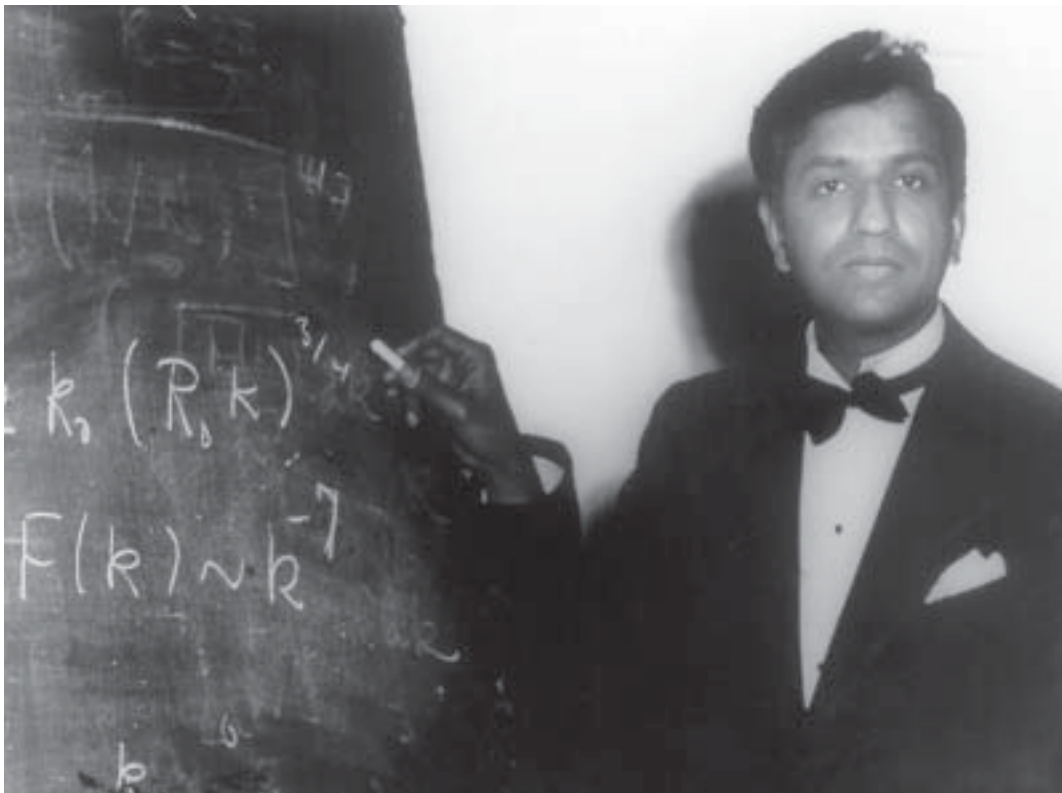


Science and Technology



Dr. Hargobind Khurana, born in India and co-winner of the 1968 Nobel Prize for Medicine and Physiology



Dr. S. Chandrasekhar, Indian born scientist, 1983 winner of Nobel Prize for Physics

Importance of the Theme

The Indian Diaspora has played an important role in the field of Science & Technology (S & T). The emigration of Indians in the nineteenth century to Fiji, Mauritius, Africa and the Caribbean countries consisted mainly of indentured labour. Even among emigrants with little or no formal education, the levels of education in succeeding generations were high and some went on to achieve international recognition in their fields. However, from the mid-twentieth century onwards, emigration to the US and some countries of the West was of a different nature. Part of the reason was because those countries became more receptive to highly qualified Indian/Asian immigrants. Indian emigration thus increasingly consisted, among others, of highly qualified scientists, engineers and other professionals, also termed as the *Brain Drain*. The opening up accelerated significantly in the wake of America's IT-led economic boom in the 90s to which Indian IT professionals had made a visible, high profile and widely recognised contribution. The standing of the Indians in the scientific community is best illustrated by the fact that Dr. Chandrashekar and Dr. Hargobind Khurana are probably the rare examples of first generation of Indian emigrants from Asia to have won Nobel Prize in Science

- 33.2. Scientists of Indian origin abroad are an organised group. They have their alumni-based and professional associations. There is thus an institutional basis for interaction with this section of the Indian Diaspora. They are also keen to contribute to their country of origin. It is, therefore, important to evolve some mechanism to deepen linkages in this field with the Indian Diaspora. They can also play an important role in enhancing India's relations with the countries of their adoption.
- 33.3. It was against this background that the High Level Committee on the Indian Diaspora requested the Department of Science & Technology to set up an Expert Group on the Role of NRIs and PIOs in S&T. The S&T Expert Group
- (i) reviewed the contributions by Indians abroad to Indian S&T programs;
 - (ii) scanned the existing mechanisms and schemes that Indians abroad can avail of, and

- (iii) recommended new avenues and institutional frameworks to network with S&T professionals of Indian Origin abroad for accelerating the pace of India's progress in science and technology. It also looked at the Chinese and Israeli systems for canalising the contribution of their immigrants to national S&T programmes.
- 33.4. The Science & Technology Expert Group Report reflects not only the views of the members of the Expert Group, but also the perceptions offered by the Indian Scientific Ministries, Departments and Agencies (MIT, MNES, DRDO, DBT, DOD, CSIR, ICMR, ICAR, NIC), technical education institutions, professional bodies and associations (MRSI Bangalore and CII Delhi), select national R&D laboratories, eminent scientists of international repute in India, Indian Missions in UK, USA and Israel, and distinguished scientists of Indian origin abroad. The main elements of the Expert Group's extensive study are given below:

Contribution to Indian S&T

- 33.5. The Scientists & Technologists of Indian Origin (STIOs) abroad have received international recognition *inter-alia* in Information Technology & Computer Science, Chemical Science & Engineering, High Energy Physics, Meteorology, Biotechnology, Materials Science & Engineering and Medical Science & Health. Some of the notable and wide ranging contributions to the Indian Science & Technology are as follows:

Thus, they have set up:

- The Advanced Network Laboratory & IBM Research Centre at IIT Delhi;
- The Kanwal Rekhi School of Information Technology at Bhupat;
- The Jyoti Mehta Biosciences and Bio-engineering School at IIT Mumbai;
- The G.S. Sanyal School of Communications;
- The Vinod Gupta School of Business Management and Advanced VLSI Design Laboratory at IIT, Kharagpur;
- Chairs on Data Flow Computing at IIT Kanpur;
- The Centre for Theoretical Physics at IISc Bangalore;
- The Centre for Atmospheric & Ocean Sciences at the University of Allahabad, Allahabad;
- The LV Prasad Eye Institute at Hyderabad.

Key initiatives of great importance for the Indian pharmaceutical sector include:

- Production of affordable Hepatitis Vaccine in India by Shantha Biotech, Hyderabad, a venture spearheaded by an Indian expatriate who returned to India; complete genome sequencing

of Indian isolate of Hepatitis-C virus that causes chronic hepatitis in collaboration with US-based Indian scientists.

- Award of contract research assignments by American Pharmaceutical Companies to Indian R&D laboratories on development of new drug molecules. They have also facilitated access of Indian scientists to:
- Research facilities like Cancer Cell Lines at the National Cancer Institute;
- Cancer Cell Lines at Harvard Medical School to test the HCG Vaccine & antibiotics for treating/prevention of lung cancer;
- Facilities at Bethesda, Maryland for testing anticancer and anti-AIDS compounds;
- Facilities at John Hopkins University to test neem extracts for their activity against malarial parasite;

In addition they are collaborating in:

- Studying the feasibility of setting up a Neutrino Observatory in India;
- Installing numerical models for medium range weather forecasting & long-term prediction of monsoons;

They also facilitated the:

- Participation of Indian scientists from NPL (Delhi), ISRO (Trivandrum), PRL (Ahmedabad), IITM (Pune), IISc (Bangalore) in a major international program - the Indian Ocean Experiment (INDODEX) ;
- Successful negotiations for placement of Indian post-doctorate fellows in premier academic-research institutions abroad for advanced research internships and training attachments in cutting-edge fields such as (i) interfacial science & colloidal phenomena, lipids research, hydrocarbon chemistry; (ii) distributed computing & verification, quantum computing, VLSI, graphics & automatic reasoning systems; (iii) prediction & long-term variability of monsoons, climate change and impact on Indian-sub-continent, prediction of tropical cyclones; (iv) RF/RHD vaccine development, functional genomics, viral hepatitis, interferon research; (v) thin films, nonmaterials, neutron scattering of materials, ceramic materials, semiconductor physics.
- Mobilising Indian professionals abroad for CME for Indian Pathologists under the aegis of the Indian Association of Pathologists & Microbiologists; Asian Schools on High Energy Physics; meetings under the aegis of Oil Technologists Association of India etc.

Current Mechanisms to Interact with Indian Scientists Abroad

33.6. The S&T Expert Group noted that the following mechanisms existed to interact with Indian scientists abroad:

- Bilateral programs of cooperation in S&T and autonomous societies for Promoting S&T cooperation coordinated by the Department of Science and Technology. These included the Indo-US S&T Forum, Indo-French Centre for Promotion of Advanced Research, DST-NSF cooperative program for scientists and engineers, DST-DAAD Project based personnel exchange etc. through which distinguished STIOs are invited to India (besides sending Indian scientists to premier overseas academic and research institutions). Such instruments of cooperation are co-financed by the two sides, be it Governments or Specialized Agencies. Linking STIOs with the Indian Technology Development Board is a means for setting up joint ventures in India based on technologies developed by Indians abroad.
- STIOs are more familiar with the ***The Transfer of Knowhow Through Expatriate Nationals*** (TOKTEN) -India Program. TOKTEN enabled 650 STIO professionals to visit 250 Indian institutions during 1980-2001 and rendered benefits to Indian S&T programs particularly in fields of high performance construction materials, drug, diagnostics and medical instrumentation, agricultural biotechnology.
- Recent initiatives by US-based alumni of IITs for providing an endowment of Rs. 60 crores to IIT Kanpur and Rs. 30 crores to IIT Kharagpur for upgrading infrastructure and human resource development have been warmly welcomed and provided a useful model for tracking their respective alumni to other Indian premier academic-cum-research institutes.
- Advisory Panels with eminent NRIs & PIOs members set up by the Department of Biotechnology and the Ministry of Information Technology have catalysed technologies and investments into India and led to several IT and BT Joint Ventures, besides keeping Indian research initiatives up-to-date with global trends and policies in the biotechnology and information and computer sciences.
- Conferment of honorary fellowships by Indian professional scientific and technical societies and Academies which attracted many STIOs to India as resource persons for major Conferences and Seminars on cutting-edge technologies and scientific developments in India.

Comparisons with Israeli and Chinese Programmes

33.7. The S&T Expert Group studied the programmes to draw upon the resources owned by expatriates by the Government of Israel and the Government of the People's Republic of China for accelerating their national capabilities in S&T and industrial productivity. Its replicability in the Indian context is, however, limited by the fact that Government of India does not so far subscribe to dual citizenship and dual employment norms.

- Under Israel's "National Incubators Programme", 50% of the team of entrepreneurs for specific R&D projects is composed of immigrants (foreigners & returning expatriates). In the Indian context also – by inducting STIOs or foreigners in Indian Technology Entrepreneur Parks / Software Technology Parks / Export Zones, one can tap the creative potential of highly talented people from abroad equipped with state-of-the-art knowledge to work with resident S&T professionals to produce novel products and boost India's industrial productivity.
- In the Chinese model - a full-fledged State Administration of Foreign Experts Affairs (SAFEA) has been set up. In addition the China Association for International Exchange of Personnel (CAIEP) views in totality issues relating to the introduction of foreign intellectual resources into Chinese national programs *and* arranges partners through annual International Fairs tabling all the requirements of local Chinese enterprises. In the Indian context it may be useful to set up a full- fledged autonomous organisation with overseas offices in countries having maximum concentration of NRIs and PIOs. The Government of India, State Governments, Indian Industrial Associations as well as Associations of Overseas Indian Scientists, Technologists, Medical Practitioners etc could patronize such an outfit. Its functions could be similar to those of SAFEA. The Ministries of the Government of India could associate themselves with the activities and initiatives of such an organisation, such as International Fairs for negotiation of Indian projects of SMEs, Research Institutes with Overseas Indians to induct state-of-the-art technology and expertise for modernizing production.

33.8. Recommendations of the S&T Expert Group – Comments of the High Level Committee

Launching and managing Web-enabled registration of STIOs abroad

(para 3.1 of the S&T Expert Group report)

The Committee agrees for launching and managing web-enabled registration of Scientists & Technologists of Indian Origin (STIOs) abroad.

Setting up Joint Venture companies in India with technologies sourced in by STIOs abroad: (para 3.2 of the S&T Expert Group report)

The Committee agrees with the recommendation for setting up joint ventures in India based on technologies sourced by STIOs abroad in association with Technology Development Board.

Establishment of Green Corridors for joint ventures in selected high tech areas: (para 3.3 of the S&T Expert Group report)

The Committee agrees with the recommendation for establishing Green Corridors in areas such as Information Technology Hardware, Biotechnology, Health-promoting Technologies and Environment related Technologies with quick clearance system for joint ventures to be set up rapidly and smoothly in India.

Scheme for Visit of distinguished STIOs to India: (para 3.4 of the S&T Expert Group report)

The S&T Expert Group has recommended that a scheme may be launched whereby Distinguished NRIs/PIOs make four short-term visits in two years on specific assignment; this assignment should be supported by evidence that the interaction between host and the visitor will be highly productive due to their earlier connection. The S&T Expert Group have suggested that this scheme could be framed on the model of Fogarty Scholars in Residence of NIH, USA (para 3.5 of S&T Expert Group report).

Whereas the Committee is of the view that such interaction with distinguished NRIs/PIOs with their counterparts in India in the field of S&T needs to be encouraged, the financial implications for such visits need to be worked out by DST and the number of visits decided accordingly.

Scheme for contact programme of STIOs with Indian peers: (para 3.5 of the S&T Expert Group report)

The S&T Group has recommended that the Government of India must play a catalytic role in setting up informal and quick connectivity between STIOs (particularly those who are based in English speaking countries like USA, Canada, UK, Australia, France, Germany, Singapore etc) and their counterparts peers in India.

The S&T Expert Group has also recommended hosting upto 100-150 visiting scientists annually with international travel, honorarium (equivalent to Fellowship of Rs.25,000 to *Swaranjayanti* Fellow), accommodation, domestic travel expenses which could be borne by DST.

Whereas the Committee is of the view that such contacts should be encouraged, the financial implications for such visits need to be worked out and the number of visiting scientists could accordingly be decided by DST depending on budgetary allocations.

The S&T Expert Group has also recommended creation of database on active Indian researches that could be uploaded by DST on Internet and have also suggested the model format/information grid for the database. The Committee agrees with this recommendation.

Scheme for Indian S&T professionals (post-doctoral level) attachment in foreign labs (for research internship & training facilitated by STIOs abroad): (para 3.6 of the S&T Expert Group report)

The S&T Expert Group has stated that a few Universities abroad are the popular destinations for Indian post docs and Ph.D students and are hosted through a proactive role played by STIOs who are on faculty of Universities & Research Labs. S&T Group has recommended that STIOs abroad could be instrumental in setting up inter-Institutional MOU for exchange of research scholars thus making way for advanced training and research of Indian S&T professional in specialised laboratories abroad through award of internship and training attachment. Exchanges arising

from such MOU could be made part of the bilateral Programme of Cooperation (POC) in S&T with co-funding by agencies executing the POCs.

The Committee agrees with this recommendation.

Scheme for Indian S&T professionals’ (senior scientist level) visit to laboratories of STIOs Abroad (on short-term assignments): (para 3.7 of the S&T Expert Group report)

S&T Expert Group has recommended that it would be useful to have a scheme by which promising young Indian scientists of up to 45 years could visit labs of NRI and PIOs on short assignment of 2-3 months. To ensure that such visits are mutually beneficial, the two sides could share the expenses. It would be useful to cover such requirements under the recently set up Indo-US S&T Forum, DST-NSF Programme in S&T, Indo-British S&T Partnership, DST-DAAD and DST-JSPS Fellowship Programmes coordinated by DST.

The Committee agrees with this recommendation, the details of which may be worked out by DST in consultation with the concerned agencies/organisations abroad.

Connecting STIOs abroad with Indian professional scientific, engineering and technical societies: (para 3.8 of the S&T Expert Group report)

Empowerment of Indian Professional Associations, Societies in Science & Engineering to invite STIOs abroad to their annual meetings and the satellite seminars and conferences on emerging trends and new developments in specific discipline of S&T.

The Committee agrees with this recommendation.

Establishing autonomous “Society for Technical Cooperation through Global Indians” (with corpus fund of Rs. 20 crores, sponsoring 2000 visits annually, facilitating introduction of 100 technologies into India) (para 3.9 of the S&T Expert Group report)

It has been suggested that Government of India may set up a Society for Technology Cooperation through Global Indians. This Society’s mandate could be to harness expertise and know-how with foreigners and Indians abroad that is beneficial to Indian industry, research and academic institutions; provide contingency support for joint research and technology development projects and facilitate exchange of information between NRIs and Indian industries problems.

Whereas the Committee agrees with this recommendation in principle, the details need to be worked out by DST in consultation with the concerned departments/agencies.

Provision in Indian Scientific Agencies Extramural Research Schemes for participation of STIOs abroad as Visiting Scholars or Research Consultant (in Indian research and technology development projects): (para 3.10 of the S&T Expert Group report)

S&T Expert Group has stated that there is a merit in amending the Extramural Research Schemes of Indian Scientific Agencies on the model of DRDO. The Group has recommended that as a policy, affiliation of high calibre scientific and technical person from abroad (in particular STIOs abroad) as Visiting Faculty or Research Consultant in research projects may be encouraged. Such a step will enlarge the knowledge base required to meet the research project objectives.

The S&T Group has recommended that the Application Form for Research Grant of various Indian Scientific Agencies be revised to contain a section on visiting Faculty or Research Consultant along with their financial entitlements to meet expenses on international travel, accommodation, daily allowance and incidentals payable out of project grant, which have been suggested by the S&T Group (para 3.11 of the S&T Expert Group report).

The Committee is of the view that this needs to be examined in detail by the DST.

Dissemination of Government guidelines for engaging NRIs & PIOs for national tasks: (para 3.11 of the S&T Expert Group report)

The S&T Expert Group has recommended flexibility in engaging nationals overseas in home country's academic institution and R&D laboratories for specific national tasks. For this purpose, the S&T Group has stated that the existing Government guidelines for engaging NRIs & PIOs including grant of employment visas may be given wider publicity and made known to all and in particular to the University and R&D Labs. They have also recommended that these guidelines may be revised as and when necessary.

The Committee agrees with this recommendation for which necessary action may be taken by the Ministry of Home Affairs and the Ministry of External Affairs.

Models and successful practices for utilising expatriates including those with S&T background in China and Israel : (Para 4 of S&T Expert Group report).

The S&T Expert Group has studied the nuances of the programmes to draw upon the expatriates by Government of Israel and Government of the People's Republic of China for accelerating capability in S&T and industrial productivity. The Group has stated that its replicability in the Indian context is limited by the fact that the Government of India does not so far subscribe to dual citizenship and dual employment norms.

The Committee recommends that the Department of Science and Technology makes an in-depth study of these and other models and submit a detailed proposal to the Government, which is suitable for India taking into account our requirements for boosting India's industrial productivity.

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