

WORKING GROUP REPORT

ON

***STRENGTHENING ACADEMIA
INDUSTRY INTERFACE*** (including
Public Private Partnership)

FOR THE XI FIVE YEAR PLAN

DECEMBER 2006

EXECUTIVE SUMMARY

Relationship between the academia and industry is not just one of technology donor-recipient, but is of interactive, collaborative, participative nature spanning respect for each other's role and contributions to bring about research production integration - the true purpose of such interactions. Here, academia-industry interactions are viewed as a system where active participation of all players is important.

In the S&T system, there are four important aspects – basic education, advanced education, basic R&D and applied R&D. For each of these aspects, academic-industry interaction may be important for achieving the desired goals and level of activity. In order to strengthen academia-industry interface and it is imperative to work on critical priorities relevant to these four aspects.

Focussed on tapping the public-private partnership effectively, this report reflects the priorities which should be targeted upon in the 11th plan. The priorities identified are **Creation of enabling environments, Facilitating right skilling, Creation of new interface structures, Enhancing mobility of S&T professionals.** New structured Mechanisms which lead towards these identified priorities have also been suggested in the report.

There would be a substantial increase in the academia-industry interaction if the suggested new mechanisms targeting these priorities in the 11th Five Year Plan are implemented.

For the new initiatives on (i) Five Centres of Relevance and Excellence (CORE) in areas of direct relevance to industry, (ii) Students internships for industry, (iii) Next Generation Innovation Missions on the lines of CORE, and (iv) CORE shared facilities with industry, a budgetary provision of Rs. 1850 crores will be required.

1. FORMATION OF WORKING GROUP

Planning Commission had constituted a Steering Committee on Science & Technology for the formulation of XI Five Year Plan (2007-2012). To assist the Steering Committee, a Working Group was constituted on 'Strengthening Academia Industry Interface (including Public Private Partnership). The composition and the terms of reference of the Working Group are given in **Annexure I**. The Committee, apart from its own meetings, had several consultations with stake holders. What follows in the outcome of these deliberations!

2. NEED FOR ACADEMIA-INDUSTRY INTERACTION

There is a tremendous need for academia industry interaction. All the Stakeholders, namely: Institutions, Industry, Students and Society stand to gain, as it can be a 'win-win' partnership.

Industries could gain by using the academia's knowledge base to improve the industry's cost, quality and global competitive dimensions, reducing dependence on foreign know-how and expenditure on internal R & D. Industries also get benefited by updating and upgrading the knowledge base of the industry's professionals through management development programmes designed by the academia.

Academics benefit by having the satisfaction of seeing its knowledge and expertise being used for socially useful and productive purposes, widening and deepening of the curricula and the perspectives of teachers and researchers and thereby improving their morale as well as that of students, secure training and final placements more easily for their students based on the respect earned from, and the relationship established with industry. Academia also gets benefit of improved financial sustainability and security.

The faculty's exposure to industry leading to improved curricula and widened and deepened teaching perspectives resulting in professional graduates of improved caliber emerging from the academia to man industry. Students stand to gain by way of hands-on training, reduction of learning curve in industrial practices; and, society stands to gain by way of improved quality of goods and services.

Overall, Effective Academia Industry Interaction leads to strengthening competitiveness, promoting innovation and new technology development and ensuring quality and quantity of the human resource base

There are several schemes, which are successfully being carried out in other countries targeted towards these areas, which are briefly described in Annex-II. Some of the relevant ongoing schemes in India are described in Annex-III.

3. INHIBITING FACTORS

Although the concept of '*Academia – Industry*' interface has been taken up by concerned agencies in the past decade or more, its full potential is far from being realized owing to the basic 'attitudinal differences' and perception of technology development between the two sides.

From industry's side: Insensitivity to, and/or lack of awareness of, the resource potential of the academia, easy availability of foreign know-how, obsession with expensive, high profile professional consultants, compulsions of existing technical collaboration agreements, bad experience of interactions with the academia in the past, anxiety to keep problems and breakthrough confidential for fear of losing the competitive edge.

From academia's side: Apathy towards applied research and extension and reluctance to leave the comfort zone of pure teaching, inadequate marketing of its strengths to industry, lack of a critical mass of experts and specialised technical infrastructure, restrictive internal policies and procedures discouraging academician's attempts to collaborate with industry. Largely ignorant about the real industrial and national needs, inadequate recognition for practising faculty as compared with pure academics performers.

Academia-Industry Interaction cannot be legislated or forced on either academia or industry- the academics should feel confident and motivated about this interaction and industry should see it as something profitable to itself vis-a-vis other options. Our industry, used to short-term and sometimes questionable measures to stay in business, also lacks a tradition of seeing knowledge as a sustainable competitive resource. A change in perspective is therefore required on both the sides.

4. AREAS OF ACADEMIA-INDUSTRY INTERACTION

In the S&T system, there are four important aspects – basic education, advanced education, basic R&D and applied R&D. For each of these aspects, academic-industry interaction may be important for achieving the desired goals and level of activity.

In Basic education, the current level of education and exposure to students is inadequate; students do not get the opportunity to work on actual equipments and thereby their confidence level is apparently low. Similarly in advanced education, quality and depth in research carried out by students at Doctoral level is inadequate and therefore, tailoring of curriculum is very crucial, so that the research scholars become more industry relevant.

Public-private partnership and industry involvement is particularly important with regard to applied R&D, where there has to be a focus on reaching the outputs and

technologies developed to the marketplace. These marketplace linkages and a demand-driven approach need to be promoted. This required that industry increasingly needs to be both the source of support as well as the performer of applied R&D.

While basic research is likely to continue to be largely supported through public funds and carried out in public institutions such as academia and the national laboratories, even in this, public-private partnership may be essential for creating and maintaining the level of research infrastructure that enables cutting-edge science.

Therefore, enhanced academia-industry interaction and the modality of public-private partnership is likely to be very important for achieving the desired outcomes in all of the four major aspects of the S&T system.

5. PRIORITIES FOR 11TH PLAN

In order to strengthen academia-industry interface, tapping the public-private partnership effectively, following priorities could be targeted upon in the 11th plan.

- i) Creation of **enabling environments**
- ii) Facilitating **right skilling**
- iii) Creation of **new interface structures** such as consortia, partnership research institutions etc. for basic and applied R&D.
- iv) Enhancing **mobility of S&T professionals**
- v) Promote **movement of technology** from laboratory to marketplace through **technology transfer and new venture creation.**

New mechanisms suggested targeting these priorities are detailed in the following section.

6. NEW MECHANISMS

6.1 CREATION OF AN ENABLING ENVIRONMENT

6.1.1 Flexible compensation based on pooling of resources

Institutions could create corpus funds received from more than one industry / organizations and to enhance the salaries for faculty in respect of "Chairs" created in academic institutions.

6.1.2 Incentives

Provision for tax exemption to the tune of 125% for all expenditure on R&D where industry and academia work together could be given, Provision of Nil service tax for any royalty coming out of technology transferred by an academic/research institutions to an industry

6.2 FACILITATING RIGHT SKILLING

6.2.1 Centres of Relevance and Excellence

There is lack of qualified skilled manpower catering to the industry requirements- one way of addressing this issue would be through creation of centers of excellence in identified areas. The TIFAC COREs under Mission REACH programme could be taken up as a model, wherein Centres of Relevance and Excellence (COREs) are set up in institutions in select areas of S&T, which are of direct relevance to industries, who in turn are major stakeholders in the CORE. The Government and the industries share the infrastructure costs and the host institution bears the recurring expenses (salary of staff, maintenance of equipments and other organizational cost) for the centre. The involvement of industry in the TIFAC CORE is right from the inception of evaluation process, in the Monitoring Committee, for customizing the curricula according to recent trends in technology and also for placement of students.

6.2.2 Student internships

Internships for students to expose them to industrial practices. The student internships to be made more meaningful and long term so that it benefits both students and industry. This would enable the industry also to plan and structure the internship program.

6.3 CREATION OF INTERFACE STRUCTURES

6.3.1 Interface structures for applied research

Creation of research and interface institutions within the academic institution that function with a degree of autonomy, with significant industrial partnership and government support.

For example, **Calit2 (California Institute for Telecommunications and Information Technology)** is an ideal example of partnership between the State, UC and California Industry. Calit2 received support from the State of California (100 million \$ grant) to design and construct the buildings on both campuses i.e. University of California, San Diego(UCSD) and University of California(UCI) with unique, core, shared facilities.

Calit2 is focusing its research and development agenda on five areas critically important to California: environment and civil infrastructure, intelligent transportation, digitally enabled genomic medicine, new media arts, and disaster response. These are areas in which UCSD and UCI have deep academic expertise. The business environments surrounding both campuses also support these areas of endeavor. San Diego is an important international center of the telecommunications and biotech industries. Irvine has long been a hub for automobile design and biomedical instrumentation and the computer gaming industry, building on the new media arts, counts some 70 companies between Los Angeles and San Diego.

Traditionally, where the university has focused on education and research, Calit2 extends focus to include development and deployment of prototype infrastructure for testing new solutions in a real-world context. *The 11th plan could target creation of at least a couple of research institutions similar to CALIT2 in India.*

There are similar success stories of such centers in India also, which include Society for Innovation and Development (SID), IISc, Bangalore. SID aims to bring leading intellectuals of IISc and their R&D development efforts closer to industries and business establishments in a cordial atmosphere. Like SID, there are many institutions having dedicated interface structures like SINE (IIT Bombay), FITT (IIT Delhi) etc.

6.3.2 Consortia projects for applied R&D and technology development

Academia-Industry-R&D lab consortia could be an effective mechanism for industry-oriented applied R&D and also to tackle ambitious scientific and technological targets. Refinement of the original mission mode concept, but now focusing in creating new innovative solution for targets that will have significant economic and social developmental value. The following would be some example areas of targets:

- i) Distributed power for rural housing at Rs.2/unit
- ii) Real time speech recognition for Indian languages
- iii) Automated sensing and action (enforcement on traffic violation)
- iv) Indigenous diagnostic equipments at an affordable price
- v) Environmentally clean technologies.

Such approaches have also been used to establish and enhance global competitiveness of industry in technology intensive areas. For example, the Core Group on Automotive R&D (CAR) could be adopted as a model. This consortium focuses on pre-competitive partnerships involving academia to help Indian companies develop advanced technologies and upgrade their manufacturing competitiveness. Government funding will

involve grant in aid to academia and/or conditional grant to innovative small companies. The industry members of the consortium will provide inputs like domain knowledge, facilities, testing equipments, sub-assemblies, etc and help to test and validate the prototypes. OEMs and component manufacturers further work on the generic technologies and develop products that they will commercialize, to gain competitive advantage.

Similar consortia could be formed for formulating Roadmaps for identified sectors. These could become the next generation of innovation missions that could be taken up in the 11th plan.

6.3.3 Shared and co-located R&D facilities

Government funding can be provided to create major national facilities to be co-shared by a number of firms on a demand-driven basis. This public-private partnership can assume two forms namely (i) co-locating an industrial R&D Centre, in early stages to start up, within the premises of National Laboratory or academic institution and ii) co-sharing some of the laboratory's select facilities with industry. E.g. the Technology Centre for Genomics Applications (TCGA).

6.4 ENHANCING MOBILITY OF S&T PROFESSIONALS

6.4.1 From academia to industries

Internship programme for young faculty - The young faculty could be given an internship programme at advanced level so that they could spend time from two months one year, full time in industry. This would enable them to impart more practical knowledge to students, relevant to industry.

6.4.2 From industry to academia

Active programmes should be established for regular visits of experts from industry to address students, academic and scientific staff and to spend a few days at campuses for participating in teaching or research. A professional from Industry, with several years of work experience should be treated equivalent to a Professor. He could be called as a Professor of Industrial Practices, so that the individual also gets due recognition. This programme could be adopted on the lines of AICTE-INAE Distinguished Visiting Professorship scheme.

6.4.3 Tapping into global talent pool

Developing an effective network through a structured mechanism for Indian diasporas would be the first step. Apart from providing support for

Indian enterprises in business like targeted identification of overseas opportunities, access to business contacts etc, this new initiative could involve Indian Diaspora with industry experience to target specifically on these two important areas in academia:

i) **Raising aspirations**

Enterprise mentoring support for schools and colleges, preferably, the member could select an institution in his/her own birthplace, so that an emotional bond is maintained. The mentor could provide guidance on improving employability skills, provision of placements and employment for Indian students, delivering lectures in Indian universities

ii) **Leveraging contacts and expertise**

Advice on economic development opportunities and strategies, intelligence on new global trends, technologies, products and practices

The existing programmes and initiatives by the alumni associations of IITs, IISc and other universities, STIO programme launched by Department of Science and Technology etc. are the steps which have been already initiated towards encouraging more involvement of Indian Diaspora. Similar schemes and initiatives need to be replicated throughout the country in large numbers.

6.5 IMPROVE FLOW OF TECHNOLOGY TO MARKETPLACE

6.5.1 Scaling up beyond incubation- transition to support growth of enterprises

Recent economic literatures have pointed out the importance of clustering. Further, the *spatial dynamics of innovation* suggest that there are locational advantages of having incubators proximate to sources of high quality R&D and manpower. Therefore, it is necessary to increase the number of Research parks within or in proximity (cycling distance) to academic institutions, where industry would find it attractive to set up its R&D. Government should make the land available adjacent to these institutions and provide highest possible concessions like all benefits of SEZ, concessions in electricity tariffs, duty exemptions for imported equipments etc. Successful examples in India include *Science and Technology Parks of IIT Kharagpur and NIT Tiruchirapalli*.

6.5.2 Supporting ecosystem

Accelerating the creation of high technology start-ups requires funds for providing seed capital to these start-ups and an ecosystem that connects technologists with risk-taking entrepreneurs and investment managers.

6.5.3 New venture funds

One of the key weaknesses in proliferation of knowledge-based entrepreneurship in India is absence of seed and early stage funding for such ventures. Therefore, Venture funds for seed funding and first stage funding should be set up. Sizeable and predictable flow of funds for venture finance should be ensured and a minimum percentage of investment in a particular asset class to be fixed.

6.5.4 Developing a cadre of Technopreneurs (from academia to start-ups)

Hundreds of academics in the western world have become technopreneurs catalyzing knowledge driven industrial development. The prevailing provisions do not give freedom to scientists to set up commercial entities while in professional employment with universities/institutions. Government may evolve facilitating provisions for faculty entrepreneurship, in the service rules.

An example of NUS (National University of Singapore) Enterprise is explained below:

NUS encourages researchers and academics to translate some of University's knowledge into opportunities for the economy. The Enterprise Cluster offers comprehensive support to University entrepreneurs by providing services that range from legal assistance with intellectual property protection and licensing, product championing, business plan writing, seed funding (NUS venture support), mentoring and incubation. It also provides the infrastructure, facilities, services and an environment that allows researchers to capitalize on their research findings and create innovative products and services for the general public. In doing so, NUS Enterprise both increases the relevance of its University's academic research to the outside world, and injects an entrepreneurial dimension to the University's teaching and research, involving the entire NUS community, which comprises students, staff and alumni.

6.6 PUBLIC-PRIVATE PARTNERSHIPS INVOLVING LARGE INDUSTRY

6.6.1 General Principles

Public support for R&D in small and medium enterprises is now an accepted part of the public policy worldwide and in India. Partnership with large companies is generally restricted in India to strategic sectors like Defence, Space and Atomic

Energy. In the remaining knowledge sector that contributes a bulk of new intellectual property a coherent policy framework is lacking although there are examples where different department of the Science Ministries have partnered with large companies. We propose that policy guidelines for public sector partnership and co-investment in R&D with large enterprise be provided for the 11th Plan.

6.6.2 Potential areas of partnerships

Several areas have been identified, where these partnerships are justified and indeed important to pursue. These include:

- Frontier Technologies

In many areas where there are new opportunities such as Nano Science, Advance Materials, Stem Cell Biology, there is a concern that public sector effort by itself is not sufficient to both accelerate science and at the same time lead to commercialized technology and products. To maximize benefit from public investment in new areas, it is important that R&D in the public sector as well as R&D in private sector grow concurrently.

- Fulfillment of National emergencies / requirements in Health and Agriculture.

In the health sector a very apt example is rapid development of vaccines and diagnostics against infectious disease that occur as large outbreaks or epidemics, threatening security to life as well as tourism and economy. An illustration is vaccine against Dengue, influenza, HIV and Tuberculosis, etc. It needs to be recognized that often private sector is not willing to invest in these areas because of the risk involved and as there are alternate investment opportunities with faster returns and less uncertainty. Drug discovery against viral infections that cause health crisis such as AIDS, Avian influenza or tuberculosis is another example. In the agriculture sector appropriate examples are new crops / seeds against drought, salinity or major disease and orphan crops of regional interest where private interest is usually low.

- Shared major facilities as core facilities

It is our experience that national facilities, established with good intent lack user friendliness and are underutilized. Public-private partnership is justified for core facilities. An appropriate model is management in the private hands, excess to private sector at commercial rates and to the SME sector and public sector at preferred rates.

This type of collaboration is already approved by the government for the infrastructure sector. A good example of such facilities would include large animal facilities, Genomic technology centres, proteomic centres and drug discovery related technology centres and several others. Similar partnership can be extended to centres for education and training where science, innovation and enterprise marriage is desired.

- **Joint Cluster building**

Knowledge based enterprise creation has been most successful in countries where cluster building approach has been promoted. Often this requires strategic co-location and funding of institutions, parks, innovation centres, business facilities, technology transfer units in single place with joint oversight of the whole cluster. Some of the components are best publicly funded, others by private sector, but the union has to be common.

6.6.3 Administrative mechanism for fastening collaboration with large industry

The areas for collaboration outlined above are different in purpose and as such several different models for investment by science department are required.

- In one model, both sides contribute equally to the R&D programmes and the company has the first right to a licence to commercialize, government gets some royalty and has a right to give at least one more licence to another company. This approach also promotes competition and benefits consumers.
- For joint facilities, public investment be limited to 26% equity and management be in the hands of industry with differential pricing system for private and public use.
- For national emergencies, public funding be given on a contract basis by the government. The company concerned would have the first right to a licence and the government should give licence to at least 2 other companies, again with a view to promote competition and greater accessibility of the products to the public.

7. BUDGETARY PROVISIONS

7.1 CURRENT INITIATIVES

Several departments have already made provisions in their respective budgetary demands for creating new public-private partnerships. Typical examples include CSIR's expanded programme on New Millennium Indian Technology Leadership

Initiatives (NMITLI), DBT and DSIR's programmes on Small Business Research Initiative (SBIRI) as well as Funds for Accelerating Start ups in Technology (FAST), several TIFAC initiatives such as Consortium on Automotive Research (CAR), etc. Therefore, these are not being replicated here. These programmes need to be expanded in scale and scope, as has been highlighted in this report.

7.2 NEW INITIATIVES

Only the new initiatives have been provided for in the following. The budgetary requirements are as under:

1. Five Centres of Relevance and Excellence (CORE) in areas of direct relevance to industry	Rs. 250 crore
2. Student internships for industry	Rs. 100 crore
3. Next Generation Innovation Missions on the lines of CORE	Rs. 500 crore
4. CORE shared facilities with industry	Rs. 1000 crore

	Rs. 1850 crore
	=====

Annexure-I

No. Prn.SA/ADV/SC/2006
Government of India
Office of the Principal Scientific Adviser to the Government of India

311, Vigyan Bhawan Annexe,
Maulana Azad Road,
New Delhi 110011
Dated: 8th May, 2006

OFFICE MEMORANDUM

Subject : Constitution of Working Group under the Steering Committee on Science and Technology for the Formulation of Eleventh Five Year Plan (2007-2012).

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 is being constituted on "Strengthening Academia Industry Interface (including Public Private Partnership)". The composition and terms of reference of the Working Group would be as follows :

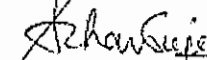
I. Composition

Sr. Name, Designation and Organization
No.

1. Dr. R.A. Mashelkar, DG, CSIR, New Delhi Chairman
2. Shri R. Seshasayee, President CII, Chennai
3. Dr. V. Sumantran, Ex-Executive Director, Tata Motors Ltd., Pune
4. Prof. S. Mohan, C.E.O., SID, IISc., Bangalore
5. Dr. J.B. Joshi, Director, University Department of Chemical Technology, University of Bombay, Mumbai
6. Dr. G. Sundararajan, Director, International Advanced Research Centre for Powder Metallurgy and New Materials (ARC-I), Hyderabad
7. Dr. S.A. Bhardwaj, Director (Technical), NPCIL, Mumbai
8. Chairman, AICTE, New Delhi
9. Prof. S.G. Dhande, Director, IIT Kanpur
10. Prof. Ashok Jhunjhunwala, IIT, Madras
11. Dr. Satish Kaura, CMD, Sanstel, New Delhi
12. Prof. Anand Patwardhan, ED, TIFAC, New Delhi Member Secretary

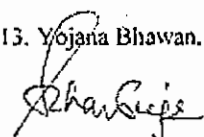
II. Terms of Reference

1. To suggest a suitable mechanism for increased participation of industry in scientific research and technological development.
2. To evolve a strategy for strengthening the interface between industry, R&D institutions and the academia for need based research.
3. To identify key sectors in which such participation could be possible in the next 5 years and also identify, wherever possible, partners who can be involved in such collaborative programmes..
4. To suggest methods to increase the spending by industry on R&D.
5. To suggest a mechanism for sharing equitably the IPR of such research outputs between the academia/ research laboratories and the industry.
6. To consider any other important and relevant item.
7. To indicate approximate financial outlay for implementation of the recommendations.
8. The Chairman may co-opt other members, if required.
9. 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
10. The Working Group would submit its report by 15th July, 2006.


(S. Chatterjee)
Adviser

Copy forwarded to:

1. Chairman, all members and Member Secretary of the Working Group.
2. Dr. V.L. Chopra, Member (S&T and Agriculture), Planning Commission, Yojna Bhawan, New Delhi
3. Dr. P.K. Biswas, Advisor (S&T), Planning Commission, Room No. 213, Yojana Bhawan, Sansad Marg, New Delhi


(S. Chatterjee)
Adviser

LESSONS FROM DEVELOPED & EMERGING ECONOMIES

1. MAGNET PROGRAM (ISRAEL)

The MAGNET program involves pre-competitive R&D within a consortium that includes a number of commercial companies together with research personnel from at least one academic or research institution. The R&D focuses on new generic technologies that will lead to new generation advanced products. The industrial partners enjoy a grant amounting to 66% of approved R&D costs, whereas the academic partner will receive 80% of said costs. A foreign company may be included in the consortium if it can bring a unique contribution to the relationship.

The Mini-MAGNET (Magneton) Program is to further support an already existing relationship between industry and an academic institution. The grant in this case amount to 66% of the approved R&D costs.

MAGNET currently includes 15 active consortia and supports three additional channels for the development of technology rich industry, using the reservoir of knowledge in the Israeli academic institutions.

For example,

- Nano-functional Materials (NFM) consortium,
- Consortium for Biotechnological Infrastructure systems
- Streaming Rich Media Messaging (STRIMM) Consortium
- Pharmacological Consortium
- Large Scale Rural Telephony (LSRT) Consortium etc.

2. FRAUNHOFER SOCIETY (GERMANY)

Fraunhofer has been bridging the gap between academic research and industrial needs for more than 50 years. It is Europe's largest R&D organization spanning over fifty locations across Europe, Asia and North America; and includes an annual client base of more than 3000 corporations.

Fraunhofer Institutes work with industry and universities to scale up cutting edge research into real working technologies on an industrial time table and leads to the development of advanced machinery and processes for a variety of applications. The salient feature of this success story is that each center of Fraunhofer is focused on a particular technology and is co-located with major universities engaging students as staff members and works closely with industries.

For e.g, The Fraunhofer USA Inc. operates five centers in the USA. Each Centre is affiliated with a Fraunhofer Institute located in Germany and partnered with a major research university in the US. In the centers, University Professors and Doctoral/Master's degree candidates work together with staff at the Fraunhofer centers to provide additional skills and knowledge for the enhancement of technology transfer from the University level to the mainstream of business.

3. EUROPEAN FRAMEWORK PROGRAMS

The Framework programs set out the priorities for the European Union's (EU) research, technological development and demonstration activities. These priorities have been identified on a set of common criteria reflecting the major concerns of increasing industrial competitiveness and the quality of life for European citizens. Framework projects are funded on a shared-cost basis, with the EU paying up to 50% of the costs for research projects. The remainder of the money comes from other sources such as grants and private funding.

The Sixth framework programme (FP6) for the four year period 2003-2006 targets seven key areas for the advancement of knowledge and technological process viz. Genomics and biotechnology for health, information technology, nanotechnologies and nanosciences, aeronautics and space, food safety, sustainable development and economic and social sciences. The overall budget represents an increase of 17% from the 5th Framework Programme, aiming at improved competitiveness and innovation through the promotion of increased cooperation, greater complementarity between academia, industry and research.

New support instruments have been introduced in FP6 (networks of excellence and integrated projects), which assemble genuine critical masses of resources, coordinate national research efforts and to diversify support activities in key areas such as the mobility of researchers and research infrastructure.

4. TAIWAN

4.1 Industry Research Centers

There are many industry research centers successfully operated by the Taiwan school of Engineering. An example is described in detail below.

The Multimedia Technology Research Center (MTrec) is aimed to stimulate university-industry collaboration and to promote technology transfer to local industry as well as to maintain world-class academic excellence. Housed in a state-of-the-art facility with high-performance audio-visual and computing equipment, the Center is funded by granting agencies and industrial partners. The Center is home to faculty members from the Department of Computer Science and Engineering and the Department of Electronic

and Computer Engineering, research scientists, engineers, and graduate students.

4.2 Cluster formation

The primary means of cluster formation in Taiwan has been through the development of science parks, based on the model originated in Stanford. Hsinchu Science Park (HSP) was the first science park in Taiwan. Formed in 1980, it was established to serve Taiwan's high technology industries and accelerate their development. It offers a wide range of tax incentives, low interest loans, R&D and manpower training grants and duty free importing of equipments and materials. The park is co-located with National Tsing-hua University, Chiao-Tung University and Industrial Technological Research Institute (ITRI). A common feature of successful technology institutions is their spatial co-location and integration, and the success of ITRI and HSP has been dependent upon their co-existence and also being co-located alongside the two universities. Since its creation, 13000 ITRI staff have moved into industry.

5. GLOBAL SCOT- TAPPING THE TALENT OF SCOTTISH DIASPORA

The Globalscot initiative of Scotland is set out to establish a global network of influential individuals who have an affiliation with Scotland to contribute to and share in Scotland's economic success. The economic development strategy- ***A smart, successful Scotland*** is based on three themes- **enhanced learning and skills, growing business, developing and strengthening global connections**. In early 2005, less than three years after the launch in March 2002, it had developed into a powerful national resource of more than 800 influential businesspeople.

The engagement and use of Globalscot members generates a range of benefits both for Scottish enterprise and academia. For example, a Globalscot member who is a Chief scientist and Vice President, R&D for a U.S biotechnology company located on the West coast undertook a 2-day tour of the Scottish biotechnology sector that directly influenced Scottish Executive's biotechnology strategy. Back in California, he involved other members in the life sciences in an initiative that resulted in a program to develop internships for Scottish life science students in Californian firms.

REVIEW OF EXISTING MECHANISMS IN INDIA

1. TECHNOLOGY DEVELOPMENT/PRE-COMMERCIAL R&D

1.1 NMITLI (New Millennium Indian Technology Leadership Initiative)

Under the NMITLI scheme, areas are identified by a top-down approach through a wide range of consultations and projects are built through bottoms-up approach. The scheme disassembles the project into distinct components and invites various institutions as well as industries to play a critical role in the development of a particular component. This concept and model is well accepted by the research community and enjoys an unprecedented brand image.

1.2 SBIRI (Small Business Innovation Research Initiative)

This scheme of DBT, supporting small and medium size enterprises with a grant or loan to help early phase of product development. The scheme support proof of concept, early stage innovative research and provide mentorship and problem solving support in addition to the grant/soft loan. The funding in the first phase will be provided for highly innovative, early stage, pre-proof-of-concept research

2. TECHNOLOGY TRANSFER AND UPSCALING (EARLY STAGE)

2.1 HGT (Home Grown Technology)

Unique scheme of TIFAC (Technology Information, Forecasting and Assessment Council) assisting the commercialisation of technologies successfully tried out in laboratories. This activity has provided a major impetus in promoting R&D efforts in various national laboratories and strengthening of linkages between research institutes and industry. The activity supplements development and demonstration of indigenous technologies, technology upgradation and technology transfer. So far HGT has supported 77 technology projects, most of them SMEs

2.2 PATSER (Programme aimed at Technological Self Reliance)

This scheme of DSIR (Department of Scientific and Industrial Research) supports industry for technology absorption, development and demonstration and building capabilities for development and commercialisation of contemporary products and process of high impact.

3. TECHNOLOGY COMMERCIALISATION

3.1 TDB (Technology Development Board)

Technology Development Board of the Department of Science and Technology aims at accelerating the development and commercialisation of indigenous technology or adapting imported technology to wider domestic application. The board provides financial assistance in the form of Equity, Soft loans, or Grants. TDB has been a key instrument in supporting several indigenous technology endeavours ranging from Shantha Biotech vaccine on Hepatitis B to the indigenously designed aircraft SARAS.

3.2 3.2 Technology incubation in academic institutions

Under the NEB (National Entrepreneurship Board) of DST, a large number of technology business incubators (TBIs) as well as Science and Technology Entrepreneurship parks (STEPS) have been set up in academic institutions across the country. These centers are excellent examples of early stages of technology commercialisation. This is accomplished under the guidance of expert faculty which helps in hand-holding the fresh graduates to give solutions to technological problems. Besides this, basic equipments for characterization, testing etc required for the start up is also provided by the institution. This scheme helps to nucleate small firms based on emerging technology needs

4. FOCUSED HUMAN RESOURCE DEVELOPMENT AND TECHNOLOGY SUPPORT

4.1 Mission REACH (Relevance and Excellence in ACHieving new heights in higher technical education)

This mission under the Technology Vision 2020 programme of TIFAC is targeted towards upgrading the quality of higher technical education in science and engineering institutions. This is accomplished by creating Centre of Relevance and Excellence (COREs) in institutions in select areas of S&T, which are of direct relevance to industries, who in turn are major stakeholders in the CORE.

This Mission is a unique example of successful academia-industry interaction. The involvement of industry in the TIFAC CORE is from right the inception of evaluation process, in the REACH Monitoring Committee, for customizing the curricula according to recent trends in technology and also for placement of students. For example in the TIFAC CORE on Clastic Petroleum Engineering at Dibrugarh University, ONGC is the industry partner – a senior official of which is a member of the Monitoring Committee. ONGC

is involved in all student projects and also absorbs 100% of the students graduating from this TIFAC CORE.

The total budget is around Rs.170 crores and the commitment from Industries and Institutions together is to the tune of Rs.106 Crores. At present there are 26 TIFAC CORES set up in the country with 92 industry partners, who are actively involved in Monitoring of the CORE, Contract R&D, CEPs, training and R&D projects. The TIFAC COREs are regularly interacting around 500 industries on a regular basis. Fourteen PG courses directly relevant to the Industry have been introduced, for the first time in India!

4.2 AICTE SCHEMES

4.2.1 Industry Institute Partnership Cell (IIPC)

The objective of the IIP Cell is to reduce the gap between industry expectations (practice) and academic offerings (theory) by direct involvement of industry to attain a symbiosis.

The AICTE provides financial assistance to the selected institution for meeting the recurring expenditure maximum of Rs.5.00 lakhs for Manpower Cost, Travel, Administrative- Overheads programmes / event expenses and Contingencies, etc. of the IIPC for maximum five full operational years subject to satisfactory yearly performance.

4.2.2 TEQIP

The Technical Education Quality Improvement Programme of Government of India (TEQIP), a scheme of World Bank, aims to upscale and support ongoing efforts of GOI to improve quality of technical education and enhance existing capacities of the institutions to become dynamic, demand-driven, responsive to rapid economic and technological developments occurring both at national and international levels. The Programme Components are i) Institutional Development (funded on competitive basis) will undertake promotion of academic excellence in institutions, networking for quality enhancement and resource sharing and services to community and industry ii) Systemic Management Capacity Improvement (funded on investment proposals).

The Programme will be implemented as a centrally coordinated, multi-state, long-term Programme in overlapping phases. Under each phase, there will be 2 to 3 cycles of selection of well performing institutions in a

competitive manner. For the First Cycle of the First Phase, six States namely, Uttar Pradesh, Madhya Pradesh, Himachal Pradesh, Kerala, Haryana and Maharashtra have been selected to participate in the programme based on their commitment and preparedness. All other States/UTs have the option to participate in subsequent selection cycles depending upon preparedness of their institutions. The estimated cost of the First Phase of the Programme is Rs 1550 crores which includes Rs 350 crores in the Central sector. The centrally funded institutions will get funds through Central budget and States funded institutions through their respective States budgets.

4.2.3 NAFETIC

National Facilities in Engineering and Technology with Industrial Collaboration (NAFETIC), aimed at establishment of National Facilities in the frontier areas of engineering and Technology in collaboration with industry. The scheme provides sophisticated testing, instrumentation and design facilities to industry in specialized/ emerging areas of engineering and technology, advanced knowledge and know-how to industry in the new areas of relevance through short-term training/continuing education programmes, provides effective linkage between industry and academic institutions for sponsored research and consultancy.

The areas where a national facility is to be setup must be clearly identified by an academic institution / university in consultation with industry, keeping in view its own strength with regard to availability of expert manpower and infrastructural facilities within the institution. The National Facility should be planned so as to run on a corporate basis, and to be self-supporting from the resources generated from the organization by providing testing, design, training, fabrication and R&D services.