intake from each country on the basis of their contribution to the population of the United States. These Acts effectively curtailed immigration from South East Europe and non-European countries which had sent lesser immigrants compared to North-Western Europe, thus making an ethnic balance in favour of North-Western Europe. No major immigration laws were enacted during 1930s - the decade, which witnessed the lowest number of immigrants due to depression combined with the restrictive immigration laws.
In the 1940s, a number of new laws showing slight relaxation of policies were introduced. Most of these laws were related to foreign policy issues. As Zolbeg, an expert on international migration has observed, American immigration policies, although viewed as domestic matters with only an incidental relationship to diplomacy, have always had a global impact and as such, have often been a component of foreign policy. In 1948, the Agricultural Labour and Illegal Entry Act was enacted in response to the severe labour shortage in the US. This Act established an agreement between the US, Canada, Mexico and the British West Indies to allow immigrants to come in as temporary workers. This programme lasted till 1964.

A general consensus about the need for a comprehensive review of US immigration policy emerged in late 1940s and it led to the enactment of the McCarren Walter Act of 1952. However the Act did not make any shift in the basic nature of the policy. It codified and carried forward, with modifications, the essential elements of both the 1917 and 1924 Acts, as well as the provisions of the Internal Security Act of September 23, 1950 related to the exclusion of communists. It reaffirmed the national origin quota system for the Eastern Hemisphere and established a four category selection system based on educational qualification and family relationships. Another major Act of 1950s was the Refugee Relief Act of August 1953. In short, foreign policy and national security considerations typified the immigration policy proposals through out the 1950s.

During 1960s, the civil rights movements marked a changing national attitude towards racism that undercurrent the restrictive policy. Moreover, the success of the Kennedy Administration’s economic policies resulted in the end of the recession that plagued much of Eisenhower period and worked to undercut the opposition to immigration reform. The healthy and expanding economy of the 1960s eased fears of job competition and even organised labour favoured a more
liberal policy. These factors together contributed to the enactment of the Immigration and Nationality Act of 1965 which was the most far reaching revision of immigration policy since the first quota Act of 1921.

The Act of 1965 abolished the national origin quota system and replaced it with a system based on reunification of families and skill requirements of the US economy. The new law assigned a world-wide quota of 2,90,000 visas per year, originally split between the Western (1,20,000) and Eastern (1,70,000) hemispheres and placed a country quota of 20,000. Within these limits, immigrant visas were distributed according to a seven category preference system giving first preference to family reunification and a high preference to certain desired skills. The new law brought about significant changes in the nature and source of immigration and the occupational characteristics of immigrants as well. In the decade after its passage, total immigration increased by 60 per cent. It was also observed that major source of immigration to the US shifted from Europe to Latin America and Asia, reversing the trend of nearly two centuries. Occupational characteristics of immigrants revealed that number of immigrants with an occupation also increased and among them, the PTK category increased significantly.

During 1980s, the large refugee inflows combined with the foreign policy exigencies of the new Cold War compelled the congress to pass the Refugee Act. The next major legislation during 1980s was the Immigration Reform and Control Act (IRCA) of 1986. It was the most significant change in US immigration law since 1965. The IRCA was enacted in response to heightened pressures to control the size of the illegal or undocumented aliens in the US. IRCA contained three major provisions that were designed to act in concert to control illegal immigration: sanctions on employers who knowingly hire undocumented workers, increased enforcement at the US borders and legalisation of undocumented aliens.
Immigration Act of 1990 (IMMACT) was the most comprehensive revision of legal immigration system since the Act of 1965. It was enacted in response to mounting concern over the greater number of immigrants admitted on the basis of family unification compared to the number of independent non-family immigrants and the limited number of visas available under preference system to certain countries. IMMACT extensively revised the family based and occupation based immigrant categories and the temporary workers categories also were revised. It greatly increased the number of employment based immigrants and speciality occupations were given great significance.

Our analysis of the US immigration policy, as discussed in Chapter III and summarised above, reveals that US policies in this regard have traversed from a liberal phase to an increasingly restrictive phase during the inter-War period. Later, during the post-War phase, it was characterised by highly selective features with a view to promoting the migration of HQM. All along its course, policy reforms were conditioned by restrictive and non-restrictive campaigns, which were reflective of the underlying economic, demographic, racial, technological and labour market considerations as well as foreign policy imperatives.

It was also observed that major provisions in the Act of 1965 and 1990 were designed to facilitate an almost unrestricted inflow of HQM from abroad. It was necessitated among other things by the vigorous R&D activities in the US economy aimed at maintaining US technological edge in the frontier areas including defence supremacy.

Later, in Chapter IV, we examined the impact of immigration policy changes on the nature and pattern of immigration into the United States, particularly PTK immigration. Historically, US have been a nation of immigrants. Majority of immigrants came from Europe with the intention of settling permanently in the US. Until early 20th century, immigration was almost unrestricted. However, towards
the beginning of the 1920s, immigration began to be increasingly restricted and since then immigration decreased substantially.

However, it was the Act of 1965 that liberalised immigration to the United States to a considerable extent. Substantial quantitative and qualitative changes in immigration were brought about by the 1965 Act. Since the enactment of the Act, total immigration increased tremendously. Besides, the major source of immigration shifted from Europe to the countries of Asia, Africa and Latin America. Another important effect of the Act was a rapid shift in the occupational composition of immigrants. Number of immigrants with a stated occupation increased in proportion and the increase was most substantial in the PTK category, especially from developing countries.

The provision of preference to professionals and skilled workers in the 1965 Act was mainly responsible for this change. The preference system was first introduced in 1924. In the Act of 1924 the preference system was instituted for the numerically restricted visas and potential immigrants with scarce skills were accorded the highest preference along with husbands and parents of US citizens. This system was retained in the 1952 Act also. Under the 1952 Act, aliens with high education or special skills were allotted the first 50 per cent of each country’s quota. However, since the quotas of Eastern Hemisphere were limited to 50 or 100 and areas with large quotas never used the 50 percent allowed, the law did not have a great impact on the magnitude of PTK immigration.

The immigration and Nationality Act of 1965 was the most important legislation as far as the immigration of professionals, especially from developing countries is concerned. Abolition of national origin quota system and broadening of the preference system was the two most important elements of the law. Third and sixth preferences in the seven category preference system as per the Act of 1965
was kept for occupational immigrants with high skills and qualifications. And 20 percent of the total visas were allotted to these categories.

The policy changes in the 1960s were concurrent with a shortage of professionals and technical workers in the American labour market. During 1950s and 1960s, there was a rapid growth in occupations requiring higher skills mainly due to the phenomenal growth in expenditure on defence R&D and space programmes as well as increased utilisation of scientists and engineers and technicians in functions other than research - by industry, government and educational institutions. In spite of large increase in the demand for scientists and engineers, the elasticity of supply remained low because of the time it takes to train new ones. In the case of the US, evidence suggests that the elasticity of supply remained low even in the long run mainly due to the high cost of training. It was in this context that the US resolved to meet domestic manpower shortage through immigration from abroad.

After the enactment of Immigration and Nationality Act of 1965, immigration of PTK resources increased sharply, for instance, from a total of 28,790 in 1955 to 48,890 in 1971. Percentage share of PTK category in the total immigration also marked an increase after 1965. For instance, the share of PTK immigrants in total occupational immigrants increased from 9.7 per cent in 1965 to 13.2 per cent in 1971. Among the PTK immigrants, engineers, scientists and medical personnel marked the largest increase.

Besides, it brought about significant changes in the source countries of PTK immigrants. Majority of PTK immigrants before 1965 came from developed countries of the west. After the enactment of the law, developing countries emerged as the principal suppliers of high quality manpower to the US, replacing Europe and North America. For instance, the share of developed countries in the immigration of scientists, engineers and physicians to the US declined from 67 per cent in 1956
to 48 per cent in 1967 while that of developing countries increased from 32.9 per cent in 1956 to 51.8 in 1967. Further, during the period 1971-76, 72 per cent of all physicians and surgeons who immigrated into the US were from developing countries. This trend continued through 1980s and 1990s. During 1988-90, developing countries constituted almost 75 per cent of total professional immigration to the US.

Among the developing countries, Asian region emerged as the principal supplier of PTK to the US. Asians emerged as the dominant group among the immigrant professionals from both developed and developing countries. Among the Asian countries, Philippines India, South Korea, Hong Kong, Taiwan and Japan stood out as the principal suppliers of PTK immigrants. For instance, of the 1,50,000 highly skilled personnel admitted during 1988-90, more than 50 per cent came from Asia.

Foreign students studying in US educational institutions constituted a major share in total professional immigration to the US. On completion of their studies, a considerable portion of the foreign students was found to change their student ‘F’ visa to get an immigrant visa. Large number of these students who stayed back in the US had higher qualification, such as post graduate degree or doctorate degree. For instance, of the 5,007 foreign students who received science and engineering doctorate during 1980-81, about 60 per cent of the engineers, over 50 per cent of physical and mathematical scientists and 40 per cent of other scientists remained to work in the US. In other categories of non-immigrant visa such as temporary workers and intra-company transferees also a considerable proportion of them adjusted their status to that of permanent resident aliens. Statistics also reveal that Asia was the largest source of students and temporary workers in the US and India was among the top sending countries.
In brief, our analysis of nature and pattern of immigration into the US (Chapter IV) enable us to state that immigration policy changes from time to time promoted a selective inflow of HQM into the US. And the US emerged as the principal recipient of high quality manpower from countries all over the world. Developing countries, particularly the countries of Asia emerged as the principal sending countries and India was one of the largest senders of HQM to the US. It could also be observed that although the share of African and Latin American countries in the immigration into the US was quantitatively much lower than the share of Asian countries, the outflow from the former countries in relation to the aggregate stock available at home was considerably high.

It was against this background that we examined the migration of HQM from India to the United States. Our examination of the Indian experience in this regard vis-à-vis the United States as presented in Chapter V, reveals that Indian migration to the United States has gone through four phases. During the first phase, which lasted till 1946, Indian immigration to the US was negligibly low on account of the severe restrictions imposed on India on the one hand and her colonial background on the other. The second phase of Indian immigration began in 1946 with the allotment of an annual quota of 100 to India, mainly based on foreign policy considerations. The enactment of the 1965 Immigration and Nationality Act signalled the third and the most important phase in Indian immigration.

1965 Act abolished the national origin quota system and replaced it with a system of preferences based on family relations and skills and educational qualifications. Immigrants with higher educational qualifications and skills were given high priority. The Act was passed, as already discussed earlier, in response to the rapid increase in the demand for PTK occupations in the American labour market, which in turn was caused by the rapid increase in US space, defence and other technological programmes.
Impact of the 1965 Act on Indian immigration was tremendous. Immigration from India registered substantial increase of 400 per cent during 1965-66. Since India had not sent much immigrants before 1965 who could have used the family based immigrant quota, most of the Indians who entered the US in the 1960s had to use the occupational preferences, mainly the third preference category (highly qualified manpower). For instance, in 1967, 88 per cent of the Indian immigrants who reported an occupation were in the PTK category and their share increased to 90 per cent in 1971.

Even before 1965, although numerically low, professionals constituted a significant proportion of all immigrants from India. Their entry was closely associated with the provision of preference for highly qualified professionals in 1952 Act and a special Act in 1962 which allowed scientific and other professional applicants to avail unused other country quota, thereby permitting entry outside national quota limitations. Hence, majority of the Indian immigrants to the US during 1952-65 was highly qualified professionals and 1965 Act accelerated the entry manifold.

After the enactment of 1965 Act, the number of Indian scientific and technical personnel immigrating to the United States increased sharply and a few occupational groups dominated the immigrant flow. For instance, 55 per cent of the science and technology personnel admitted as immigrants from 1956 to 1986 were engineers, 29 per cent were physicians and surgeons, 14 per cent were natural scientists and the rest 2 per cent were computer specialists. It was also observed that 20 per cent of IIT graduates on an average from all IITs left the country and 56 per cent of the medical professionals graduated from AIIMS during 1956-80 immigrated to foreign countries. Among the recipient countries, USA was the major destination of Indian HQM. Institution specific studies show that 87 per cent
of AIIMS graduates who emigrated from India were in USA and 82.6 per cent of the graduates of IIT Bombay who migrated were in US/Canada.

Gradually, during 1980s, proportion of professionals in total immigration began to decline as more and more immigrants began to enter under family preference. This trend was equally applicable to immigration from other regions also. In other words, the proportion of PTK in total immigration marked substantial decrease towards the end of 1980s. The ever growing demand for highly qualified professionals in R&D, information technology, computer field etc. necessitated a thorough revision of the immigration policies that would allow the entry of highly qualified and trained personnel. It culminated in the enactment of the Immigration Act of 1990, which revised the family-based and employment based preference system extensively.

The effect of the Act of 1990 was such that it lead to a substantial increase in total immigration and the employment based immigration in particular. Thus, total immigration from India increased from 30,667 in 1990 to 40,121 in 1993. Number of PTK immigrants increased from 3,813 in 1992 to 7,973 in 1993. The category of immigration entitled temporary workers also increased considerably. Most of the temporary workers from India entered under the ‘H1-B’ visa category i.e., speciality occupations requiring higher qualifications and skills. Thus, India experienced substantial outflow of its high quality manpower to the US through the immigration policy changes whereas the United States gained invaluable human capital enabling the latter to maintain the technological edge and supremacy.

Our analysis of Indian experience in the reverse transfer of technology to the United States reveals that it has been caused by a complex interaction of push factors in the Indian context and a number pull factors originating in the United States. In view of her colonial experience, it was quite natural for independent India to design such a national policy that would multiply the stock of qualified and
trained professionals - an essential input for technological self-reliance. In turn, in proportion to or ahead of the proclaimed objectives, the stock of such manpower resources grew in India. However, the problems emanating from flaws in educational planning, employment planning and technology planning and the lack of integration between different sectors of the economy, say, sector which produces educated manpower and sector which utilise it, as well as the existence of a weak national R&D system provided adequate impetus for massive outflow of HQM from the country.

India’s manpower planning was designed, not taking into consideration the manpower needs of the economy and educational planning was not in compliance with employment planning. Anticipating a rapid increase in the demand for science and technology personnel to pursue its development efforts, India had invested heavily in the educational sector, especially in higher education. As a result, the realm of higher education in India grew at a very fast pace and there was a tremendous increase in the supply of science and technology personnel. In fact, India made considerable progress in developing a large number of highly qualified personnel in the fields of science, engineering, technology and health.

However, this increase in the stock of science and technology manpower was far ahead of the growth of the national capacity to effectively absorb all those coming out of the institutions of higher education nor could the economy effectively utilise the growth in science and technology manpower. This was mainly due to the lack of an organic link between the pattern of production and pattern of consumption, which could be explained only in terms of the science and technology policies, and actual scientific and technological capabilities of the nation and its linkages with global system.

India’s science and technology policy was adopted with the objective of developing technological competence so as to achieve self-reliance. However, the
implicit policy involving the import of foreign technology followed as part of achieving the objectives of explicit policy of technological self-reliance adversely affected the technological capability of the nation. Production based on imported technology, as part of India’s policy of import substituting industrialisation, fundamentally resulted in the alienation of science from production and the consequent marginalisation of science in the economy and society. Reliance on foreign technology partly resulted in a lack of demand for local science and technology. The relatively weak nature of national R&D system, the delinking of science and technology apparatus from production process etc. lead to under-utilisation of science and technology personnel.

In spite of the inability of the economy to create adequate employment for highly educated, higher education system continued to expand. This was mainly due to the fact that most often, the educational policy was not planned after the demands of the economy. Several factors other than manpower requirements influenced the educational resource allocation. One of such factors was the elitist nature and western bias of higher education. Prestige was attached to higher education as well as many of the desirable jobs, particularly with public sector were allocated based on educational credentials. It resulted into an explosive expansion of higher education and fostered employment expectations that could hardly be met.

Moreover, the adoption of western-modelled education resulted in the alienation of the highly educated from the domestic environment. For example, prestigious institutions such as IITs and IISc were established with substantial cooperation and assistance from foreign countries such as USA, UK and West Germany. Although collaboration with foreign educational system helped to achieve excellence by international standards, it also resulted in the deleterious consequence of the alienation of scientists and technologists from the developmental needs of the country. For example, to produce an engineer who really fits into the
Indian technology scene, it is pointless to process him through US academic programme. The alienation of such personnel from domestic environment as well as their desire to pursue advanced science and technology induced them to migrate to western countries.

Further, the process of reverse transfer from India to the US was accelerated by a host of pull factors exerted by the United States. As already observed earlier superior position of the United States in the global science and technology system did act as the major pull factor that attracted science and technology personnel from the developing countries and India in particular. Besides, US provided higher work conditions to scientific and technological personnel than any other country in the world. The diverse pull factors found expression in the Immigration policy of the United States and in turn the Acts of 1965 and 1990 contained major provisions that facilitated the immigration of HQM into that country.

Our examination of the crucial issues in reverse transfer of technology from India to the United States, as comprehensively summarised above, allows us to draw certain important general and specific observations. First of all, it was observed that, international migration in its modern sense, which began with the industrial revolution in Europe, entered a qualitatively distinct phase in the post-War period. The qualitative transformation was characterised by, among other things, certain major trends; an excessive outflow of HQM resources, unlike the unskilled and the general nature of migration during the previous phases; the source of outflow was mostly the developing countries of Asia Africa and Latin America whereas prior to World War II migration took place mostly from Europe, and emergence of the United States as the predominant destination of HQM resources replacing other developed countries.

Our analysis of this qualitative transformation in international migration reveals that it was influenced by a host of interrelated push and pull factors
operative in a hierarchically structured global science and technological system. In such an international structure, nations were assigned implicitly as well as explicitly roles and functions in conformity with the colonial phase. Technology was increasingly used as an instrument of domination and control so as to retain the technological edge and superiority of the developed countries. This was ensured through tremendous investment in R&D in the frontier areas including defence R&D, generating a high demand for highly qualified and experienced manpower resources. Internal supply being inadequately low, it was quite natural for the industrially and technologically advanced countries to meet the demand through selective immigration.

Conversely, a host of push factors, which were more or less common in the case of almost all developing countries, stimulated the excessive outflow of HQM from these countries. These factors which used to range from the disproportionately higher growth of HQM, its mismatch with manpower and economic planning, relatively weak nature of indigenous R&D system, dependence on western technology, to the elitist nature and western orientation of higher education acted in combination with each other setting the stage for a reverse flow of technology, as embodied in personnel.

Our examination of the US experience in this regard allows us to state emphatically that the United States emerged as the most important destination of HQM outflow from developing countries primarily due to the short supply of HQM internally. Moreover, there are evidences to suggest that internal demand for HQM was met through immigration, as it would have been economically viable compared to development of such resources at home. Major immigration policy changes enacted by the Acts of 1965 and 1990, with definite provision for HQM immigration, are indicative of the same.
Our analysis of the changing course of US immigration policy reveal that the selective phase in the post-War period was preceded by a restrictive phase during the inter-War period and a liberal phase during the pre-War period. If labour shortages and booming economic activities stimulated the liberal phase, ethnic and racial considerations, depression and economic recession as well as oversupply of unskilled labour triggered restrictionist policies during the inter-War period. On the other hand, renewed economic activity combined with substantial R&D investment generated a high level of demand for HQM resources, the internal supply of which was inadequate. Besides, foreign policy imperatives together with spirit of civil rights era demanded liberalisation of immigration policy.

In the ensuing circumstances, the anti-restrictionist sentiments prevailed over restrictionist campaign, thereby ushering in an era of selective immigration. Inevitably the interplay of push and pull considerations acted in consensus thereby ensuring the required manpower resources in the desired manner. In the process, developing countries as a whole experienced considerable loss as such HQM resources were synonymous with tremendous investment in human capital and for similar reasons, it proved to be tremendous gain for the recipient United States.

An examination of Indian experience in reverse transfer of technology vis-à-vis the United States which has been the emphasis of this study reveals that it conformed to the general experience of the developing countries in the post-War period. In the course of our analysis, it was observed that the stock of HQM resources grew at a tremendous pace in independent India in proportion to or far ahead of the targets set for. However, the mismatch of the output from the institutions of higher education with the employment and manpower planning lead to either unemployment or underemployment of HQM. The national technology system with its dependent nature on western technology, insignificant and weak nature of the indigenous R&D, delinking of production process from indigenous
technological capabilities all contributed in varying degrees whereby national economy failed to absorb the HQM stock available even when demands of development necessitated it. Logically, India began to experience an excessive outflow of the qualified trained and experienced manpower resources. Perhaps the pull considerations emanating from the United States far outweighed the inducements from other developed countries thereby promoting the selective outflow of HQM from India to the United States.

The predominant position of India in the immigration of HQM into the United States is well illustrated by a number of case studies. Our examination reveals that after the enactment of the 1965 Act, there has been a tremendous increase in the immigration from India, to the extent of nearly 400 per cent during 1965-66. A majority of immigrants were highly qualified and experienced as is evident from the fact that 54 per cent of the science and technology personnel admitted as immigrants during 1966-86 were engineers, 30 per cent were physicians and surgeons, 14 per cent were natural scientists and the rest 2 per cent were computer specialists. It could also be observed that substantial proportion of engineers, scientists and medical professionals educated and trained in the premier institutions such as IITs, IISc, and AIIMS during 1956-80 emigrated from India and major destination of them were the United States. The pace of HQM immigration from India to the United States was further accentuated by the Act of 1990 and the trend continued unabated in the 1990s as well.

In brief, our examination of Indian experience in reverse transfer of technology allows us to state that migration of Indian professionals to the US was conditioned by the interplay of large number of push and pull factors, which resulted from the economic and technological inequality between these nations as well as structural imbalances within these economies. Regardless of the economic and
social forces that propelled and attracted immigrants, ultimately their numbers and characteristics were shaped by the immigration policy of the United States.

The process of globalisation, which gathered tremendous momentum in the 1990s, has ushered in an era of major economic reforms in India. It has been characterised by a series of policy measures designed to liberalise and open up a number of hitherto protected sectors of national economy. Liberalisation of the manufacturing and service sectors of the national economy together with policies that facilitate a free flow of foreign direct investment, inevitably, shall reshape the very nature of outflow of HQM from India.

The globalisation of R&D through setting up overseas subsidiaries in developing countries shall enable the TNCs to meet their HQM resource requirements in future, without taking recourse to immigration. Besides, globalisation and the evolution of new corporate structure may significantly alter the very nature of international migration in the future, as long as the HQM resources could be utilised in the country of origin itself or made available on a short term contract basis.

Stated in general terms, reverse transfer of technology is the subtle manifestation of the asymmetries that characterise modern societies. Although individual emigrant and parent countries may derive marginal benefits from the perspective of developing countries, reverse transfer of technology represent the most explicit and most refined form of neo-colonial dependence. With successive waves of globalisation, the problem may appear to change its form, but shall essentially remain intact in its content.