## REPORT OF THE

# WORKING GROUP ON LEVERAGING INTERNATIONAL COLLABORATION INPUTS

## 1. PREAMBLE\_

The Planning Commission has constituted a Steering Committee on Science and Technology for the Formulation of Eleventh Five Year Plan (2007-2012). To assist the Steering Committee and to finalize its recommendations, a Working Group on "Leveraging International Collaboration Inputs" was set up by the Office of Principal Scientific Adviser to the Government of India vide their order No. Prn.SA/ADV/SC/2006 of 8<sup>th</sup> May, 2006.

## 2. COMPOSITION

- 1. Prof. V.S. Ramamurthy, Formerly Secretary, DST, New Delhi Chairman
- 2. Dr. S. Natesh, Sr. Advisor, Deptt. of Bio-technology, New Delhi
- 3. Dr. S. Kailas, Associate Director, Physics Group, BARC, Mumbai
- 4. Shri. Rajeev Lochan, Assistant Scientific Secretary, ISRO, Bangalore
- 5. Shri S.K. Das, Adviser, Deptt. Of Ocean Development, New Delhi
- 6. Dr. Naresh Kumar, Head R&D Planning Division, CSIR, New Delhi
- 7. Prof. Ashok Mishra, Director, IIT, Bombay
- 8. Prof. Akhilesh Tyagi, Delhi University, Delhi
- 9. Shri Y.P. Kumar, Adviser, DST, New Delhi Member Secretary

## 3. TERMS OF REFERENCE

- 1. To identify important areas of international S&T collaboration/ cooperation consistent with ongoing national research and development efforts.
- 2. To suggest measures for greater and more effective use of major international facilities abroad.
- 3. To establish synergy between different institutions/ departments having international collaborative programmes.
- 4. To consider any other important and relevant item.
- 5. To indicate approximate financial outlay for implementation of the

recommendations.

- 6. The Co-Chairmen may co-opt other members, if required.
- 7. The expenditure on TA/DA in connection with the meetings of the Working Group in respect of the official members will be borne by their respective Ministry/ Department. However, in the case of non-official members, they will be entitled for TA/DA as admissible to Grade-I Officials of the Government of India and the expenditure in this regard would be met by the Planning Commission.
- 8. The Working Group would submit its report by 15<sup>th</sup> July, 2006

## 4 MEETINGS OF THE WORKING GROUP

The Working Group on "Leveraging International Collaboration Inputs met on 7<sup>th</sup> July 2006. The Working Group, in addition, also sought the views of other experts on International S&T Cooperation Programmes and also of the aided institutions. This report has been prepared based on the deliberations took place in the meeting as well as other inputs received.

## 5. <u>BACKGROUND NOTE:</u>

## 5.1 FRAMEWORK OF INTERNATIONAL S&T COLLABORATIONS

International S&T Collaborations of various scientific Departments/agencies are essentially the mechanism:

- to provide opportunity and platform to work together and in building and developing further dialogues,
- to provide first hand acquaintance with scientific and technological developments and work culture in other countries,
- to provide access to sophisticated research facilities abroad,
- to provide the possibility of interaction between scientific researchers to update and refine their knowledge base for accelerating the pace of investigation as also to fill up any gaps in the available information,
- to develop advanced technologies, high tech equipment and new generation materials required for the economic growth of the participating countries, and
- to take mutual advantage of complementary scientific & technological capabilities amongst participating country teams.

#### 5.2 NEED AND RELEVANCE OF INTERNATIONAL COLLABORATIONS

- International Collaboration in S&T helps in opening the dialogues and developing further relations both at bilateral or multilateral/regional level.
- International Collaborations in S&T are inevitable to maintain pace of progress and growth of S&T.
- International collaborations are important for sharing the information and generating new knowledge which is must for any knowledge society.
- International Collaborations, if used appropriately by properly defining national priorities and appropriate linkages with domestic programmes could play important role in technology led economic growth.
- International collaborations need to be country specific where both parties are benefited.
- International collaborations could be used as effective tool in using technology diplomacy for leveraging national interests both at bilateral, regional and multi lateral levels.
- International Collaborations inputs may be useful in improving scientific education and knowledge dissemination by providing broad band connectivity of institutions /universities in India to International libraries of repute.
- International Collaborations are important from the point of view of sharing of cost and optimal utilization of resources.

The recommendations of the Working Group are described in following paragraphs.

### LEVERAGING INTERNATIONAL COLLABORATION INPUTS

The working group has observed that the international collaboration inputs have so far been used by various Departments/agencies for providing facilities to individual scientists in the form of joint R&D projects involving exchange visits, sharing of scientific data & information and knowledge through joint workshops and seminars, providing access to sophisticated and international facilities. International Collaborations have also been used successfully for developing joint centers and joint mechanisms such as Indo French Center for Promotion of Advancement Research (IFCPAR), Indo-US S&T Forum, NAM S&T Center. Such collaborations have also been effectively used for providing fellowships to young researchers from India to upgrade their skills and capabilities. In addition, some initiatives have also been taken during the end of 10<sup>th</sup> Five Year Plan for supporting pre-commercial R&D e.g. Indo Israel Initiative on Industrial R&D, Tech Summits and Technology Fairs etc.

The Working Group is of the opinion that in the 11th Five Year Plan, the International Collaboration Inputs and activities should be leveraged primarily aiming at complementing and supplementing ongoing national efforts in selected areas of basic research such as Materials, Chemistry, Physics, Astrophysics, Mathematics, life sciences etc. There need to be a synergy between the domestic programmes/initiatives and international collaborations and co-operations so that these inputs could be effectively used in capacity building in areas of national importance/priorities. While efforts benefiting individual scientists/groups (bottom up approach) need to be continued during 11<sup>th</sup> Five Year Plan, new initiatives aiming at developing and implementing mega S&T projects (top down approach) both in areas of basic sciences and other areas of need including societal needs also should be given due importance and priority. International collaboration inputs should also be effectively used in developing world class facilities in selected areas in the country as well as for India's participation in major International S&T mega projects/initiatives. Technology-led diplomacy should be used for enhancing India's image abroad both from geo political angle as well as from development and growth of S&T.

The following approach is suggested for better leveraging of International Collaboration inputs for  $11^{\text{th}}$  Five Year Plan:-

#### 1. Continuation of bottom-up approach

The initiatives taken by various departments and organizations during 10<sup>th</sup> Plan period for developing collaborative activities between individual scientists and groups (bottom up approach) need to be continued during 11<sup>th</sup> Five Year plan for providing them opportunities for interacting with their counterparts abroad, access to sophisticated facilities, participation in seminar/symposia, exploratory visits, fellowships to young researchers for developing their knowledge. About 40% of the total available budget should be devoted for such initiatives. Such initiatives/opportunities should help in complementing and supporting domestic efforts in building strong knowledge base,

generating new knowledge, development of world class manpower and institutional capabilities in various areas of basic research.

## 2. Synergy Between national programmes and international collaboration inputs

International collaboration inputs should be effectively used as a natural extension of national initiatives/efforts for building national strength and capabilities in selected areas of sciences, engineering and technology. National priorities/ national strength and national needs should be kept in mind/view while negotiating/concluding S&T Cooperation Agreements and other instruments with developed as well as developing countries. Similar considerations should be kept in view while identifying areas of cooperation with other countries of the world. Thus, international collaboration inputs should be used in linking up the research groups working on nationally important and relevant projects with the counterpart researchers abroad. This may call for creation of dynamic data bases of research groups/centers working both in India as well as in collaborating partner countries. Such linkages would help in better utilization of resources both manpower and other resources.

## 3. Effective Coordination between Implementing Agencies

For better leveraging international collaboration inputs, the Working Group feels that there is a need for developing an effective coordination mechanism between various S&T Departments and Agencies in the country. Such a mechanism would help in avoiding overlapping of interests and duplication of efforts. For this purpose, the working Group recommends that a National Coordination Committee on International Collaboration Inputs be constituted preferably under the chairmanship of Secretary, DST with adequate representation of subject experts both from academia and R&D, industry representatives and representatives of various S&T Departments and agencies. This Committee should act as a think tank for guiding and developing appropriate strategies and programmes for better leveraging international collaboration inputs.

## 4. Developing Strategic Relationship with select countries

In the recent part, India had emerged as world power in a few areas of R&D such as biotechnology, nanotechnology, drugs and pharmaceuticals, new materials, space science including astro physics, health, IT, automotive research etc. For further developing our national capabilities in these areas as well as for creating research bases/groups in other areas of national needs, including societal needs, it is recommended that strategic relationships/alliances be developed with appropriate countries for mutual benefits and gains. Such linkages also need to be developed with those countries which have gained experience in developing strong programmes/mechanisms on Industry-academic and R&D collaborations. Such relationships would help in faster flow of technologies from R&D laboratories to industry and industry to market. Thus, international cooperation inputs should also be leveraged for India's technology led economic growth in select industrial sectors. This calls for building strategic partnerships for technology led cooperation with select countries (~15) as an integral part of "S&T Intelligence System".

## 5. Gaining leadership through Technology-led Diplomacy

The world order is changing fast. Trade advantages are polarizing the nations. New alliances and groups of nations are being formed based on these changes and economic indicators. Technology-led growth of economy is the global model of developed nation. Balancing political and economic freedoms of nations has brought technology-led diplomacy to the center stage of international cooperation. India, therefore, needs to leverage from technology-led diplomacy in international cooperation in S&T. For several developing countries, India is a role model for Science and Technology based growth. India can play an enabling role for many nations. This should be used for geo political advantage of the country.

## 6. International Cooperation in areas of need including Societal needs

There are many nations which are far ahead of India in technological development and growth in key areas of economy. From those countries, India stand to gain in certain sectors of national development. Therefore, rather than reinventing the wheel, India need to develop strategic partnership in those areas with other nations after appropriate cost benefit analysis. Energy, water, environment, disaster management/preparedness, health and nutritional security of India would call for large models of S&T Cooperation. Wherever India could assist other developing or less developed nations, it should develop cooperation in S&T with those countries for gaining geo political advantages.

## 7. International Cooperation based on mutual gain and complement strength

As mentioned in earlier paragraphs, India need to develop a strategy for gaining advantages from International Collaboration inputs. Our strategy for international cooperation needs to be based on mutual gain and complement strength. For this purpose, we need to define areas of our strength as well as areas where we may need outside help and use those parameters while developing International co-operations.

## 8. Retaining Indian Talent and attracting talent from abroad including Indian diaspora

If India has to develop a strong base in select areas of research and development and retain its competence in other areas of basic research, it has to adopt a dual policy. While it has to retain its own S&T talent in the country by providing comparable and attractive opportunities for their development and growth including fellowships for working in foreign laboratories and institutions. On the other hand, it has to evolve various other mechanisms for attracting best talent from other parts of the world. One of the potent source of such talent could be the people of Indian Origin settled abroad and excelling in their respective areas of S&T (Indian Diaspora). We need to attract them, Indian for building active research centers/schools in frontier areas of science, engineering and technology by providing critically sized R&D grants. Scientists and Technologists of Indian Origin (STIOs) abroad could contribute significantly in developing the capabilities of Indian institutions and S&T groups if they are provided long term connectivity with the Indian researchers. In this regards, the initiative taken by DST during the 10<sup>th</sup> Five Year Plan for providing fellowships to STIOs is a laudable effort and needs to be strengthened both in quality and quantity in the 11th Five Year Plan. Also, we should launch large number of attractive fellowships both at pre PhD Post Doctoral level to attract foreign researchers to work in Indian Institutions. Similarly, other modes such as guest lectures, planning visits, short duration fellowships, joint research projects from industry etc should be encouraged to attract foreign researchers to work with Indian researchers.

## 9. Participation in mega science projects

While the support to basic sciences need to be continued and strengthened, however, there is a need for Indian's active participation in International Science projects which are multi nation projects or large collaborative projects such as International Partnership on Hydrogen Economy (IPHE), Facility for Antiproton and Ion Research (FAIR), ILC, International Thermo nuclear Experiment Reactor (ITER), Relative Heavy Ion Collider (RHIC) etc. Similarly, India should also leverage international collaboration inputs for developing mega science projects and developing sophisticated facilities in India in areas where it has edge such as Synchrotron facility, HANLE Telescope, INO, Coordinated Research Project on Spintronics, Congnitive Sciences, National Large Solar Telescope, Space Cornograph aboard INSAT, large optical/infrared telescope etc. Such facilities should be provided access to scientists both from developed countries as well as developing countries.

#### 10. Access to advanced facilities

More avenues should be provided to Indian scientists to gain access and usage of advanced international facilities such as CERN (Geneva), ELETTRA (Italy), Sp Ring - 8 (Japan), KEK Accelerator (Japan), National Laboratory for High Energy Physics (Japan), Synchrotron Radiation Source Beam line Facilities at Novosibirsk, Russia and Brazil, FAIR (Germany), Fermi Lab (USA)), Synchrotron Light Source (Singapore), HLC, RIB, ITER etc.

## 11. Support to pre-commercial R&D

Another area where in International S&T Collaboration inputs should be leveraged effectively for national gain during the 11th Five Year Plan relates to undertaking joint R&D projects of industrial interest/commercial value at pre-commercial stage involving academic and R&D groups as well as industrial group at both the ends. To begin with, such cooperation could be concluded for pre-commercial R&D or up scaling of technologies which have been developed and tested at laboratory scales. Since, India has fully developed IPR regime, many countries are keen to collaborate and join hands in this effort including Israel, U.K Germany, USA, France, Australia etc. Such a initiative, if implemented carefully, would help in many ways including cost sharing, working on cutting edge technologies, sharing of intellectual resources and other facilities, in bringing new industrial R&D culture, develop a culture of accountability both in terms of time and quality, sharing of R&D for profit. Thus, it would also create newer avenues for younger persons who wish to seek and develop career in R&D. In this direction, it would be appropriate to support both joint R&D projects with industrial partners at both the ends as well as start Joint R&D and Technology Centers in identified areas with partner countries both in India and also in abroad.

#### 12. Increase in financial outlays

Working Group feels that for harnessing the fruits of International Collaboration inputs, there is a need for augmenting financial resources for this important activity. It is recommended that at least a 10 fold increase be made in financial outlays during 11<sup>th</sup> Five Year Plan.

## 13. International Collaboration for developing negotiating capabilities

Technology transfer negotiations are a complicated task and requires special skills such as knowledge of sources of technology, its social impact, relative costs, modes of technology transfer and other issues such as legal and environmental issues. International collaboration inputs should be used for providing appropriate inputs/capabilities on technology negotiations, technology sourcing etc. Appropriate training programmes should be designed for developing indigenous capabilities in these areas.

## 14. Commercial Technology Transfer

In a few cases, transfer of commercially proven technologies developed abroad, could also be supported provided such technologies are of social relevance and useful for large masses or help in bringing down the cost or indigenous development of such technologies may require not only huge resources but also considerable time.

### 15. Change in outlook and approach

With an impressive economic growth rate witnessed by the country on a constant basis in the last decade, India is seen today as a vibrant economy, an emerging super power, a nation with a large and huge market, a nation with young population and a nation with many opportunities and possibilities. To capture this perspective, India has to not only invest considerably on R&D including international S&T Cooperation, but also make a drastic shift in its mind set. We have to think big to achieve big. This may call for attitudinal changes at all levels as well as change in outlook and approach. We also need to develop capabilities in sensing and capturing opportunities in time. We also need to develop appropriate strategies for reducing our dependency on foreign technologies. Those countries which are of geo political advantage to India may be given special/different treatment or generous support, if needed.

#### 16. National Image Building

International cooperation programs should also help in enhancing India's global image and visibility abroad. This calls for proactive approach by way of projecting India's prowess and progress in selected field of S&T through participation in Tech Summits, Technology Fairs, Indian S&T Day etc. This may further require development of appropriate materials such as brochures, news letters, CDs, films etc.

- 17. The Working Group recommends the following strategy for better leveraging of International S&T Collaboration inputs during 11<sup>th</sup> Five Year Plan period:-
  - (i) Support for Basic Science and Applied R&D
  - (ii) Promote pre-commercial R&D stages
  - (iii) Provide hand holding and facilitate commercial technology transfer
  - (iv) Participate in International mega science projects and develop mega Science and socially relevant projects for India
  - (v) Promote Joint R&D Centers
  - (vi) Other promotional initiatives/activities.

Thus, in the changed scenario where India is being recognized as an emerging world power both on R&D and economic fronts, International S&T Collaboration inputs should be effectively used for leveraging strategic advantage for the country in many ways including in developing India's leadership in basic sciences (including contract research) and innovation; strengthening India's capacities towards national security with regard to water, energy, environment and information infrastructure; attracting foreign companies to establish manufacturing bases (and the associated research) in India in IT hardware, Opto-electronic systems, Medical Diagnostics and devices and, Automobile components sector; sharing of resources, generating new knowledge; capacity building and confidence developing etc.

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