



**Report of the  
Working Group  
On  
Science & Technology  
Human Resource Development  
For  
12<sup>th</sup> Five Year Plan (2012-17)**



**Ministry of Science & Technology  
Government of India**

**September, 2011**





## Foreword

Human resource in Science and Technology is a major driver for India's emergence as a knowledge super power. Strategic and sustained support with higher investment in Science and Technology education and training in schools, colleges, universities, research institutions and industry is essential to generate effective leaders and competent scientific workforce and teachers for realizing this vision. For this purpose knowledge driven countries need to build critical mass of well trained scientists, engineers, professionals, technicians, graduates and domain experts with scientific training and skills. Significant component of the workforce must be equipped with skills to learn and deploy emerging knowledge to address the challenges in the changing economic scenario and fulfilment of aspirations of the people.

A comprehensive and inclusive analysis of information, inputs and data provided to the Working Group relates to the wide range of challenges in S&T education and training, institutional restructuring, new teaching methods, tools, incentives, rewards and mobility of scientists, new career paths for science students and for domain experts engaged in science, global partnerships, role of industry, global technological development trajectories and future career opportunities. It was appreciated that to address these complex issues effectively a long term vision and a parallel strategy encompassing policy interventions, investments, implementation strategies and action plan is required based on multi-stakeholder consensus involving Central and State Governments, universities, colleges, schools and many others. Therefore, out of this matrix of interconnected issues, efforts have been made in this report to identify priority issues/challenges and recommend strategic solutions, programs, schemes and other interventions for implementation during the 12th Plan.

In publishing these recommendations through this report, we envision thought-provoking discussions and debates that will value add to the proposed plans, strategies and implementation.

Finally the overall aim is to create and develop an ecosystem where concept and scope of education, innovation and science are integrated as a single entity leading to innovation and entrepreneurship.

I thank all the Members and Secretariat for this comprehensive treatment in addressing this complex yet critical issue.

M.K.Bhan  
Chairman  
12<sup>th</sup> plan working group on S&T HRD  
Planning Commission



## ACKNOWLEDGEMENTS

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I would like to thank and appreciate the sincere efforts of Dr.M.K.Bhan, Secretary DBT &Chairman of the Working Group for his quality inputs and innovative ideas on addressing issues in S&T- Human Resource Development.

I sincerely appreciate the efforts of all the Working Group members like Prof. L. S. Shasidhara (IISER), Prof. Gautam Biswas (CMERI), Prof. T. K. Chandrasekhar (NISER), Prof. K. S. Dasgupta (IIST), Prof. Arup Raychaudhuri (SN Bose Institute), Prof. Hemachandra Pradhan (Homi Bhaba Centre), Dr. Hari Gopal (Advisor, DST), Dr. Rajesh Luthra (Scientist G, CSIR), Dr. Rajendran (CII), Shri Pawan Aggarwal (Advisor HRD, Planning Commission), Shri. A. K. Verma (Advisor S&T, Planning Commission), Dr. Bharadwaj (Jt. Advisor S&T, Planning Commission) and all other members for their innovative suggestions and key recommendations for addressing issues pertaining to S&T sector in the country. The generous contribution of members time, efforts and expertise often under stringent schedules are gratefully acknowledged.

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Prof. Ganesh (Director) for facilitating the second Working Group meeting in Pune. The Working Group appreciates the contributions of various teachers, scientists, faculty of various Institutions in Pune who have actively participated in the second Working Group meeting and gave various suggestions for strengthening S&T education in the country.

The Working Group would like to extend its acknowledgements to all researchers, scientists, industry representatives, academicians and all others who have contributed their ideas and suggestions through written emails and published articles for addressing issues in S&T HRD. The Working Group would also like to appreciate the sincere efforts of its research and drafting team Dr. Padma Singh, Dr. Rajneesh K. Gaur of DBT, Mr. Murali Krishna Chimata and Mr. Ritesh Navale for providing key inputs and much needed background support in analysing the issues and key recommendations by the Working Group for Formulation of the 12th Five Year Plan in S&T-Human Resource Development.

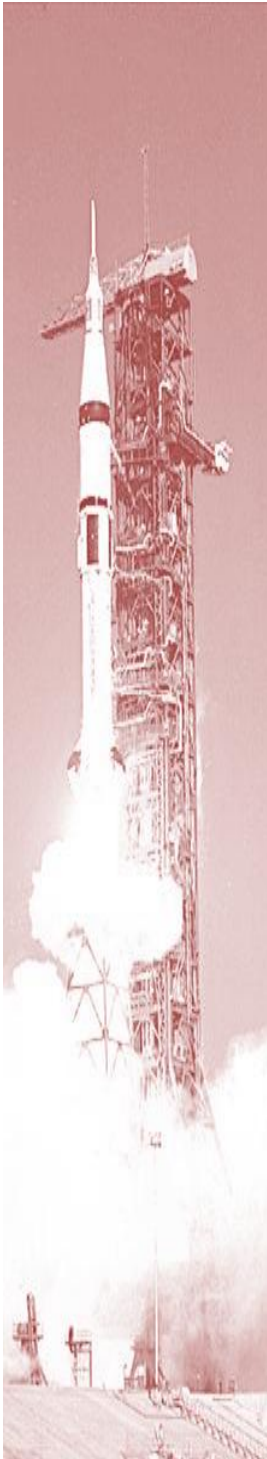
Dr. S.R. Rao (Advisor, DBT)

Convener,

Working Group of 12th Five Year Plan in S&T-HRD



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## EXECUTIVE SUMMARY

The approach paper of planning commission on “Innovation and Technology” for 12<sup>th</sup> five year plan prepared through consultative process envisages bringing in paradigm shift on two major fronts. The first one relates to expanding the scope of science and technology to domains where the full potential of S&T has not been fully exploited. These areas would include amongst others education, healthcare, energy, water, food security, environment and strategic and security sectors as well as wealth creation through industrial research, innovation and commercialization. The other aspect is related to new and effective mechanisms for funding research and development, institutional framework and connectivity, and where relevant, changing the governance patterns. The belief is that to be more impactful the same things need to be done differently.

Further, among the 12 strategy challenges of Twelfth plan identified by the Planning Commission, enhancing skills and faster generation of employment, improved access to quality education along with several steps for promoting technology and innovation have been emphasized. For this purpose knowledge driven countries need to build critical mass of well trained scientists, engineers, professionals, technicians, graduates and domain experts with scientific training and skills. Significant component of the workforce must be equipped with skills to learn and deploy emerging knowledge to address the challenges in the changing economic scenario and fulfilment of aspirations of the people.

There is an immediate need for creation of ecosystem where concept and scope of education, innovation and science are integrated as a single entity; where education is linked with innovation and entrepreneurship; and where critical mass of S&T enabled, educated and effective persons are required for the country through community engagement, innovation experience and experimentation in addition to education. The planning Commission has constituted the Working Group for S&T



HRD with major mandate to recommend strategies for strengthening the Science and Technology education system in the country to develop high quality S&T human resource and address the challenges of sustainable supply of talent pipeline for careers with research and innovation.

The working group constituted under the Chairmanship of Dr. M.K.Bhan, Secretary, DBT met on two occasions in New Delhi and Pune. Based on the observations in the first meeting, for further exploration various stakeholders were invited in the second meeting to define and express their views and send their written inputs and observations. The stakeholders with valuable inputs included 37% from academic and education institutions, 29% from universities and colleges, 17% each from policy makers from Government agencies and from industry. Besides these inputs, the secretariat collected and compiled resources and data from various publications and reports of national and international agencies to obtain insights on critical issues of S&T HRD. Efforts have been made to provide fact sheets and several Annexure for mapping and comparison of S&T HRD resources in Indian and the Globe. A separate chapter is formulated on 'S&T HRD Stakeholders Issues and Recommendations' to cover the entire range of issues, recommendations/interventions at various levels of S&T education and training.

A comprehensive and inclusive analysis of information, inputs and data provided to the Working Group relates to the wide range of challenges in S&T education and training, institutional restructuring, new teaching methods, tools, incentives, rewards and mobility of scientists, new career paths for science students and for domain experts engaged in science, global partnerships, role of industry, global technological development trajectories and future career opportunities. It was appreciated that to realize these complex issues a long term vision and strategy encompassing policy interventions, investments, implementational strategies and action plan, multi-stakeholder consensus, is required involving Central and State Governments, universities, colleges, schools and many others. Therefore, out of this



matrix of inter connected issues, efforts have been made in this report to identify priority issues/challenges and recommend the strategic solutions, programs, schemes and other interventions for implementation during the Twelfth Plan.

In brief the priorities and recommendations are:

1. **Appropriate Institutional Mechanism To Promote S&T HRD Activities:** It has been recommended to establish an autonomous *National Agency for S&T Education and Training* for policy research; serve as data warehouse for S&T HRD statistics and resources; foster global partnerships and establish linkages with international agencies (OECD, UNESCO); R&D in development and designing of education tools, training modules, curriculum/syllabus, monitoring and evaluation methods etc; and to implement programs/projects in critical areas including unaddressed national needs of S&T education, training and skill development.
2. **Adaption Of Existing Public Private R&D Partnership Models And Development Of New PPP Models For S&T HRD Activities:** It was recommended that through inter-ministerial/departmental committee a feasibility study may be commissioned for adaption of existing PPP models (of technology development across S&T Departments) and address new models specially tailored for the needs of S&T –HRD; with clearly stated legal and administrative aspects and generic guidelines for PPP in S&T education and training requirements. Fiscal incentives including grants / soft loans and tax benefits to participating private and non profit sector entities in PPP or as a part of corporate social responsibility have also been identified.
3. **Synergizing Inter Ministerial Policies And Programs In Education With Special Reference To Science And Technology Component:** Working Group envisages creating an environment where science, education and research is discussed as a single entity yet maintaining the needed diversity. Synergy is required at three different levels: Policy, Programs and



Projects. It was therefore recommended to constitute a permanent notified “Inter-Ministerial S&T Commission of Secretaries” (IMCS- S&T) at the Apex level chaired by Member (S&T) Planning Commission to address various issues. The recommendations in the report also contain suggested terms of references and policies to be reviewed and streamlined across ministries/departments.

**4. Reforms, Redesign and Strengthening S&T Education & Training:**

Recognizing the ongoing schemes in strengthening universities and colleges, the working group recommended continuation and expansion of schemes (PURSE, FIST, BUILDER, STAR Colleges) of DST and DBT with necessary modifications based on current experiences and suggested eight different schemes for 12<sup>th</sup> Five Year Plan such as: scheme to upgrade 500 science colleges; establish 50 science parks / exploratory science centres; support mobile research laboratories or “Lab on Wheels; large scale support varied Summer School Programs; central assistance for faculty expansion in State S&T universities and institutions; graduate research projects; teachers ignition grants for R&D scheme and schemes for mentoring graduates /post graduates by established scientists from national and international institutions.

**5. Expanding Scope For Careers In S&T, Research, Innovation And Support Services:**

Besides, generally acknowledged shortage of qualified Ph.Ds, scientists and teachers three other major challenges in S&T-HRD were recognized: the need for specialized human resource to address convergence and multi disciplinary of sciences; gainful employment of graduate and post graduate students including women; specialized technical and skill requirements due to increased automation and sophistication in instrumentation for research, manufacturing and industrial requirements. Various innovative schemes proposed for addressing these challenges include: “Glue Grant “research scheme; Graduate Interdisciplinary Ph.D programs; special programs/fellowships for emerging areas; post graduate diploma courses or short term certificate courses for technician training and



skill development; establishment of vocational technician training centres in collaboration with industry and setting up of finishing schools to make available readymade talent to various S&T based industries.

6. **Expanding Current Global Partnerships In S&T To Augment Human Resource Development:** Recognizing the value addition and quality of HR training and skill development in the ongoing S&T-R&D collaborations, there was a consensus to expand the scope of global partnerships for leveraging and augmenting the requirement of large number of well trained and highly qualified researchers, teachers, professionals and technicians. Important recommendations in this context included simplification of the existing mechanisms and multiple clearance systems for international collaborations between Indian Universities, Institutions, colleges with foreign counter parts particularly for twining programs of R&D linked Ph.D and Post-Doctoral Programs, Incorporation of S&T education and training as an integral part in the Protocols of Cooperation signed between countries and launching of special competitive grant scheme such as “International Collaborations for Education and Training” (ICET) with funding levels up to Rs. 50.00 Lakhs per applicant University/ Institution/College for exploring opportunities.
  
7. **Diverse Fellowships And Career Development Awards For R&D, Innovation And Entrepreneurship:** Most of the current fellowships and awards are addressing the needs of physical and life sciences requirements pursuing post graduate studies or Ph.D. Adequate attention has not been paid to address the needs of (i) engineering, medical and other professional courses to engage themselves in S&T-R&D or pursuing Ph.D after post graduate studies and others relevant to innovation support; (ii) Specialists/ experts engaged in various steps and activities of S&T based product development involving regulatory/intellectual property due diligence, technology packaging, innovation and design and (iii) setting up of start-up



companies by scientist entrepreneurs: post graduate/doctoral students, group of students in universities and colleges. It was therefore recommended to review to rationalize the incentives, existing pay packages/fellowships for professionals interested in pursuing Ph.D or R&D as a career; Institute wide array of Career Development Awards with lucrative pay packages to working professionals/faculty to participate in innovation and technology development activities. It was recommended that a pull mechanism is required to attract domain scholars to scientific career than merely a career path that allows focus on research. This is crucial in medical, veterinary, forestry and other areas where careers are by practise rather than scholarship based. It was recommended that we expand the scope of the current technology development programs (example TePP of DSIR) and to include opportunities for S&T intensive colleges and institutions to promote collective innovation experience; and Institute 'Ignition Grants' (up to Rs. 50 Lakhs per project) for encouraging innovation and technology development by scientist entrepreneurs.



**8. Employing New Tools and Technologies for Education Including**

**S&T:** The issue of employing modern tools and technologies for education in general and for development of HRD has been addressed at school level through several forums / committees and focus groups. However, Working Group has identified three different levels where interventions through new tools and technologies are required such as: teaching methods, learning methods and knowledge landscape. The S&T Departments may jointly set up a “Think Tank” of experts and stakeholders from industry and academia for review and assessment of existing as well as emerging S&T (education) technologies, feasibility for developing or adapting new technologies, addressing the issues of content, designing innovative schemes, including servicing and up gradation requirements. Meanwhile, it was recommended that in the 12<sup>th</sup> plan, the available schemes of Centres of Excellence in S&T Departments may be expanded to include setting up of up to 5 centres for S&T education content, technology and tool development with workshops.

**9. Science Literacy:** Programs on public perception and understanding of

science requires novel outlook in the society with ever increasing applications of technology, emerging areas of complex scientific discoveries, convergence of sciences and easy access to information through internet, television and radio with multiple channels, influential people and agencies owning the communication systems. The working group has recommended that the S&T departments and research institutions under their administrative control should put in place an appropriate mechanisms for communication of scientific achievements, replying to public concerns in subject specific areas and canvassing the opportunities in S&T education and training. Some suggestions made included: designating an officer-in-charge for the purpose in each department/institution with good communication abilities and domain knowledge; departmental ‘Media Box Corner’ in respective home pages for



regulative upload authenticated information for media; constitution of Ad-hoc group of experts and policy makers for prompt communication and clarification in emergencies; schemes to promote courses for new generation of S&T journalists in collaboration with well-established media schools and foundations.

The detailed recommendations described in chapter-III also facilitate references, examples of success stories and models at national and international level. In general, these recommendations could be implemented with suitable amendments by any of the S&T Departments. The financial requirements for implementation of these recommendations over a period of 5 years have been estimated at the level of Rs. 4400 crores. It also provides a list of action points recommended for DST, DBT and CSIR for implementation in short term (1-2 years).

To sum up, the Working Group considers addressing S&T HRD as a most challenging task and requires continuous uninterrupted and inclusive dialogue at policy, people, programs / project levels. An organized annual assessment can ensure integration of S&T as component of education policy and fulfil the aspirations and expectations of the society in recognizing S&T as a main component of public policy, innovation and enterprise and socio-economic development.

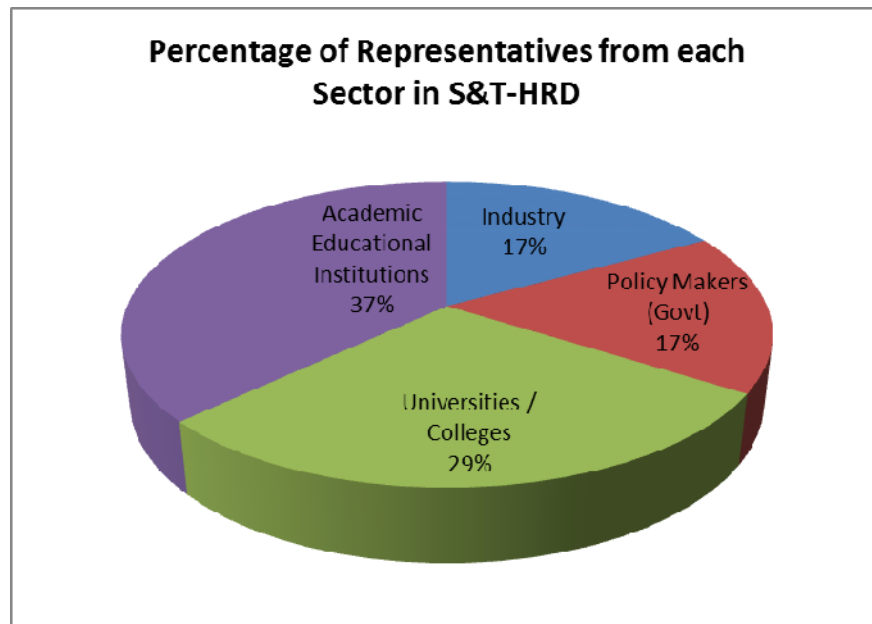




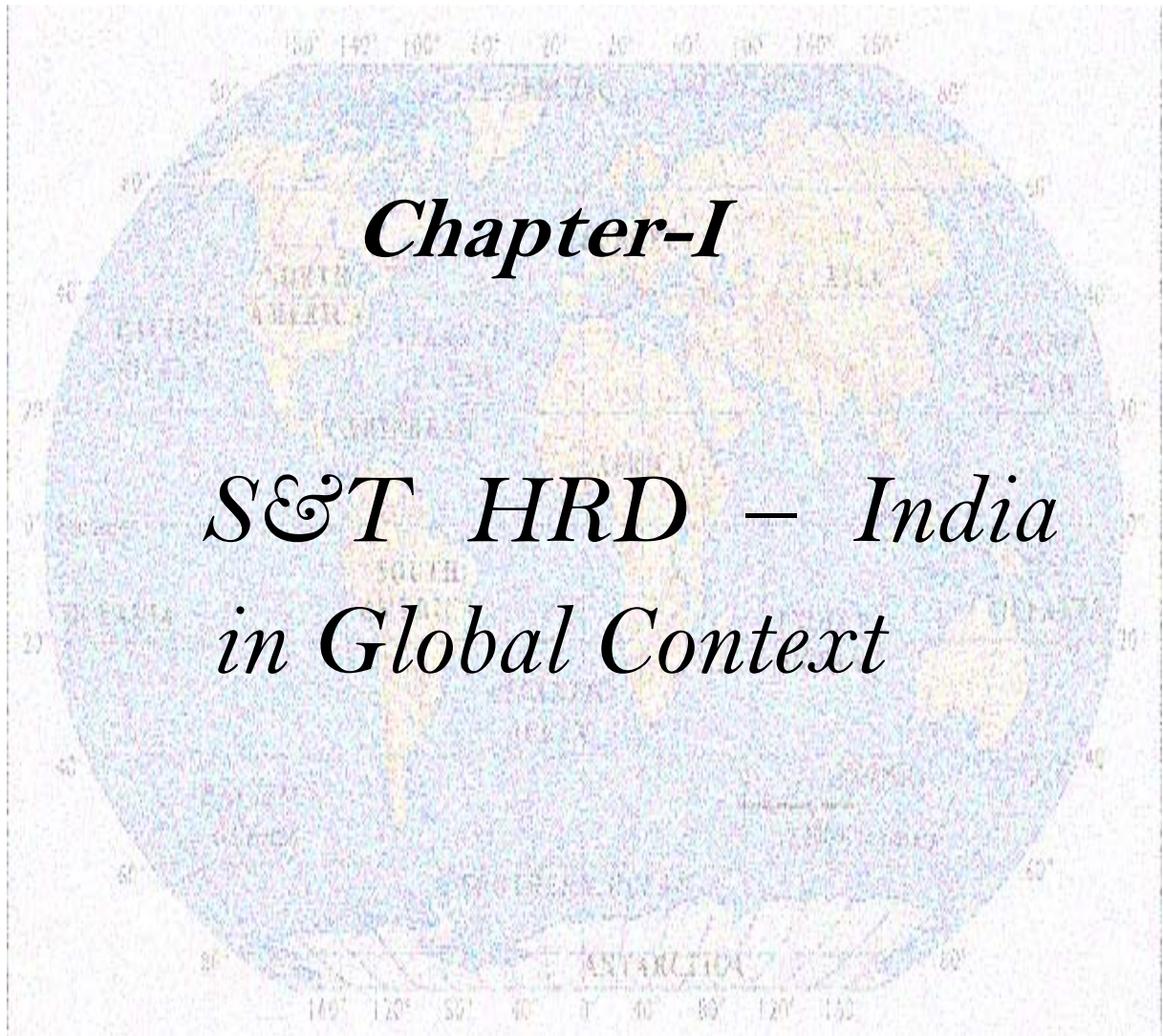
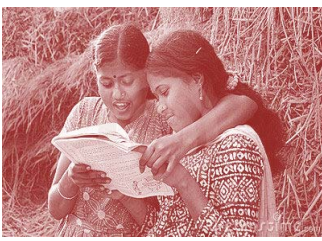
## METHODOLOGY

- Identification of key issues pertaining to Science and Technology – HRD
- Identification of diverse stakeholders from varied S&T Departments
- Constitution of a Working Group with diversified stakeholders
- First meetings with Working Group (New Delhi)
- Compilation of inputs, suggestions and recommendations for strengthening S&T-HRD
- Second meeting with wide range of stakeholders in an open house session
- Compilation of inputs, suggestions and recommendations
- Receipt of email inputs, suggestions and recommendations from other stakeholders concerned to S&T-HRD
- Secondary surveys, collection of background documents for drafting the Report
- Constitution of a drafting team
- Compilation of inputs and recommendations from the Working Group and other key stakeholders
- Formulation of a draft report
- Circulation of the draft report copy to Working Group members for their inputs and suggestions
- Finalization of the Report and submission to Planning Commission.

*List of Working Group Members – Annexure 1.0*



The above diagram presents an overview of representatives from various sectors of S&T. The Working Group constituted had representation from various stakeholders of S&T sectors (Faculty, Scientists & Teacher from national institutions, universities and colleges, industry representatives from CII and FICCI; policy makers from Government S&T/HRD Agencies and Planning Commission) so that equal opportunity could be provided for all stakeholders to raise their concerns and issues affecting the fostering and growth of S&T HRD which could eventually be addressed effectively by recommending some strategic suggestions as well as by bringing some policy resolutions wherever felt appropriate.





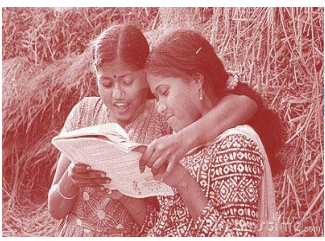
This chapter provides an overview of Indian scenario in comparison to the global economies. An overview of how developed and developing nations are strengthening their educational and S&T base for attaining self-reliance and overall economic development has been represented in the present chapter which could act as a critical focus point for encouraging education and S&T in HRD which are the key components in fostering the concept of innovation ecosystem, without which much progress could not be attained.

A large amount data and statistics are available in various publications/reports of National/International agencies comparing several indicators across developed and developing countries related to R&D expenditures, S&T personnel etc. To provide an overview, a factsheet is prepared highlighting salient indicators of India in comparison with selected countries such as China, Brazil and other relevant developing countries.



## FACT SHEET

- Public Education Expenditure as % of GDP is 3% to 6% in India compared to European countries & some middle east countries  
*(Annexure 1.1)*
- Public Education Expenditure per student (% of GDP) Tertiary education 50 to 100 compared to Europe, Russia, Australia some American countries  
*(Annexure 1.2)*
- Public Education Expenditure per Student (% of GDP), secondary education is around 10 to 20 compared to Southern & Northern American countries  
*(Annexure 1.3)*
- Student Enrolment Ratio at Tertiary Education (Total) is between 10 to 30 compared to Russia, Australia, Europe, middle east countries and Southern America  
*(Annexure 1.4)*
- Regional Density of Researchers in India was 2.3 % in year 2002 and 2.2% in year 2007 compared European countries, Russia, Africa, Mexico, China, Japan etc.  
*(Annexure 1.5)*
- Distribution of researchers in India per million is less than 100 compared to European countries, Russia, Australia, Middle East Southern and Northern America  
*(Annexure 1.6)*
- In India, around 35% to 40% researcher employed in Private enterprises, around 45% to 50% employed in government and 10% to 15% employed in Higher Education compared to Korea, China, Japan, Singapore, Philippines, Canada & some African countries  
*(Annexure 1.7)*



## *Chapter II*

# *India - S&T HRD Resource Mapping*



Mapping of various resources with regard to S&T sector was done through secondary desk based research and through evaluation of various reports which were available in public domain to understand the existing resources in terms of availability of institutions, universities, organizations etc. The following chapter highlights the available resources with respect to S&T in India which can eventually give insights for strengthening or creation of new facilities as per requirement to foster the innovation in India.

Mapping of the following aspects and indicators have been done:

- S&T Agencies / Ministries and Departments in India.
- Professional Bodies
- Autonomous S&T Institutions
- Scientific Programs / Scientific Services and Statutory Bodies
- Current Status of various Institutions in India
- Structure of Education System in India
- Expenditure incurred by various departments on education
- Expenditure incurred by various Departments in R&D
- Status of graduate institutions, sanctioned intake of graduates, total output of engineering graduates, growth of engineering graduates per million and engineering degrees awarded in India.
- Status of vocational institutes in various States of India and utilization of seats with respect to sanctioned seats.



## FACT SHEET

### S&T Related Ministry/Departments in India

| S No | Department / Ministry / Organization                          | No of Institutions | Annexure No |
|------|---------------------------------------------------------------|--------------------|-------------|
| 1    | Council of Scientific and Industrial Research (CSIR)          | 39                 | 2.0         |
| 2    | Defence Research and Development Organization (DRDO)          | 48                 | 2.1         |
| 3    | Indian Council of Medical Research (ICMR)                     | 30                 | 2.2         |
| 4    | Indian Space Research Organization (ISRO)                     | 18                 | 2.3         |
| 5    | Department of Atomic Energy (DAE)                             | 12                 | 2.4         |
| 6    | Department of Science and Technology (DST)                    | 18                 | 2.5         |
| 7    | Department of Scientific and Industrial Research (DSIR)       | 5                  | 2.6         |
| 8    | Department of Biotechnology (DBT)                             | 16                 | 2.7         |
| 9    | Ministry of Environment and Forests (MoEF)                    | 13                 | 2.8         |
| 10   | Ministry of Food Processing Industries ( MoFPI)               | 4                  | 2.9         |
| 11   | Department of AYUSH                                           | 11                 | 2.10        |
| 12   | Ministry of Communications and Information Technology (MoCIT) | 17                 | 2.11        |
| 13   | Ministry of Petroleum (MoP)                                   | 23                 | 2.12        |
| 14   | Ministry of New and Renewable Energy (MNRE)                   | 5                  | 2.13        |
| 15   | Ministry of Power (MoP)                                       | 14                 | 2.14        |
| 16   | Department of Coal (DOC)                                      | 6                  | 2.15        |
| 17   | Ministry of Water Resources (MoWR)                            | 16                 | 2.16        |
| 18   | Ministry of Earth Sciences ( MoES)                            | 8                  | 2.17        |
| 19   | Indian Council of Agriculture Research (ICAR)                 | 97                 | 2.18        |
| 20   | Department of Agriculture Research & Education (DARE)         | 7                  | 2.19        |
| 22   | Ministry of Human Resource Development (MHRD)                 |                    |             |





| Ministry of Human Resource Development (MHRD)                 | No of Institutions |
|---------------------------------------------------------------|--------------------|
| Apex Bodies (UGC, AICTE etc)                                  | 5                  |
| Central Universities                                          | 40                 |
| Universities (State and Private / Deemed)                     | 520                |
| Indian Institute of Technology (IITs)                         | 15                 |
| Indian Institute of Management (IIMs)                         | 13                 |
| National Institute of Technology (NITs)                       | 40                 |
| Indian Institute of Information Technology (IIITs)            | 4                  |
| Indian Institute of Science Education and Research (IISERs)   | 5                  |
| National Institute of Technical Teachers' Training & Research | 4                  |
| Other Institutes of MHRD                                      | 30                 |

Reference ([www.mhrd.gov.in](http://www.mhrd.gov.in)) updated August 2011



## An Overview of Educated Human Resources in India

### Number of Universities and University Level Institutions - State wise (Annexure 3.9)

| Universities                                      | Numbers    |
|---------------------------------------------------|------------|
| Central Universities                              | 28         |
| State Universities                                | 222        |
| Private Universities                              | 17         |
| Deemed Universities                               | 104        |
| Institutions established under<br>Legislature Act | 5          |
| Institutions of National<br>Importance            | 33         |
| <b>Total</b>                                      | <b>409</b> |

### Number of Colleges and Polytechnics - State wise

(Annexure 3.10)

|                                                     |              |
|-----------------------------------------------------|--------------|
| Arts, Fine arts, social work, Science &<br>commerce | 14146        |
| Engineering/technology/architecture                 | 2466         |
| Medical                                             | 2230         |
| Education/teacher trainings                         | 3284         |
| Others                                              | 3864         |
| <b>Total Colleges</b>                               | <b>25990</b> |
| <b>Polytechnics</b>                                 | <b>1742</b>  |

*Source: Higher Education Statistics Report 2008-09 by MHRD,  
(Up to 30 Sept 2008)*



**Enrolment (Excluding Open Universities) By Level/Courses  
Category Students) - State wise**

**(All**

**(Annexure 3.11)**

| <b>Post Graduate Degrees</b> |               |
|------------------------------|---------------|
| <b>Arts</b>                  | <b>660516</b> |
| <b>Commerce</b>              | <b>189603</b> |
| <b>Ph.D./M.Phill</b>         | <b>78388</b>  |

**(Annexure 3.12 )**

| <b>Post Graduate Degree</b>                            |               |
|--------------------------------------------------------|---------------|
| <b>Science</b>                                         | <b>382619</b> |
| <b>Engineering/technology/architecture/d<br/>esign</b> | <b>95185</b>  |
| <b>Medicine</b>                                        | <b>31025</b>  |

**(Annexure 3.13 )**

|                                                       |               |
|-------------------------------------------------------|---------------|
| <b>Agriculture &amp; allied</b>                       | <b>11461</b>  |
| <b>Management/hotel/travel/tourism<br/>management</b> | <b>125002</b> |
| <b>Education/teacher training</b>                     | <b>25696</b>  |

**(Annexure 3.14 )**

|               |              |
|---------------|--------------|
| <b>Law</b>    | <b>11625</b> |
| <b>Others</b> | <b>44430</b> |

**Under Graduate Degrees**

**(Annexure 3.15 )**

|                |                |
|----------------|----------------|
| <b>Arts</b>    | <b>5108233</b> |
| <b>Science</b> | <b>2000374</b> |



|                 |                |
|-----------------|----------------|
| <b>Commerce</b> | <b>1699263</b> |
|-----------------|----------------|

(Annexure 3.16 )

|                                           |                |
|-------------------------------------------|----------------|
| <b>Engineering/technology/<br/>design</b> | <b>1663691</b> |
| <b>Medicine</b>                           | <b>273366</b>  |
| <b>Agriculture and allied</b>             | <b>81530</b>   |

(Annexure 3.17 )

|                                                       |               |
|-------------------------------------------------------|---------------|
| <b>Management/hotel/travel/tourism<br/>management</b> | <b>181277</b> |
| <b>Education/teacher training</b>                     | <b>460490</b> |
| <b>Law</b>                                            | <b>203577</b> |

(Annexure 3.18 )

|                              |               |
|------------------------------|---------------|
| <b>Post Graduate Diploma</b> | <b>107020</b> |
|------------------------------|---------------|

#### **Pupil Teacher Ratio in Higher Education**

(Annexure 3.19 )

|                            |                 |
|----------------------------|-----------------|
| <b>Number of teachers</b>  | <b>652665</b>   |
| <b>Total enrolment</b>     | <b>13577027</b> |
| <b>Pupil teacher ratio</b> | <b>21</b>       |



## Education Trends in India

The trend of growth in degree institutions can be seen in

*Annexure 3.3*

The trend of growth in sanctioned intake of graduate can be seen in

*Annexure 3.4*

The trend of growth in total output of engineering graduates can be seen in

*Annexure 3.5*

The trend of growth in engineering graduates per million populations can be seen in

*Annexure 3.6*

The trend of growth in engineering doctorate degrees awarded can be seen in

*Annexure 3.7*

### Vocational Training:

There are 2133 government it is having seating capacity of 432006, and 5960 are private it is having seating capacity 683622. (Total number of it is are 8039 and total seating capacity is 1115628)

*Annexure 3.8*

### Expenditure on Education:

Expenditure budget of MHRD, Department of Higher Education was Rs 13,103 Cr. in year 2011-12, out of which 50% spent on general education, 40% spent on technical education and 10% spent on North-East region.

*Annexure 3.21*

Total expenditure on education by various departments is 13% to 14% as percentage of public expenditure.

*Annexure 3.1*

Expenditure on R&D by different S&T departments can be seen in

*Annexure 3.2*



### Schemes of Various Ministries for S&T HRD

There are 14 major schemes/programmes of DST for S&T Human Resource Development.

*Annexure 3.22*

There are 14 major schemes/programmes of CSIR for S&T Human Resource Development.

*Annexure 3.23*

There are 12 different schemes/programmes of Department of Atomic Energy for S&T Human Resource Development.

*Annexure 3.24*

There are 24 different schemes/programmes of DBT for S&T Human Resource Development.

*Annexure 3.25*

### Current Status of Key Institutions in India

The below table represents the current status of various organizations in India. More than 500 Universities, Institutes of Global standards like IITs and NITs are catering to the national needs in terms of engineering discipline, however the number of students pursuing engineering need to be increased dramatically so that most of the students can pursue doctoral degrees which is a pre requisite for any knowledge driven nation like India. Apart from these Institutions various other departments and institutions are catering to the growing demand in S&T.



| <b>Resource Mapping of Institutions in S&amp;T</b>           | <b>No's</b> |
|--------------------------------------------------------------|-------------|
| Central Universities                                         | 40          |
| Universities                                                 | 520         |
| IGNOU                                                        | 1           |
| IITs                                                         | 15          |
| IISERs                                                       | 5           |
| IIMs                                                         | 13          |
| National Institute of Technology (NITs)                      | 40          |
| IIITs ( Indian Institute of Information technology)          | 4           |
| National Institute of Technical Teachers Training & Research | 4           |
| Regional Board of Apprenticeship / Practical Training        | 4           |
| <b>Other Organizations</b>                                   | <b>No's</b> |
| PSU (EdCIL)                                                  | 1           |
| Technical Education (AICTE)                                  | 1           |
| NAAC                                                         | 1           |
| National University of Education Planning & Research (NUEPA) | 1           |
| National Book Trust                                          | 1           |
| Indian Institute of Advanced Studies                         | 1           |
| Engineering Colleges                                         | 2466        |
| Medical Colleges                                             | 2230        |
| Educational Training Institutes (B.Ed)                       | 3284        |
| Polytechnics                                                 | 1742        |
| Others (ITIs , Vocational Colleges etc)                      | 25990       |

**Source:** *Higher Technical Education Report in India* by Prof. Chopra and Prof. Sharma (2007) & Ministry of HRD and DST



## *Chapter III*

### *Key Strategic Recommendations for*

### *12<sup>th</sup> Five Year Plan*





In the chapter 4 varied issues and wish list of suggestions from members of working group and stakeholders were enumerated in 18 categories/components. This enumeration opens up opportunities for continuity of the S&T-HRD consultative process for formulation of long-term strategy aiming at rational integration of S&T policy in education and HRD policy of the nation.

For the purpose of 12<sup>th</sup> plan, it was decided to address and prioritise the complex issues highlighting challenges and provide comprehensive recommendations which include strategy, mechanism, schemes/programmes that can be considered for implementation collectively or separately by all S&T and S&T related departments towards a common goal of addressing needs S&T-HRD.



# 1

## Appropriate Institutional Mechanism to Promote S&T- HRD Activities:

Central and State Government Ministries / Departments / Agencies and stakeholders in the country are engaged in various S&T education, training and skill development activities. Innovative schemes have been implemented involving wide-ranging intellectual efforts, investments and institutional mechanisms. The Working Group emphasised that there is a need to leverage these on going efforts of various stakeholders to bring about needed synergy, resource optimization and provide a common platform for interfacing S&T HRD efforts with that of national HRD plan and strategy. Such a platform or institutional mechanism should orchestrate policies, people and programs through top down and bottom up approaches addressing medium and long term needs of S&T education and training for advancement of human resource capability to accelerate S&T based innovation and enterprise.

### Recommendations

#### Establishment of National Agency for S&T Education and Training

To accelerate global S&T competitiveness, capability of the nation to innovate and engage in emerging and new generation R&D and technology development for the present and future requirements, it is imperative to coordinate and network the efforts and policies of various ministries and departments through a common platform for knowledge and resource sharing. There was a consensus among stakeholders during consultations of the working group that there is a need for establishment of a vibrant platform at national level to coordinate and network the existing centres and institutions, to leverage on going schemes and programmes of various ministries/ departments.



It is proposed to establish therefore a “National Agency for S&T Education and Training” under the overall administrative control of S&T division of Planning Commission.

Such agency shall function as an autonomous core institution for S&T Education and Training for policy formulation, implementing of projects for promotion, development and improvement of Science and Technology education, training and skill development at all levels for overall growth of S&T sector through optimal utilization of resources.

**Some Major Tasks of the Proposed Agency include:**

- Networking and co-ordination of various national policy making, funding and implementing bodies in S&T and HRD sector to evolve a coherent national strategy for S&T–HRD so as to create an ecosystem where the concept and scope of education, science and innovation are integrated as single entity for promotion of nation building activities.
- To serve as a national data warehouse where all S&T-HRD relevant data will be collected, compiled, analysed and disseminated for assisting various agencies in formulating area specific policies and strategies.
- To foster global partnerships and linkages with international agencies like World Bank, OECD, UNESCO for quality research in policy, S&T-HRD indicators, input and output management of S&T HRD.



- To engage in R&D for development and designing of education tools, training modules, curriculum/syllabus, monitoring and evaluation methodologies for use by various stakeholders.
  
- To implement programs / projects in critical areas and unaddressed national needs of stakeholders in S&T education, training and skill development.

**Agency:** National Agency for S&T Education and Training

**Mandate:** To cater the needs of overall S&T education and training. Networking & co-ordination of all S&T HRD relevant Ministries / Departments.

**Chairman of Agency:** Member (S&T), Planning Commission

**Board members:** Secretaries of all relevant ministries/departments

**Financial and technical inputs:** Under the administration of S&T division of Planning Commission.

**Major Functions:**

- Policy research for strategy and impact assessment
- Data resources and S&T education research platform
- Foster international partnerships
- Implement programs and projects
  - Designing education tools and training modules
  - Capacity building programs for teachers and educational Institutions
  - New schemes and interventions required for S&T-HRD
  - New models of curriculum, career development, monitoring and evaluation

**Models available:** International

[www.sei.dost.gov.ph](http://www.sei.dost.gov.ph) (Department of S&T- Philippines)

[www.advanceeducation.gov.ab.ca/home.aspx](http://www.advanceeducation.gov.ab.ca/home.aspx)

(Government of Alberta)

**Proposed Budget:** Rs. 400 Crores



## 2

### Adaption of Existing Public Private R&D Partnership Models and Development of New PPP Models for S&T HRD Activities:

In addition to ever evolving global technology innovation trends, markets for new products, demand and supply of human resource with new skills and S&T competitiveness, it has been observed in the Chapter-II that there is a disproportion in the national investments and resources (Technical and Human) for scaling up of S&T education and training activities across the nation with 40 central and 520 other universities, 15 IITs, 3 IISERs, 13 IIMs, 2466 Engineering colleges, 2230 Medical colleges, 3284 Educational training institutes and more than 1700 polytechnics .

Globally, increased private investments have thus become imperative to expand educational infrastructure to provide greater access to quality education at all levels. While exclusive private investments are already addressed in education sector in general starting from establishment of public schools to private universities/institutions, very few public-private partnership initiatives are known in promoting general education especially in S&T education and training.

The Working Group observed that several PPP models initiated during the previous plan periods for promoting research and technology development programs such as Technology Development Board (TDB), Small Business Innovative Research Initiative (SBIRI), Biotechnology Industry Partnership Programs (BIPP) have resulted in success stories shifting the paradigm of innovation dynamics earlier involving only public sector institutions. However, recognizing that there are very few PPP initiatives in S&T education and training sector, it was deliberated first to examine the feasibility of adoption of existing PPP models (of technology development across S&T Departments) and also address new models for S&T-HRD. Second, to identify various projects/assignments/tasks where such partnerships are significant and complement the efforts of public sector initiatives to achieve large scale



interventions. Third, to suggest fiscal incentives including grants/soft loans and tax benefits to participating private sector entities.

## Recommendations

**A**

**To examine the feasibility of adoption of existing PPP models (of technology development across S&T Departments) and also address new models for S&T–HRD.**

It was recommended to constitute an Inter-Departmental/Ministerial Steering Committee (All Departments / Agencies of MoST, MHRD, D/O Space and Atomic Energy, MoES, MoCIT) with the following terms of reference:

- i) To commission an independent study for assessing the suitability of existing PPP models, suggesting new models and possible fiscal and monetary benefits.
- ii) To develop clear legal and administrative framework for PPP with broad generic guidelines facilitating sectoral adoption and implementation. The framework should also include, Standard Operating procedures (SOPs) for appraisal, approval, monitoring and evaluation processes.

### PPP model could be worked out for

#### Support services:

- Educational tools: invention, creating, manufacturing, distribution & utilisation of tools.
- e-learning & self-learning schools
- Specialised skill development programmes
- Science literacy

#### Infrastructure development

- Laboratory infrastructure and cost sharing models for schools, colleges and universities
- Exploratory research centres
- Science parks

#### Capacity building

- Teachers trainings
- Training to students, teachers and institutes for quality management, soft skills, specialised skills, courses/modules
- Programme management, education management, resource management, effective execution and implementation
- Industrial trainings
- Education: vocational and skill development education
- Quality management in education

#### More Information:

*Initiatives of Infosys*

[http://www.mysoresamachar.com/info\\_trg\\_cent.htm](http://www.mysoresamachar.com/info_trg_cent.htm)

Proposed Budget: 200 Crores



**Dow Chemical Company.** The aims of Dow science-grant program is to improve mathematics, science, and technology education; upgrade teacher training and development; and increased parental involvement. The company focuses on school districts and boards in Dow factory communities rather than on individual schools and on programs that promote systemic educational reform. The company also pursues projects with key strategic partners such as one with the U.S. National Science Resources Center where Dow gave financial assistance to 42 school districts for the organization of science centers, dissemination of new science-curriculum materials, and teachers professional development.

**Hewlett-Packard Company.** Hewlett-Packard reports that in 2001 it has 'contributed more than \$54 million in resources worldwide to advance the ability of students, teachers, community residents, and nonprofits to solve some of their most fundamental challenges. The company programs sponsored the attendance of five U.S. school-district teams ranging from kindergarten to grade- 8 from low-income, ethnically diverse communities at the National Science Resources Center Institutes; supported the Institute for Women and Technology Virtual Development Centers; built Digital Villages in two communities in Ghana and South Africa; and recognized some of the Asia Pacific region most promising minds through Young Inventors Awards (YIA).

**Sony Corporation.** Founders Masaru Ibuka and Akio Morita wrote that introducing science education into elementary schools is key to rebuilding Japan in the aftermaths of World War-II. This belief guided the establishment of the Sony Foundation for Education, which has offered financial support for schools and teachers over the past 42 years. The Foundation's Science-Education Program for Children funds elementary and junior high schools and teachers throughout Japan, especially those who are enthusiastically fostering interest in science among children. Recently, Sony began providing assistance for public elementary schools in Mexican communities. In another program, Sony provided support for a project in South Africa called School TV Access, which is run by the South African Broadcasting Company.

Reference: [www.interacademycouncil.net](http://www.interacademycouncil.net)



**B** Identify various projects/assignments/tasks where such partnerships are significant and complement the efforts of public sector initiatives to achieve large scale interventions

The following activities could be implemented through simple management contracts to intricate PPP arrangements.

- i. Development of education tools, skill development programs and ICT applications.
- ii. Infrastructure development including laboratories, science/ research parks, incubators for R&D and education tool development, establishment of specialized skill development and training centres and finishing schools, vocational and (simple to high end instruments/equipment), speciality training centres etc.
- iii. Implementation of projects and programs for capacity building and training to students, teachers/faculty and technicians, programs in niche areas such as project management, technology management.
- iv. Other issues related to industry-academic interface:
  - ✓ It was recommended to develop new or revisit the existing guidelines to promote lateral mobility of scientists/faculty between industry and academic institutions/universities for research assignments and sharing knowledge and experience.
  - ✓ Industry experts should be recognized for supervising and mentoring the Ph.D scholars registered in Universities through some special scheme with guidelines.





## **C** Fiscal Incentives including Grants/Soft Loans and Tax Benefits to Participating Private Sector Entities

The working group has realised the need of incentivization of private sector for their active participation in overall S&T HRD of the country. Besides, grants and soft loans arising out of PPP projects mentioned above, it has been recommended that private industry should be given following benefits-

- i. The weighted tax deduction system currently provided to DSIR recognized R&D activities/facilities/ equipments of companies under section 35 of IT ACT. The Act should be extended to include those companies which are actively engaged in S&T education and training activities.
- ii. Relevant tax exemptions should be given for education tools and softwares developed in India.
- iii. Corporate social responsibility in activities related to S&T-HRD should be acknowledged in appropriate forums and should be widely publicised for encouraging more industries to come forward.

**Corporates:** Fiscal benefits, Corporate Social Responsibility accreditation

**SMEs:** Fiscal and monetary benefit in terms of priority/credit in grants, schemes

**Available models:**

BITP (Biotech Industrial Training Programme), DBT

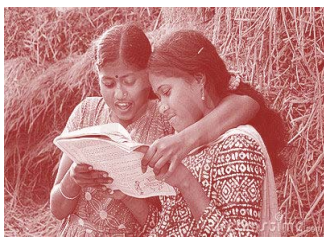


### 3

## Synergizing Inter Ministerial Policies and Programs in Education with special reference to Science and Technology component:

There are several agencies and departments in the country that are addressing the needs and issues of S&T sector through various schemes and programs as alluded in the previous chapter. Therefore, it has become increasingly difficult to have a comprehensive view of various policies, schemes, success stories and issues generic to all agencies. Further, Ministries other than Ministry of S&T in the Government have under their administrative control various Science and Technology research institutes addressing health care, energy, water, food security, environment, strategic and security sectors as well as industrial research and innovation (Annexure 2.0 of the Report: lists of Ministries/Departments engaged in S&T-HRD). Accordingly, there are varying levels of S&T capacity and HR requirements in both upstream and downstream areas of S&T applications across sectors of national importance. It was difficult for the Working Group to determine such diverse needs of S&T–HRD requirements in such complex milieu of different governing systems, institutional policies, mandates and activities.

The Working Group recommends to evolve mechanisms and arrangements to review and examination of this Inter-Ministerial complexity for synergizing the efforts and inputs of various Departments and Ministries and to share knowledge and experiences for developing generic approaches yet addressing tailor-made sectoral requirements.



## 4

### Recommendations

#### Evolving Mechanisms and Arrangements for Review and Examination of Inter-Ministerial Complexity in S&T-HRD

Working Group envisages creating an environment where science, education and research could be discussed as a single entity yet maintaining the needed diversity. Synergy, is required at three different levels: Policy, Programs and Projects. It is therefore recommended:

- To constitute a permanent notified **Inter-Ministerial S&T Commission of Secretaries (IMCS- S&T)** at the Apex level chaired by Member (S&T) Planning Commission to address various issues.
- To support the Apex body with technical and subject specific inputs an **Inter-Ministerial S&T Experts Committee** may also be constituted either independently or as a component of the proposed National Agency for S&T Education and Training with following mandate:

To collectively address and work out a strategy for S&T-HRD requirements in priority sectors of National importance such as Disaster Management, Emergency health care, Water Management etc.

#### Reforms, Redesign and Strengthening S&T Education & Training:

##### **Policies to be reviewed and streamlined**

- Process of recruitment of personnel (teachers/faculty, research, JRF, SRF etc)
- Eligibility criteria for selection and recruitment of S&T project staff (NET, BET, UGC-CSIR, BIT, ICMR, ICAR etc.)
- Evaluation criteria of Institutions including Universities
- Fellowships and Pay scales of personnel (asymmetry in JRF, SRF, Research Associate fellowships, state university faculty, central university faculty professionals in Ph.D courses)
- Accreditation and certification ( Labs, Colleges, Institutions, Industries etc.)
- Central & State Bodies and Councils

##### **Actors/Players/Partners:**

- 鑄
- Funding bodies (DBT, DST, CSIR, DSIR, DAE, DoS, MoHRD, UGC )
- Policy Making Bodies ( Planning Commission, DST)
- Monitoring Bodies (UGC)
- Accreditation Bodies (AICTE, NAAC)
- Project and Program Level Bodies ( Various schemes of MoHRD, DBT, DST, UGC)



The Working Group acknowledged benefits and outcomes of the 11<sup>th</sup> Plan programs to build S&T infrastructure such as ‘Promotion of University Research And Scientific Excellence’ (PURSE) and ‘Fund for Improvement of S&T infrastructure’ in universities & higher educational institutions (FIST) of DST and ‘Boost to University Interdisciplinary Life Science Departments for Education and Research’ (BUILDER) and STAR college program in Biology.

Universities and Colleges are at various levels of track record, governance (Central/State) with location specific disadvantages. The above schemes of DST and DBT are designed mostly to cater the top category of Universities/Colleges based on the publications ‘h’ index etc. Redesigning Universities and Colleges is an integrated activity involving various diverse and complementary activities like capacity building, infrastructure creation and renovation, efficient resource utilisation and mobilisation of human resources, knowledge and experiences for strengthening S&T at all levels of education. For a country with huge diversity and scale of operation, the Working Group deliberated on implementing varied innovative schemes to cater to diverse situations with an overall objective of rejuvenating the S&T capacity in research, education, innovation and enterprise. Redesigning should also consider fresh investments as well as smart efforts by all relevant stakeholders.



## Recommendations

**A**

Continuation and expansion of schemes (PURSE, FIST, BUILDER, STAR Colleges) of DST and DBT with necessary modifications based on current experiences would be highly beneficial.

**B**

Launching of new schemes and programs to cater the diversity and scale of operations. Some suggestions include:

- i. A onetime grant scheme to at least 500 graduate science colleges to upgrade laboratories, establish digital libraries and re-furbish the education tools based on past performance and aptitude for S&T education and training.
- ii. Establishment of 50 Science Parks or Exploratory Science Centres for hands on experience and talent training around cluster of colleges in partnership with Universities and National Institutions in the vicinity.
- iii. Mobile research laboratories or 'Lab on Wheels' may be supported to cater to small towns and rural or remote areas for enhanced learning of practical experiments by teachers and students. Large number of summer school programs may be supported by working out a budgetary package with guidelines.
- iv. N  
ational Institutions and Universities may be supported to operate summer school programs for value addition and hands on training to college students. On pilot basis, a scheme could also be started to identify bright students in science at school level in rural or remote areas for such training programmes. Summer training concepts should be promoted for empowering knowledge to students in subjects of their choice. Institutions can select students based on certain set criteria and also can support for their travel and accommodation. Sustained engagement during all vacations should be promoted.



v. Special Central Assistance to S&T for faculty expansion in State Universities to be initiated to undertake regular recruitment of faculty positions. Initial funding for faculty recruitment and support could be provided by Central Government for a defined period of time (say 5 Years) subsequent to which this responsibility would be vested with their respective State Governments. Retirement age and service conditions need to be maintained uniformly between State Government Universities and Central Universities.

- A. Continuation and expansion of existing schemes**
- B. New Schemes with modification & at larger scale**
- One time grant scheme - up gradation of laboratory, digital library & educational tools
  - Establish at least 50 science park
  - Promote 'Lab on Wheels/Mobile Labs'
  - Encourage summer school programmes
  - Special Central assistance – S&T faculty recruitment
  - Project grants at graduate level with support of mentorship & intercollege consortium
  - Start Teachers Ignition Grant and Research Experience Scheme laboratory
  - Special grant to graduate schools for inviting mentor for teaching, guiding in research activities.

**Proposed Budget:** Rs. 2000 Crores

vi. Support “Learn by Lab” approach involving new funding schemes and initiatives to attract the bright talent to study sciences. Project funding in the form of grants should be initiated for students from under graduate level to create interest and passion for science among the students. Inter-collegiate consortium may be encouraged where students are selected and mentors from various Colleges/Universities are identified for guidance and supervision.

vii. A new scheme like “Teachers Ignition Grant Research Experience” may be launched to address the issues pertaining to science education and research. Funding should be on continuous mode for a certain period of time with periodic review. The National Agency for



S&T Education and Training proposed earlier could coordinate this activity.

- viii. A special grant should be made available for graduate science colleges to invite faculty or established scientists from National Institutions or Universities to mentor in various science subjects for teaching, guiding research activities and designing laboratories and experiments.

### **Expanding Current Global Partnerships in S&T to Augment Human**

#### **5**

#### **Resource Development:**

Working Group observed that the global partnership in S&T research has been playing a significant role in terms of capacity building, infrastructure development, scientific aptitude and participation in International Consortia and cutting edge research resulting in excellent outcomes. For example, currently India is collaborating through bilateral co-funding opportunities with 24 member countries in EU, 5 countries in North America, 5 countries in South America, 9 countries in Africa, 29 Asian countries and Australia ([www.stic-dst.org](http://www.stic-dst.org)). Although, education and training are integral parts of some of these collaborations, the opportunities are limited to project partners and their staff in a collaborative R&D project and in very few cases with joint Ph.D/PDF programs. Recognising the value addition and quality of HR training and skill development in these collaborations, there was a consensus in consultations to expand the scope of global partnerships for leveraging and augmenting the requirement of large number of well trained and highly qualified researchers, teachers, professionals and technicians.



## Recommendations

On a policy front, Ministries of S&T and MoHRD in collaboration with Ministry of External Affairs (MEA), Government of India may open a dialogue for simplification of the existing mechanisms and multiple clearance systems for International Collaborations between Indian Universities, Institutions, Colleges with foreign counter parts particularly for twining programs of R&D linked to Ph.D and Post-Doctoral programs and knowledge sharing through International conferences, seminars, workshops, training and skill development programs.

The current international programs are under the umbrella of Protocols of Cooperation signed between MoST and its counter parts in foreign countries especially for joint R&D, exchange visits of scientists. The Working Group suggested that there could be collaborative agreements exclusively for S&T education and training for high quality human resource development.

Model agreements and explicit guidelines for collaboration at different levels should be made available by the MoST for facilitating various levels and modalities of partnerships. Few illustrations may be seen in the Box.

### **Policy level :**

- ✓ Simplification of multiple clearance system for international collaborations
- ✓ Encourage International collaborations for S&T education and training
- ✓ Formulate partnership modalities & explicit guidelines for different level of collaborations

### **Activities to be supported:**

- Exchange programs for Student, faculty, administrators (grants & special financial assistance)
- Organize knowledge sharing activities like conferences, exhibitions, workshops etc (grants)
- Special grant for foreign faculty/expert of adjunct faculties to come to India for short term and provide mentoring and teaching (grants)
- Skill development programmes and short term programs (grants)
- Arrange webinars of foreign experts (grants)

### **Support required from Government Agencies**

- Scheme for universities/institutions for international collaboration upto Rs.50 Lakhs
- Timely and sufficient financial support
- Strict monitoring of collaboration standards and activities





International collaborations among Indian and Foreign Universities/Colleges also need to be promoted (beyond academics) with various foreign industries, professional bodies dealing with technology transfer, IPR, regulation, science awareness, policy research, governance research, high end technology research, teaching methods and several other knowledge sharing activities.

**Mode of Collaboration:**

- Indian University/Colleges – Foreign University/Colleges
- Indian Industry – Foreign University/ Colleges
- Indian University/ Colleges - Foreign Industry
- A network of Indian Universities – a network of Foreign Universities
- Indian Universities/ Colleges – Foreign professional bodies

**Proposed Budget:** Rs. 200 Crores

The concerned S&T Departments may also consider launching special schemes for facilitating financial requirements of the above recommended opportunities of collaboration at various levels. Different activities are listed in Box.

To accelerate the aforesaid collaborations at University and Institutional level, it has been recommended to start a special competitive grant scheme International Collaborations for Education and Training (ICET) with funding levels up to Rs. 50.00 Lakhs per applicant. Broad guidelines could be drafted, through consultative process among S&T departments and Stakeholders for mandate- specific applications.



## 6

### Expanding Scope for Careers in S&T, Research, Innovation and Support Services:

Conventional programs on S&T-HRD implemented by various Departments are in general focussed on ensuring critical mass of research scientists or science teachers in Universities/Institutions. However, changing economic scenario and aspirations of the people along with emergence of new fields of S&T, there is a need to revisit and suitably amend S&T-HRD programs. Besides, generally acknowledged shortage of skilled Ph.Ds, scientists and teachers, during consultations with various stakeholders three other major challenges in S&T-HRD are as follows:

- ✓ Convergence or inter-disciplinary sciences requires trained research personnel trained at the interface of different disciplines.
- ✓ Many students with science background at graduate and post graduate level and even with Ph.D are not gainfully employed either due to lack of opportunity for higher studies or due to the quality of Ph.D training ( with required skill sets) Vs high bench marks set of selection criteria for research and faculty positions in public and private sectors.
- ✓ Increased automation, highly sophisticated and expensive instruments/ equipment, Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in R&D and industrial production require human resource with specialized technical training and skill sets tailor made for the purpose.
- ✓ Many industries in India often complain of non-availability of ready made talent that fits into a job profile. While some companies do conduct training programs, there is a need to provide graduates and post graduates with technical skills as well as communication / IT and problem solving or analytical skills. Such training programs would provide job opportunities to students in S&T besides saving time efforts & investment of companies in preparing the fresh graduates.

### Recommendations

#### A

#### Convergence or Inter disciplinary of sciences



S&T departments may consider launching schemes:

- i. **Glue Grant Research** linking education and research programs between Universities and Colleges, Universities and National Institutions, General Universities with professional Universities at the interfaces of for example: physical & biological sciences including space, atomic energy, engineering, medical, agriculture, veterinary sciences; some examples of research interfaces

include: space and agriculture applications or meteorology; nano-science and biology; engineering and medicine etc.

- Promote linking education & research between university and colleges 'Glue Grant'
- Special schemes/grants & programmes for emerging interdisciplinary fields of S&T
- Support global pioneering research group meeting
- Support through grants & facilitate academic & research collaborations
- Set up graduate schools
- Initiate short term courses for gainful employment
- Set up vocational/occupational colleges of each S&T domain
- Setting up finishing schools

**Proposed Budget:** Rs. 300 Crores

- ii. Setup **Graduate Schools** for inter disciplinary Ph.D programs involving 4-6 mentors belonging to different disciplines through a network of inter departmental or inter institutional arrangements linking disciplines at fundamental level and domain level. Some illustrations are given in the box.



### **Graduate School of Engineering and Applied Sciences, MIT, USA**

The School of Engineering and Applied Sciences (SEAS) offers doctoral and master's degree programs that lie at the interfaces of engineering, the applied sciences (from biology to physics), and technology. Particular areas of academic focus include applied mathematics, applied physics, bioengineering, computer science, electrical engineering, environmental sciences and engineering, and mechanical engineering. In keeping with the interdisciplinary nature of modern research, the school does not have traditional academic departments and does not award degrees by specific research area. Students may instead work towards a Master of Science, Master of Engineering, and Doctor of Philosophy degree in one of four subjects—Applied Mathematics, Applied Physics, Computer Science, and Engineering Science.

The faculty members in the SEAS, nearly 30 percent of whom have joint appointments in other research areas, have close ties with the science departments (especially Physics, Biology, Chemistry, and Earth and Planetary Sciences) in the Faculty of Arts and Sciences and increasing ties to Harvard's professional schools (including business and medicine). Students may also pursue collaborative options through the Medical Engineering and Medical Physics (MEMPH) program, which is part of the Harvard-MIT Division of Health Sciences and Technology.

The majority of the course offerings, most of which span across disciplines, are listed in the Courses of Instruction under the following broad headings: applied mathematics, applied physics, computer science, and engineering sciences. In addition to lecture courses and seminars, students may take directed reading and research courses in connection with their dissertations and, on occasion, use them to explore topics not covered in regular courses. Programs that include considerable work in one or more science departments are common. Students may supplement their studies by cross-registering in other Harvard graduate schools or at the Massachusetts Institute of Technology.

[http://www.gsas.harvard.edu/programs\\_of\\_study/school\\_of\\_engineering\\_and\\_applied\\_sciences.php](http://www.gsas.harvard.edu/programs_of_study/school_of_engineering_and_applied_sciences.php)



- iii. Special scheme ( including recommendations A & B ) and programs need to be implemented to address the requirement of talented manpower especially in the emerging fields of Science and Technology (for example Nanotechnology, Stem Cell Research, Nuclear Energy Safety, Bio-energy etc.) for globally competitiveness. These schemes may include support to pioneer group meetings for new, emerging and promising concepts on which very few research groups in the world are actively working involving at least one Indian research group. Similarly science-interaction meeting to discuss directions of work and facilitate collaborations would be also organized in India. Unlike conferences, these interactive meetings will be small groups on a round table, meeting for a focused purpose. Such meetings would facilitate leadership by Indian researchers in emerging fields.

## **B** S&T Career Paths for Innovation and Support Services

- i. Recognising that technology and product development requires large number of skills along the value chain from discovery to markets, it is suggested to support graduate/post graduate diploma courses, short term ( 3-6 months) certificate programs for gainful employment of students willing to take up alternative career paths to classical R&D based opportunities. The list of topics that can be explored may be seen in the box.

### **Activities:**

- Advanced Courses: Biotechnology, Nanotechnology, Space Technology, Aerospace, Nuclear, Stem cells etc.
- Scientific Research: Basic, applied and high end research
- Vocational training courses
- Interdisciplinary courses
- Technical and industrial skill employment courses
- Supporting Business functions: marketing, managers, entrepreneurs

### **Support Services**

- Teaching
- IPR
- S&T services
- Consultancy
- Entrepreneurship
- Process Services
- Educational Services

### **Institutional infrastructure/mechanism:**

Finishing schools, Graduate schools, Self learning schools, Skill development schools



- ii. Advances of technology are profoundly dependant on sophisticated equipment and facilities both for R&D and manufacturing. There is an acute shortage of S&T-HR with skills ranging from handling equipment in fundamental sciences to engineering and design. It is proposed to set up at least one occupational/vocational/technician training Institute/college for each domain area of S&T as per needs during the 12<sup>th</sup> Plan in collaboration with equipment manufacturing and facility designing/construction companies. There could be apprenticeship program with industry for a period as an integral part of vocational certificate programs.
  
- iii. Setting up of **Finishing Schools** to make available readymade talent to various S&T based industries. These finishing schools could be S&T domain specific and could be established preferably through public private partnerships or consortium of industries with Government support or in partnerships with Industry associations (CII, FICCI).

### Career Paths

|                        |                         |                                 |
|------------------------|-------------------------|---------------------------------|
| Research Assistant     | Safety Specialists      | Editors for Scientific Journals |
| Research Associate     | Application Specialists | Bio suppliers                   |
| Junior Research Fellow | Marketing Managers      | Legal Attorneys                 |
| Senior Research Fellow | Business Analysts       | Patent Attorneys                |
| Scientist              | Biostatisticians        | Business Development Managers   |
| IP Attorneys           | Toxicologists           | Liasoning Officers              |
| Trainers               | Assistant Professor     | Technical Recruiters (HR)       |



|                                |                                      |                                                                |
|--------------------------------|--------------------------------------|----------------------------------------------------------------|
| Doctors                        | Associate Professor                  | Sales Representatives (Medical)                                |
| Clinical Technicians           | Professor                            | Six-Sigma Trainers                                             |
| Pharmacists                    | Vice Chancellor                      | Project Management Certification Trainers                      |
| Breeders                       | Registrar                            | Soft Skills Trainers                                           |
| Agronomists                    | Rectors                              | Lab Coordinators / Lab Technicians                             |
| Entomologists                  | Lab Managers                         | Safety Health and Environment Specialist                       |
| Horticulturists                | Disaster Managers                    | Utilities and Maintenance Managers                             |
| Clinical Data Managers         | Documentation Specialists            | Emergency Support Managers (Medical / Fire / Chemical Hazards) |
| Technical Writers              | Technical Writers                    | Validation Specialists / Instrumentation Engineers             |
| Grant Managers / Fund Managers | Project Managers / Project Engineers |                                                                |



## 7

### Diverse Fellowships And Career Development Awards For R&D, Innovation And Entrepreneurship

The Working Group took note of successful implementation of several fellowship and award schemes implemented during the earlier plans including the 11<sup>th</sup> plan by the S&T Departments. Some of these fellowships and awards recently instituted such as INSPIRE, Ramanujam Fellowship, KVPY of DST and CSIR Program on Youth for Leadership in Science (CPYLS), RAPID Grants to Young Scientists, Ramalingaswamy Fellowships, Tata Innovation Fellowships (TIF), Welcome Trust-DBT fellowships for Bio-Medical science, Various fellowships and studentship programs of Department of Atomic Energy and Department of Space (*Annexure 3.24*).

While analysing the range of on going fellowships and awards catering to various levels of stakeholders from students to retired scientists above, during the discussions of the Working Group the following observations were made.

- Ranges of professionals are required for validation, translational research, technology perfection and product development across various sectors of S&T. Most of the current fellowships and awards are addressing the needs of physical and life sciences requirements. As a result professionals such as those from engineering, medicine and others are constrained to engage themselves in S&T-R&D or pursuing Ph.D after post graduate studies due to asymmetry in the salary/fellowship requirements (related to non practice allowance, higher pay structure in Industry for professionals etc).
- The fellowships and awards are inadequate to encourage and recognize the contribution of specialists/experts engaged in various steps and activities of product development involving regulatory/intellectual property due diligence, technology packaging, innovation and design.





- The opportunities are limited to accelerate S&T innovation and setting up of startup companies by scientist entrepreneurs: post graduate/doctoral students, group of students in universities and colleges.

## Recommendations

- The existing pay packages/fellowships for professionals interested in pursuing Ph.D or R&D as a career (for example MD/Ph.D programs; MS/M.Tech (Engineering and Technology)/ Ph.D programs) need a review to harmonize the amounts and incentives with that of practicing a profession in an industry/PSU/manufacturing setup. This step would promote integration of professional inputs in research, augment appropriate technology development and provide multi-disciplinary perspective in various sector of S&T.
- Institute wide array of Career Development Awards with lucrative pay packages to working professionals / faculty to participate in innovation and technology development activities. (Some examples include DBT-Tata innovation fellowship given to R&D scientists). This would accelerate innovation and product development/design activities which quite often do not result into scientific publications (a measure of performance of science).
- Expand the scope of the current programs and (example TePP of DSIR) to include opportunities for S&T intensive colleges and institutions addressing collective efforts of graduate and post graduate students for providing innovation experience and experimentation. (for example, Nano Satellite Development Project of ISRO)

- Harmonise amounts & incentives
- Promote with lucrative pay packages to working professionals/faculty for participation in innovation, research and technology development (e.g. DBT Tata Innovation Fellowship)
- Expand scope of UG, PG students for innovation experience
- Encourage scientist/ entrepreneurship/ students for innovation and technology development by ignition grants

**Proposed Budget:** Rs. 500 Crores



- iv. Institute Ignition Grants (up to Rs. 50 Lakhs per project) for encouraging innovation and technology development by scientist, entrepreneurs, post graduate/doctoral students.

#### **Nano-Satellite by students**

This is a project with different kind of experience for students. Stud Sat, Student Satellite, is a student satellite program jointly developed by institutes in Bangalore and Hyderabad. It is the first Pico-satellite of India. Even, ISRO is yet to launch its first Pico-satellite. One of the major characteristics of any Pico-satellite is the weight which is usually less than 1 kg.

There are around 45 students presently working on the project. The project is initiated and managed completely by students. Also, the team won Hans Von Muldau Award for the best team project awarded by International Astronautical Federation

**Mission Objective were** - to give hands on experience on the design, fabrication and realization of a space mission at a minimum cost to students. And to perform the functions carried-out by any remote-sensing satellite.

The satellite is jointly developed by the following institutes,

- Nitte Meenakshi Institute of Technology, Bangalore.
- B M S Institute of Technology, Bangalore.
- Chaitanya Bharathi Institute of Technology, Hyderabad
- Institute of Aeronautical Engineering, Hyderabad.
- M S Ramaiah Institute of Technology, Bangalore.
- Rashtreeya Vidyalaya College of Engineering, Bangalore.
- Vignan Institute of Technology & Science, Hyderabad.

The project is continuously being guided by many ISRO scientists, including Prof. UR Rao, former chairman of ISRO.



## 8

### Employing New Tools and Technologies for Education Including S&T:

The issue of employing modern tools and technologies for education in general and for development of HRD have been addressed at school level through several forums / committees and focus groups. Some of the recommendations made for school level are also applicable to college and university settings. However, Working Group has identified three different levels where interventions through new tools and technologies are required such as: teaching methods, learning methods and knowledge landscape. These methods need a strong backup of various supporting activities like financial support, educational tools creation, tools adoption, tool literacy etc. Creation, distribution, utilization and tracking of tools and technologies in education is to be done. Similarly a strong backup of knowledge database is required and this includes knowledge collection, knowledge compilation etc. Knowledge creation needs a primary survey, knowledge customization according to users, knowledge customization should be aiming of more attractive, effective and interesting learning as well as teaching.

#### Recommendations

- i. The S&T Departments may jointly set up a “Think Tank” of experts, eminent teachers/faculty and industry representatives with expertise in education technology, senior representatives of S&T Departments, Department of Information Technology, Ministry of Communications and Information Technology, Ministry of HRD, for review and assessment of existing as well as emerging S&T (education) technologies, feasibility for developing or adapting new technologies, addressing the issues of content, designing innovative schemes, including servicing and up gradation requirements. Some opportunities and modalities are shown in the Box.
- ii. The available schemes of Centres of Excellence in S&T Departments may

#### **Rejuvenation areas:**

- Teaching methods – webinars, practical, labs
- Learning methods – e learning, self learning, user friendly methods
- Knowledge dissemination – specific knowledge creation, creation and compilation, customization

**Monitoring:** National Agency

**Mode:** PPP mode for tool creation, distribution, tool literacy, PPP mode for knowledge creation



be expanded to include setting up of up to 5 centres for S&T education content, technology and tool development with workshops. These centres could be integrated with the activities of IISERs, NISER, IITs, etc.



## 9

### Science Literacy

With ever increasing applications of technology, emerging areas of complex scientific discoveries, convergence of sciences and easy access to information through internet, television and radio with multiple channels, influential people and agencies owning the communication systems, the civil society is overloaded with information. This situation of current times has therefore makes it difficult for a citizen to take decisions on choice of food, medicine, energy, house hold and personal S&T based products. In the democratic set up, therefore the populace exercises both direct and indirect influence on the formulation of public policy related to S&T. Some examples of recent times in India include public reaction to Nuclear Energy Bill, reactive response of Fukushima Nuclear Disaster due to Tsunami on Indian Nuclear energy establishments leading to formulation of Nuclear Energy Safety Authority Bill, activism inciting moratorium by policy makers for commercialization of Genetically Engineered Brinjal (Bt Brinjal) even after thorough scientific safety assessment etc.

The pioneering efforts of establishing Vigyan Prasar (VP) as early as 1989 under the DST to take on large scale science and technology popularization task is a recognition of the fact that the S&T policy makers considered public perception and understanding of science is important. Vigyan Prasar to a degree and scale with limited budget engaged itself in promoting and propagating a scientific and rationale outlook in the society. However contemporary challenges in terms of complexity of technologies, safety standards and regulations, international agreements and conventions on environment, biodefense agents, dual use technologies and related issues require a fresh outlook in our strategy of S&T communication, scale of operation, deployment of technology and tools, involvement of State Governments including its Universities / Institutions / Colleges / Schools.

#### Recommendations



The S&T departments and their research institutions should putting place appropriate mechanism for communication of scientific achievements, replying to public concerns in subject specific areas and canvassing the opportunities in S&T education and training. Some mechanisms suggested include:

- i. Designating an officer-in-charge public relations and S&T communication in each department/institution with good communication abilities and domain knowledge. The name and full address with email and telephone numbers should be made available on respective websites similar to current practices of RTI information system.
- ii. Each department and institute may consider including a 'Media Box Corner' in the respective home page of website for regular deposit of newsworthy and authenticated, achievements, information for carry access to journalists a media personal.
- iii. Each department and institute depending on the requirements and emergencies may constitute an ad-hoc group of experts and policy makers for prompt communication and clarification of misconceptions etc in case of emergencies.

- Designate in charge in each S&T related ministry/department for effective Science Communication
- Start media box corner in ministry/department for authenticated information
- Formulate ministerial /departmental expert group for prompt communication and clarification
- Schemes for new science journalism programs
- Promote university/institute for collaborative scientific journalism courses with media schools
- Encourage research institution for outreach activities through special schemes

**Proposed Budget:** 200Crores



Schemes may be launched for training to produce new generation of S&T journalists for audio-visual, electronic and print media for mass communication and also provide new career opportunities to science graduates to address the emerging complexity of technologies, scientific controversies and wrong perceptions. Although such initiatives have been taken up to a degree by Vigyan Prasar in collaboration with Indian Science Communication Society, a non-profit organization in Lucknow, it is suggested to expand these opportunities addressing domain specific needs in collaboration with well established media schools and foundations such as Times Media Foundation, Hindu Media Foundation and other such institutions of regional importance.

The research institutions currently popularize scientific achievements on annual basis usually through celebration of National Science Day. Each S&T department may expand this programme through a special scheme to include universities and colleges.



The Working Group made following recommendation for implementation in short term

| Sl. No. | Recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                 | Agency                                                                                                                            |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1.      | Set up Science centres in every district to complement school and college education in Science. Each centre will have hands-on activities/workshops for teachers and students and organize stimulating talks by experts from academia and industry. These centres may also be used for organizing INSPIRE science camps, science exhibitions etc.                                                                                              | <ul style="list-style-type: none"> <li>▪ Department of Science and Technology</li> </ul>                                          |
| 2.      | Institute doctoral and post-doctoral fellowships for Indian students to get trained in abroad in topics (such as earth science, climate prediction, oceanography, theoretical computer science etc) that are not well represented in India, but most important in the current era. With fellowships on hands, our students could approach best Universities in the world for a position.                                                       | <ul style="list-style-type: none"> <li>▪ Department of Science and Technology</li> </ul>                                          |
| 3.      | Expand the star college scheme of DBT to a full-fledged scheme for the entire country for all science subjects. At least one college is identified per district for converting it into a centre of excellence in post-school education in science. Provide, funding for hiring good teachers, set up good laboratories, invite reputed scientists, special training opportunities for teachers in Universities and national laboratories etc.- | <ul style="list-style-type: none"> <li>▪ Department of Science &amp; Technology</li> <li>▪ Department of Biotechnology</li> </ul> |





| Sl. No. | Recommendation                                                                                                                                                                                                                                                                                                                                | Agency                                                                                                                                                                                     |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.      | Enhance post-doctoral fellowship to establish a vibrant post-doctoral culture in the country, which is almost non-existent now.                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>▪ Department of Science and Technology</li> <li>▪ Department of Biotechnology</li> <li>▪ Council of Scientific &amp; Industrial Research</li> </ul> |
| 5.      | Mobile Labs or Lab on Wheels (on PPP model) to introduce rural and under-privileged children to the excitement of science.                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>▪ Ministry of Human Resource Development</li> </ul>                                                                                                 |
| 6.      | Open at least 5 more HBCSE-type centres in different parts of the country to help develop better curriculum for school and post-school education in science and for training teachers in pedagogy. These centres should be set up as autonomous institutes with provision to introduce certificate courses on science education for teachers. | <ul style="list-style-type: none"> <li>▪ Ministry of Human Resource Development</li> </ul>                                                                                                 |
| 7.      | Provide special funding to Universities and national institutes to jointly start graduate schools in interdisciplinary topics such as neuroscience, Nano-science, translational health science, etc. Make provisions for international collaborations for both teaching and research in graduate schools.                                     | <ul style="list-style-type: none"> <li>▪ Ministry of Human Resource Development</li> <li>▪ Department of Science &amp; Technology</li> </ul>                                               |
| 8.      | Special funding scheme for research projects submitted by college teachers. More liberal small grants to encourage them to start research and larger grants with better peer-review system.                                                                                                                                                   | <ul style="list-style-type: none"> <li>▪ Department of Science &amp; Technology</li> <li>▪ Department of Biotechnology</li> </ul>                                                          |
| 9.      | Current level of funding for chemicals and reagents is far too less for Indian labs to carry out cutting-                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>▪ Department of Science and Technology</li> </ul>                                                                                                   |



| Sl. No. | Recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Agency                                                                                                                                     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|         | edge research in frontier areas of biology, chemistry, nanotechnology etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>▪ Department of Biotechnology</li> <li>▪ Council of Scientific &amp; Industrial Research</li> </ul> |
| 10.     | <p>Set up 5-6 fully-equipped state-of-the-art convention centres to exclusively to organize conferences/symposia/seminars/workshops and mentorship programs in all areas of science and technology. Any scientist or academician wanting to organize a conference/workshop should send the proposal to one of these centres, which would be subjected to a peer-review for selection. The centre will take care of funding and all logistics to execute proposals. In the current method of scientists/academicians having to run around for everything from funding to hotel bookings to transport arrangement is only a deterrent to organize quality meetings. People appointed to run proposed convention centres will be assessed based on the number and quality of the meetings organized in a financial year.</p> | <ul style="list-style-type: none"> <li>▪ Department of Science &amp; Technology</li> <li>▪ Department of Biotechnology</li> </ul>          |

### Financial Projections



It has been observed all the S&T Departments have separate schemes and programs addressing Human Resource Development. In general the Working Group recommended that at least 20% of the annual GBS may be earmarked for S&T-HRD. The recommendations contained in this report may be suitably integrated either as new initiatives within the existing schemes or implemented as new schemes. The budget estimated for various recommendations are as follows:

| S. No. | Recommendation                                                                                                      | Rs. in crores<br>2012-17 |
|--------|---------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1      | Appropriate Institutional Mechanism to Promote S&T-HRD Activities                                                   | 400.00                   |
| 2      | Adaption of Existing Public Private R&D Partnership Models and Development of New PPP Models for S&T HRD Activities | 500.00                   |
| 3      | Reforms, Redesign and Strengthening S&T Education & Training                                                        | 2000.00                  |
| 4      | Expanding Current Global Partnerships in S&T to Augment Human Resource Development                                  | 200.00                   |
| 5      | Expanding scope for careers in S&T, research, innovation and support services                                       | 300.00                   |
| 6      | Diverse Fellowships And Career Development Awards For R&D, Innovation And Entrepreneurship                          | 500.00                   |
| 7      | Employing New Tools and Technologies for Education Including S&T                                                    | 300.00                   |
| 8      | Science Literacy                                                                                                    | 200.00                   |
|        | <b>Total Budget</b>                                                                                                 | <b>4400.00</b>           |



## *Chapter IV*

# *S&T HRD Stakeholders Issues & Suggestions*



Realizing the importance of complex and cross-sectoral issues in S&T, the Planning Commission has constituted a Working Group with experts from various domains and fields, to understand the complexity associated with every branch of S&T. It is an important aspect that all the essential S&T communities, including all those favouring the expansion and growth of S&T capacity building, engage the relevant stakeholders, recognize the issues and concerns appropriate and justified along with strategic solutions for those issues.

There were several suggestions from the members of Working Group. Suggestions and inputs were sought from various other stakeholders also through emails and written articles which were eventually circulated among the Working Group members to establish synergies with the issues raised by the Working Group and other stakeholders. For ease of understanding the issues & suggestions were categorized, articulated in a format and compiled of by the Working Group secretariat.

Most of these issues and suggestions have a long term impact and to harness the benefits of for improvement of S&T-HRD situation S&T in a quicker time majority of these recommendations can be implemented in 12<sup>th</sup> Five Year Plan and other recommendations could have a broad implication in Vision 2025. The following chapter highlights the key issues associated with respect to categorised area and also provides/suggestions and a 'Wish List' of the key action points captured from all stakeholders.



## Educational Contents

### Issues

Traditional syllabus

Lack of interdisciplinary subjects

Lack of effective S&T integration in school level education

Lack of updates in S&T

Lack of practical skills

Lack of industry orientated syllabus content

Lack of S&T industry involvement in syllabus formation

Lack of output driven inputs of syllabus

### Suggestions

Change in S&T syllabus content at all levels of education

PPP mode of collaboration between Govt. and IT industry should be done to convert syllabus into audio visual

Interdisciplinary syllabus should be introduced at all levels of education

Involve S&T industry experts in framing the syllabus

Syllabus pattern should be in global context

A continuous research system/unit needed to study syllabus, its impact and updates required

Research orientation required in education contents and experience in place of education



## Educational Tools

### Issues

|                                                                                |
|--------------------------------------------------------------------------------|
| Lack of S&T educational tools including ICT                                    |
| No Accessibility to students                                                   |
| High cost of educational tools                                                 |
| Lack of S&T advanced tools and its exposure                                    |
| Hurdle in teaching without educational tools                                   |
| Unclear science concepts for students                                          |
| Loss of Science learning enthusiasm due to lack of S&T educational tools       |
| Lack of PPP models for creating, distributing, utilizing S&T educational tools |

### Suggestions

|                                                                                                       |
|-------------------------------------------------------------------------------------------------------|
| PPP model need to produce safer, cheaper S&T educational tools and distribution in schools, colleges  |
| Promote S&T educational tools at all levels of education                                              |
| Teachers and students need to be promoted to development of innovative educational tools              |
| Mobile Labs or Lab on Wheels to be introduced to provide practical training                           |
| Syllabus should be converted into animations and audio visuals through ICT at all levels of education |
| Various science modules need to be developed of all the subjects of all different levels of education |
| Schemes to be introduced for encouraging open innovation by students and teachers                     |
| Exploratory science centres for undertaking research activities should be done                        |
| Awareness programs to be launched to encourage science education                                      |
| Teachers to be equipped with S&T educational tools                                                    |
| Practical training to be provided to teachers for effective use of tools                              |



## Teaching Methods

### Issues

Traditional teaching methods

Lack of adoption of e- teaching/e-learning

Lack of advance teaching tools (ICT)

Lack of required S&T teaching set of skill with teachers

### Suggestions

Novel teaching methods to be introduced

PPP mode of partnership with industries to be encouraged for adopting new teaching methods

Regular & updated training to be provided for teachers

Look into global teaching methods and customise it into Indian context

E-learning should be promoted

Training need to be provided for all teachers for sound and effective use of ICT tools for teaching

A continuous research is required to study and analyse teaching method, global context, customization & updating of training modules from time to time.





## Examination Pattern & System

### Issues

|                                                                                               |
|-----------------------------------------------------------------------------------------------|
| Rigid exam pattern & system                                                                   |
| Rigid performance evaluation system                                                           |
| Textbook based exams                                                                          |
| Lack of assessment of S&T skills in exams                                                     |
| Lack of testing applied knowledge in exams                                                    |
| Exam oriented studies only                                                                    |
| Differences between exam system/contents and skills required by industry                      |
| Same exam for students going for basic science (research) and applied science (post R&D jobs) |
| Different exams for different states that leads to regional disparities                       |

### Suggestions

|                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reforms are required in exam pattern and exam system                                                                                                                |
| Uniformity in exam pattern and method is needed all over the country to avoid skill assessment disparity                                                            |
| More weightage to be given for practical, field work in exams                                                                                                       |
| Simplified and year long evaluation systems to be introduced rather than only exams                                                                                 |
| Inputs to be sought from industries for skill requirements and skill development                                                                                    |
| Examination pattern to be revised on a regular basis as per S&T industry requirement                                                                                |
| Open book system need to be implemented                                                                                                                             |
| Involvement of S&T experts on framing exam system to assess required S&T skills from students                                                                       |
| A S&T based exam need to be conducted by a central body irrespective of educational levels & academic syllabus to encourage bright students (like science Olympiad) |



## S&T Infrastructure

### **Issues**

Lack of laboratories

Poor laboratories infrastructure/equipment

Less time for practical/laboratory learning for students

Restrictions to access of laboratories

Hurdle in teaching due to lack of infrastructure

Loss of Science learning enthusiasm due to lack of infrastructure

### **Suggestions**

Cost sharing model of lab infrastructure required for inter-college, inter-university level

Cost sharing model to be follow at district places in PPP mode

More mobile labs should be established for rural/remote areas

Training to be provided for teachers for better utilization of infrastructure

A science park with excellent infrastructure can be established at district places

One time liberal support should be given for S&T lab infrastructure improvement to S&T academic institutions

Huge ICT based S&T infrastructure could be synergised with National Knowledge Commission

Educational institutes need to promote students to access laboratory facilities



## S&T Knowledge

### Issues

|                                                                                               |
|-----------------------------------------------------------------------------------------------|
| Lack of unavailability of customised science modules                                          |
| Lack of knowledge access tools - ICT/Internet                                                 |
| High cost of ICT tools                                                                        |
| Lack of S&T (audio-video) education material for all level of students & all subjects         |
| Lack of self-learning modules of various S&T sectors                                          |
| Lack of S&T data collection, compilation, customisation for various sectors                   |
| Lack of national database for S&T                                                             |
| Lack of access to various national & international databases in institutes, colleges, schools |
| Lack of S&T knowledge generation efforts                                                      |

### Suggestions

|                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------|
| PPP mode of participation to be sought for development of audio visuals in S&T education                                     |
| Rapid adoption of ICT tools and their continuous updation contracts/systems                                                  |
| Portal to be established with information on all schemes, institutions etc. related to S&T                                   |
| e-learning tools to be introduced                                                                                            |
| National and International databases as well as e-library journal consortium could be maintained by a separate department    |
| A national S&T database need to be created and open to all                                                                   |
| A large scale project of national S&T data collection, compilation, customization and archival should be started immediately |



## S&T Awareness

### Issues

Lack of science careers awareness

Lack of specialised studies/efforts to bring science career information in one platform

Lack of career guidance studies & efforts

Lack of organised efforts for S&T career awareness

Lack of S&T interaction platform

### Suggestions

Common portal or website by Govt should be launched with all relevant information of S&T and HRD

Mentorship programs to be launched for students in schools and colleges

Awareness programs like Inspire, space / maths/ science Olympiads to be launched

Web based platform need to be create for career awareness

S&T career helpline (voice based/web based) need to be created

## S&T Education System



## Issues

Predefine streamlined/rigid education system at 11<sup>th</sup> PCB/PCM for engineering & biological sciences

Admission barriers - availability of science seats (11<sup>th</sup> standard) due to lack of eligibility flexibility

Lack of availability of S&T Flexible/distance/e-learning

Non availability of seats in specific science stream to meet demand

Inaccessibility for multiple degrees/education simultaneously

Lack of promising professions/jobs for basic science students

High cost of professional S&T courses (Engg, Medical, Pharma)

Less number of seats (S&T professional courses) in government colleges

No special incentives on innovation in UG

Demand supply gap in S&T-HR available and jobs available

No specialised courses available (science)

Variety of entrance exams for S&T courses admission

College/universities having different policies-admission, eligibility, fees, seats allotment

## Suggestions

Major reforms in S&T education

New schemes to be launched to encourage science based research

An autonomous agency with integration of all S&T ministries for promotion of S&T education to be launched

Studies to be undertaken to assess demand supply gap in each S&T sector

Professional courses and colleges to be encouraged widely

Multiple degree education not only allowed but also encouraged

Special incentives and schemes to be launched to encourage science research

Research in education sector to be encouraged

Professional courses could be subsidised for talented students



Increase number of seats in government colleges

Special innovation scheme at UG level could be introduced at colleges/universities

A deep study with international agencies (UNESCO/world bank/OECD) can be done on continuous basis for S&T-HRD

More interdisciplinary with support of specialised courses of various science branches to be created

Industry involvement required for output oriented inputs in S&T HRD

A common exam to be conducted all over country for same course (JRF, SRF)

Harmonised policy to be established in college/universities for admissions, seat allotment & fees to mobilise quality HR

## Financial Aids

Issues



|                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inaccessibility and unawareness of educational scholarships/ loans                                                                                         |
| Different policies of college fees                                                                                                                         |
| Unawareness of national and international scholarships                                                                                                     |
| Lack of number of scholarships - huge gap in demand and supply                                                                                             |
| Lack of single platform of information & selection for higher study scholarships - national and international                                              |
| Lack of organised information/guidance for higher studies abroad                                                                                           |
| Lack of scholarships/fellowships/pay offers to attract foreign students                                                                                    |
| Rigidity in eligibility criteria for scholarships/funds/incentives                                                                                         |
| High interest rates for educational loans (Industrial loans are available ranging from 1% to 5% by various S&T departments (educational loan minimum 10%)) |

### **Suggestions**

|                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------|
| Single window clearance for students to get education loan                                                       |
| Education loans strictly to be provided without mortgage or security                                             |
| Educational loans from banks and other departments should be on a nominal interest basis                         |
| Common department or portal or website with all S&T and HRD relevant financial aid information to be established |
| Single window/platform for S&T financial aid application, evaluation and approval                                |
| Awareness campaign for scholarships at single platform                                                           |
| Provide attractive scholarships for foreign students to come India for study & research in S&T                   |

## **Internships and Industrial Trainings**

### **Issues**

|                                                                                  |
|----------------------------------------------------------------------------------|
| Lack of single window platform for selection & hiring for internships/industrial |
|----------------------------------------------------------------------------------|



|                                                                      |
|----------------------------------------------------------------------|
| trainings                                                            |
| Lack of availability of internships/industrial trainings             |
| Lack of organised efforts in summer internships/industrial trainings |
| Lack of incentives for industry to hire interns/trainees             |
| Lack of vocational trainings                                         |
| Lack of Finishing schools                                            |
| Lack of S&T skill acquisition specialised schools                    |
| Lack of entrepreneurial development provisions in education          |

### **Suggestions**

|                                                                                          |
|------------------------------------------------------------------------------------------|
| Summer projects and training programs for school students to be launched                 |
| Finishing schools to be expanded & strengthened                                          |
| Entrepreneurship development programs and schemes to be introduced                       |
| More idea incubators could be developed at university level                              |
| A single window platform need to be created for S&T internships and industrial trainings |
| Incentivise industry for offering internships/industrial training                        |
| Create vocational training schools, finishing schools & skill acquisition schools        |

## **International Alliances**

### **Issues**





Lack of strategic relations with foreign universities for education

Lack of international collaboration initiative by universities/colleges

Lack of synergy collaborations with national & international institutes

Cumbersome clearance mechanisms to forge international collaborations

### **Suggestions**

More synergic international collaborations are required in S&T education along with R&D

International collaborations to be established with Indian universities/colleges

Single window clearance and facilitation for foreign universities to enter/collaborate in India

More alliances with foreign countries/universities need to be developed to facilitate Indian students to educate abroad

More scholarships are required for students willing to study abroad

Single window for all scholarships to all students

More collaborations of universities are required for student exchange programmes

Encourage & facilitate universities to initiate collaborations with foreign universities



## Teachers/Faculties

### Issues

|                                                                                        |
|----------------------------------------------------------------------------------------|
| Unavailability of teachers                                                             |
| Lack of expert teachers                                                                |
| Lack of teacher training                                                               |
| Lack of communication of appropriate teaching opportunities                            |
| Lack of uniform teachers performance evaluation system                                 |
| Lack of communication with science educational institutes & industry                   |
| Lack of a platform for teacher & scientist interaction                                 |
| Lack of incentives to attract talented HR in teaching                                  |
| Lack of industry experienced teachers                                                  |
| Lack of industry exposure to teachers                                                  |
| Unawareness of industry skills requirement                                             |
| Lack of support to teachers from host institution management                           |
| Low salaries (disparities)                                                             |
| Limited salary and service permanency based motivation                                 |
| Lack of special incentives for teachers for extracurricular activities/research in S&T |

### Suggestions

|                                                                                                             |
|-------------------------------------------------------------------------------------------------------------|
| Recruit the required teachers immediately                                                                   |
| Laboratory training to be provided to school teachers                                                       |
| A uniform system to be developed for teachers performance evaluation                                        |
| A uniform teacher eligibility criteria to be adopted                                                        |
| A national level platform required to communicate various teaching opportunities.                           |
| Increase pay scale of contract basis teachers, attract S&T students to serve in S&T education               |
| PPP mode of partnership should be sought from Industries for teacher training                               |
| New schemes for providing financial support for teachers for undertaking research activities to be launched |



Incentives to be provided for efficient teachers

A platform is required for providing interaction between teachers and scientists

Ignition or Glue grant scheme for teachers to be launched

Teachers to be encouraged to undertake innovative research in various institutions

A network of teachers training centres linked to industry, institutions or not for profit organizations

Promote industry people to join academics on high incentives

Incentivise professionals to involve in S&T interdisciplinary subjects (tax incentives for contributing time, expertise in academic education)

Teachers training modules should rapidly convey through ICT/webinars

A continuous research system is required to study specific needs of teacher training, its impact etc.

## Educational Institutes

### Issues

Lack of SOP's for autonomous bodies/colleges/universities for S&T



|                                                                                                      |
|------------------------------------------------------------------------------------------------------|
| Lack of efficient utilization of available resources                                                 |
| Lack of well-developed performance evaluation indicators criteria of educational institutes          |
| Lack of strong monitoring and performance evaluation system                                          |
| Lack of uniformity of performance assessment criteria of institutions (various state Govt. policies) |
| Lack of clarity on mandates/roles of university, research institution, colleges                      |
| Lack of inter-institutional communication for S&T knowledge sharing activities                       |
| Lack of platform for inter-university, inter-institutional synergy communication                     |
| Lack of inter-institutional cost sharing models for S&T projects                                     |
| Lack of inter-institutional synergising efforts on S&T                                               |
| Lack of a national databases of students, faculties, projects & other potentials of institute        |

### Suggestions

|                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Develop SOPs with strong research study on global SOPs for S&T                                                                                                                                              |
| Make uniform SOPs acceptable to all educational institutes                                                                                                                                                  |
| A performance evaluation criteria need to be more transparent & clear                                                                                                                                       |
| Develop new customised performance evaluation criteria other than traditional (indicators) method from school to college (e.g. number of students getting placements rather than number of students passed) |
| Accept performance evaluation criteria uniformly in country for S&T educational institutes                                                                                                                  |
| Separate the mandate of university from colleges and focus on specific role of institutions                                                                                                                 |
| More communication platforms are required in S&T                                                                                                                                                            |
| Inter-institutional (infrastructure) cost sharing model could be adopted                                                                                                                                    |
| A web based strong database of schools, colleges, students and their present job status need to be generated this is needed to map the real S&T human resources                                             |



(concept model of LinkedIn, orkut could be followed)

Promote, encourage & fund educational institutes for knowledge synergising activities like S&T exhibitions, competitions

## Governance Agencies

### Issues

Lack of effective coordination between Central Govt. & State Govt.



Different policies of different ministries - scholarships/education funding/ research funding

Different funding policies, eligibility, selection, performance by different ministries/departments

Short term support-project based recruitment of S&T HRD

Lack of communication between funding agencies & educational institutes

### **Suggestions**

Policy resolutions to be brought for integration of S&T with HRD and education policy

More evolved system and policy is to be created for coordination

Coordination to be established with State and Central Governments in terms of schemes and funding for S&T

Harmonisation to be created in funding policies, eligibility and performance selection criteria in all departments of S&T and HRD

Considerable investment increase is required for the S&T HRD sector by all departments

Provisions to be made for long term support to project based personnel to attract & retain quality HR in S&T

A transparent, well-coordinated mechanism could be evolved for efficient communication between various institutional stakeholders, monitoring agencies and funding agencies

## **Public Research Institutes**

### **Issues**



|                                                                                            |
|--------------------------------------------------------------------------------------------|
| Ambiguity in pay scale of research personnel (JRFs, SRFs & project staff)                  |
| Lack of long term promising career opportunity for S&T personnel                           |
| Lack of funding from funding bodies                                                        |
| Lack of quality human resources                                                            |
| Lack of funding for infrastructure                                                         |
| Lack of long term support for research                                                     |
| Lack of interdisciplinary knowledge                                                        |
| Lack of IPR, tech transfer knowledge and other supporting chains                           |
| Lack of market feasibility, global market guidance for research and technologies developed |

**Suggestions**

|                                                                                                               |
|---------------------------------------------------------------------------------------------------------------|
| Uniform pay scales and service conditions should be adopted for all S&T ministries                            |
| Long term support to project based personnel should be provided                                               |
| Funding to personnel pay scale need to be increased considerably (JRF, SRF)                                   |
| Attract quality HR to public institute research                                                               |
| Provide long term support to research projects                                                                |
| Interdisciplinary subjects, practical skills to be provided in public research institute                      |
| Technology transfer offices need to be promoted in universities and institutes                                |
| Linkages with industry need to be established                                                                 |
| Single window for personnel recruitment in public research institutes                                         |
| Single window for submission & approval of R&D projects for getting funds by different ministries/departments |

**S&T Industry**

**Issues**

|                                                                |
|----------------------------------------------------------------|
| Lack of industry-ready talented/quality S&T HR                 |
| Lack of database/information on S&T human resources in country |



Lack of single window for recruitment of S&T HR

Lack of link between college, faculty, students database on a single platform

Differences in exam system - unable to judge talent

Lack of inclusion of required skills in education system

Lack of clarity on basic science/basic concepts in candidates

Lack of interdisciplinary knowledge of subjects

Lack of innovativeness in candidates

Lack of interaction with academics

Lack of technical/practical skills

Lack of soft skills & analytical skills

### **Suggestions**

National S&T HR database need to be created

A single window for S&T employment in country could be created

Platform is required for database of colleges, faculties, students

The exam/evaluation system need to be uniform to avoid diversity/disparity

Industry need to be involved and consulted to education bodies on regular basis for required skills

Corporates should teach/ train/ provide mentorship to students at graduate and PG level as a corporate social responsibility

Should have tie ups and linkages with universities and Institutions for undertaking effective research

PPP models are incentivised for R&D

Incentivise industry for skills development programs for S&T HRD

Finishing schools for industry-ready students

## **Public Sector Scientists**

### **Issues**

University professors/scientists have to do other work apart from research





(administration work load apart from research)

Long & time consuming procedures in approvals from university/college administration/management

Lack of funding support

Different funding schemes, eligibility and other criteria of various funding bodies

Lack of access to paid S&T databases

### **Suggestions**

Separate the administrative work from scientists and let them concentrate on research

A mechanism need to be adopted by all research institutes to facilitate researcher at every level

Increase funding for public research institutes

Single window submission and evaluation can be made to increase the possibilities of funding from different bodies

To provide access to databases

## **Private Sector Scientists**

### **Issues**

IP ownership restrictions



Research publication restrictions

Lack of interdisciplinary training

Restriction to further education & PhD

Lack of investments in capacity building

### **Suggestions**

A binding to company to retain share of inventor

Introduce interdisciplinary training from school level to college level

Promote and incentivise industry to educate its personnel (company rating and tax rebates)

Incentivise industry in capacity building of their personnel

Higher education and PhD to be allowed

## **Professionals**

**Issues**



Less salary in research

Less job availability in basic research

Poor infrastructure in research in public institutes

More job opportunities in KPO/BPO rather than S&T jobs

Huge gap in skills required by industry and academic education

### **Suggestions**

Attractive package need to offer to attract talented & quality HR

More jobs need to be created in basic research

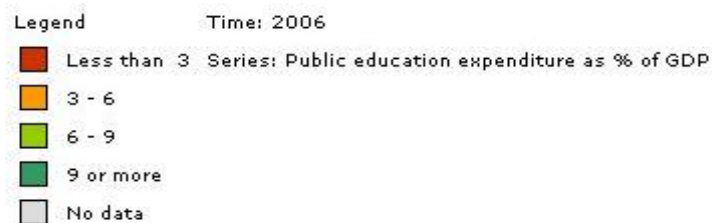
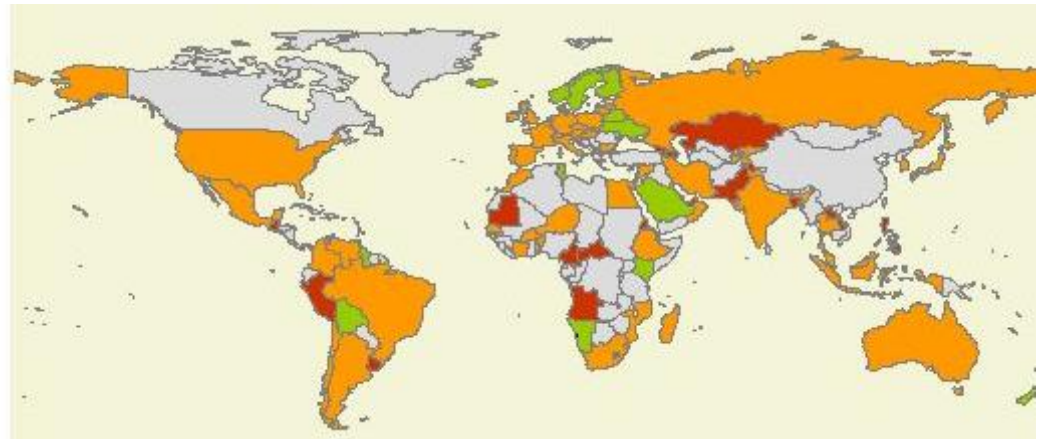
Create world class infrastructure in some universities and colleges

Demand based skills should be included as a part of academics

**List of Working Group Members**

1. Dr.M.K.Bhan, Secretary, DBT (Chairman)
2. Dr.VedPrakash, Chairman, UGC
3. Prof. L.S.Shashidhara, IISER, Pune
4. Dr.N.Mukunda, IISc, Bangalore
5. Dr.GauthamBiswas, CMERI, Durgapur
6. Dr.T.K.Chandrasekhar, NISER, Bhubaneshwar
7. Dr. K.S. Das Gupta, IIST, Tiruvananthapuram
8. ShriPawanAggarwal, Adviser (Education), Planning Commission
9. Dr. Arup Kumar Raychaudhuri, SN Bose Institute, Kolkata
10. Dr.HemachandraPradhan, BARC, Mumbai
11. Dr.HariGopal, Adviser, DST
12. Dr. Rajesh Luthra, Head, HRDG, CSIR
13. Shri. A.K.Verma, Adviser (S&T), Planning Commission
14. Representative of DG, CII
15. Dr.S.R.rao, Adviser, DBT (Convener)

### Public Education Expenditure as % of GDP



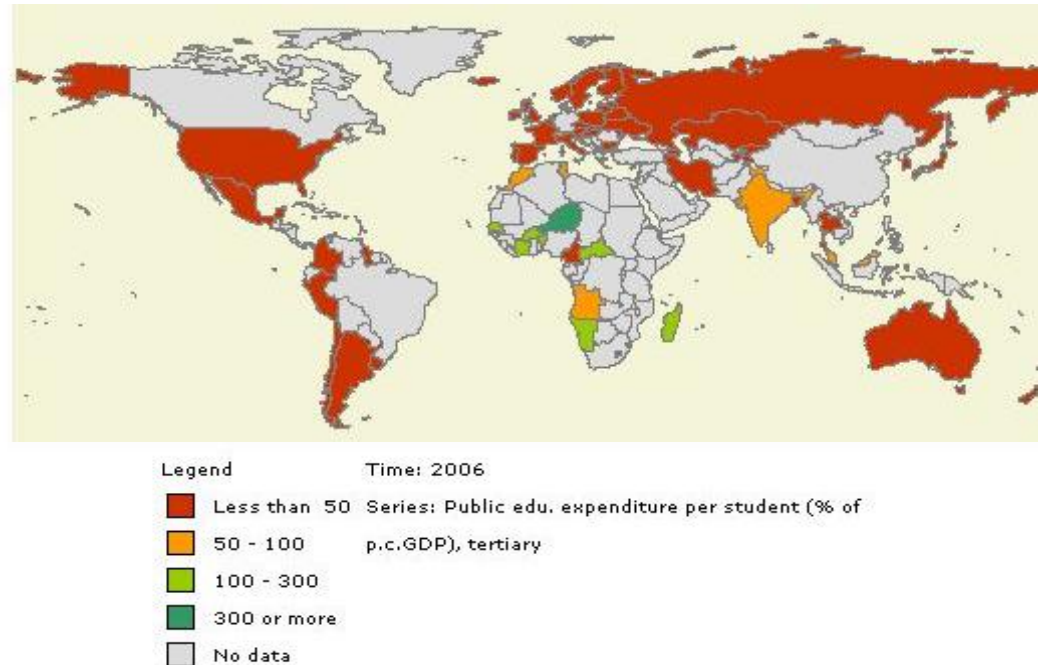
Source : [www.worldbank.com](http://www.worldbank.com)

The graph represents the expenditure incurred by various nations as percentage of their gross domestic product (GDP) spent on public education.

The expenditure spent on education is less than 3 percent of their GDP in certain regions of Middle East, few African countries and a couple of South American countries.

It is clearly evident from the graph that European countries and few countries in Middle East are spending 6 to 9 percent of their GDP in education in comparison to few countries and regions like India, Australia, North America, South America, Russia and most of the Asian countries.

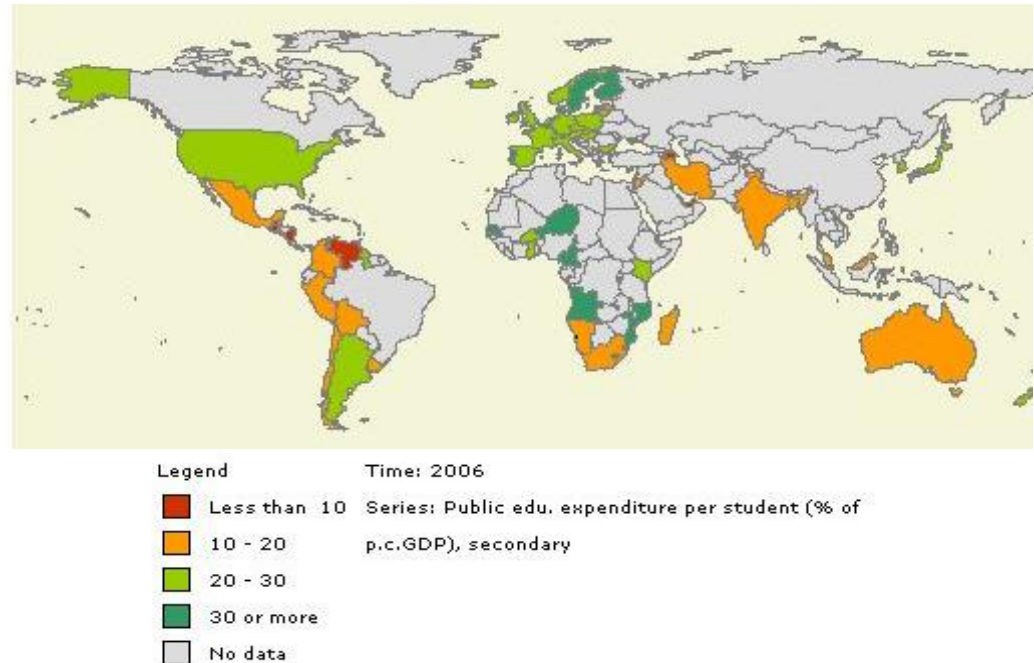
### Public Education Expenditure per Student (% of GDP) Tertiary Education



Source : [www.worldbank.com](http://www.worldbank.com)

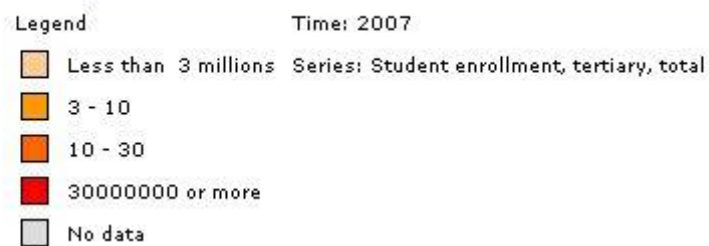
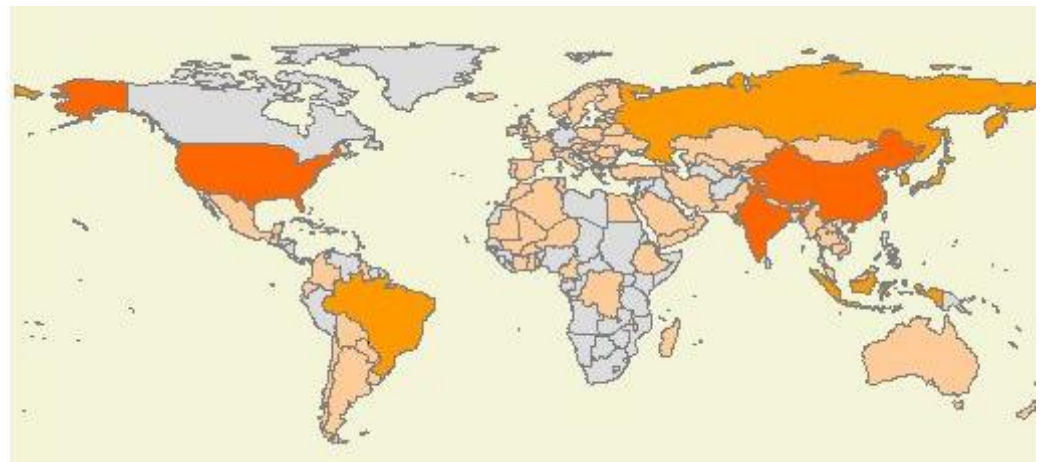
The graph represents the expenditure incurred by various nations as percentage of their gross domestic product (GDP) spent on public education expenditure per student. It is evident from the above graph that in comparison to India which is incurring 50 to 100 percent of p.c. GDP most of the other continents and regions like Australia, Europe, Russia, North America and few South American countries are spending less than 50 percent of p.c. GDP on public education expenditure per student on tertiary education.

### Public Education Expenditure per Student (% of GDP), Secondary Education



Source : [www.worldbank.com](http://www.worldbank.com)

The graph represents the expenditure incurred by various nations as percentage of their gross domestic product (GDP) spent on public education expenditure per student for secondary education. It is evident from the above graph that regions like India, Australia, S. American countries and a few countries in Middle East are incurring around 10 to 20 percent of their GDP for strengthening secondary education in comparison to European Countries, USA and a few South American nations which are spending more than 20 to 30 percent of their p.c. GDP. Some of the European and African countries are spending more than 30 percent of their p.c. GDP.

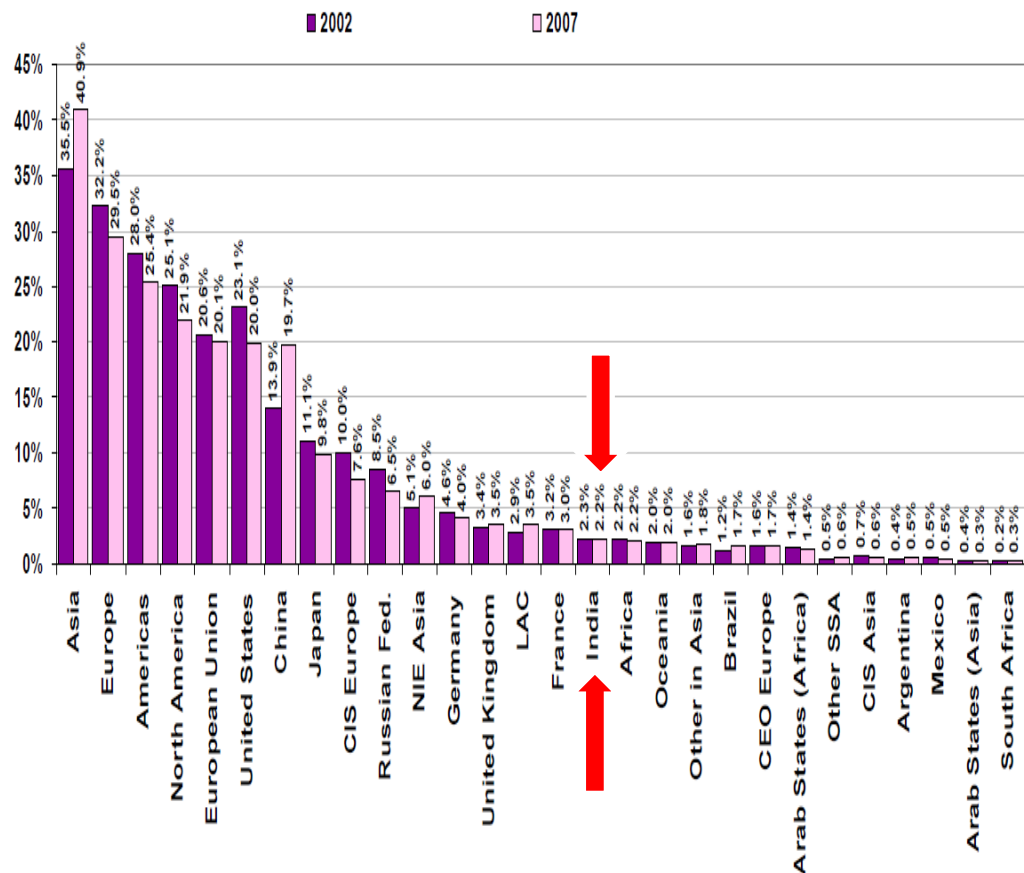
**Student Enrolment Ratio at Tertiary Education (Total)**

Source : [www.worldbank.com](http://www.worldbank.com)

The graph represents tertiary student enrolment in a global perspective. It is clearly evident from the above graph that the tertiary student enrolment is quite high in regions like India, China, North America this phenomenon could be primarily due to the high population density in these regions.



## Regional Density of Researchers

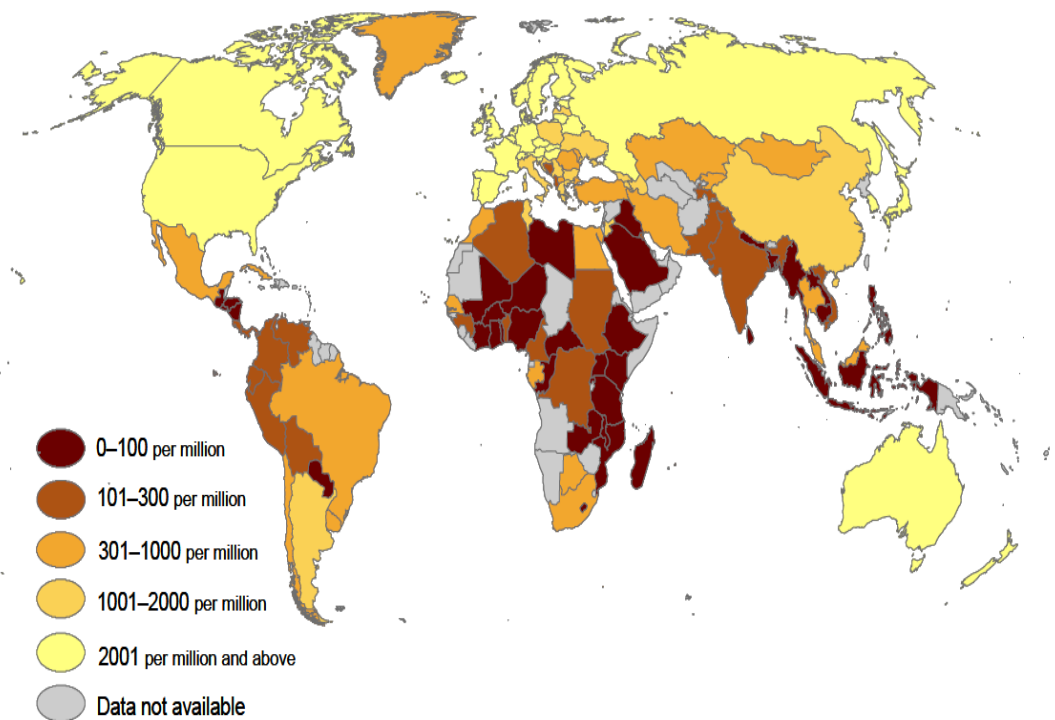


Source: UNESCO Institute for Statistics estimates, August 2010

Note : Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, as well as in the management of the projects concerned (Frascati Manual, 2002).

The graph provides a global overview of countries with the highest concentration of researchers as well as a breakdown by region. It is the responsibility of the policy makers to ensure that their countries have adequate number of researchers to foster the innovation ecosystem. It is the responsibility of the policy makers to ensure that their countries have adequate number of researchers to foster the innovation ecosystem. In the graph it is visible that the density of researchers in India is very low 2.2% whereas in developing countries the density is quite high up to 20%. Initiatives need to be taken by various nations to encourage the researcher by devising new innovative schemes etc. In the drive to strengthen knowledge-based societies, policymakers are looking to ensure that their countries have an adequate supply of researchers.

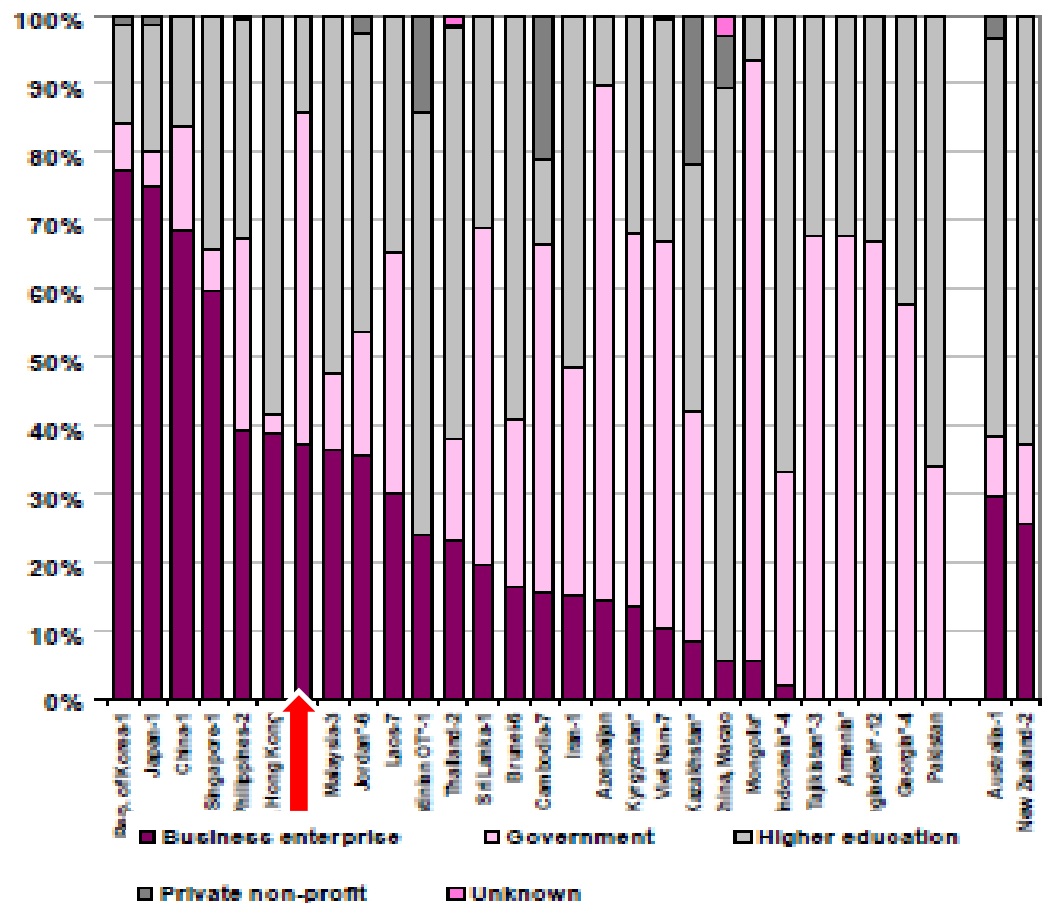
### Distribution of Researchers per Million - Regional Wise



*Source: UNESCO Institute for Statistics, July 2011.*

The graph illustrates the distribution of researchers per 1 million inhabitants. The data are expressed in full-time equivalents (FTE), which is a measure of the actual volume of human resources devoted to research and development (R&D). It is important to note when interpreting the data that headcounts (HC) were used for countries where FTE figures were not available. The above graph clearly depicts that the number of researchers per million in India are quite low than the most of the regions like USA, Australia, Europe and most of the Asian countries.

Percentage of Researchers By Employment In Various Nations



The present graph represents the current global scenario in terms of availability of researchers sector wise. It is clearly evident from the graph that in India the percentage of researchers in business enterprises are approximately 38% and the availability of researchers in government is between 40-45% and in higher education the number of researchers are about 15%. It is felt from the above graph that the number of researchers in higher education needs to be improved and government should take initiatives and launch new schemes for providing sufficient funds to encouraging researchers in higher education to pursue research.

### List of S&T Funding Departments and Ministries

1. All India Council for Technical Education (AICTE)
2. Council of Scientific and Industrial Research (CSIR)
3. Defense Research and Development Organization (DRDO)
4. Department of Atomic Energy (DAE)
5. Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy (AYUSH)
6. Department of Biotechnology (DBT)
7. Department of Coal (DOC)
8. Ministry of Earth Sciences (MoES)
9. Department of Science and Technology (DST)
10. Department of Scientific and Industrial Research (DSIR)
11. Indian Council of Medical Research (ICMR)
12. India Meteorological Department (IMD)
13. Indian Space Research Organization (ISRO)
14. Ministry of Communications & Information Technology (MOCIT)
15. Department of Information Technology
16. Ministry of Environment and Forests (MOEF)
17. Ministry of Food Processing Industries (MFPI)
18. Ministry of New and Renewable Energy
19. Ministry of Power, Central Power Research Institute (CPRI)
20. Ministry of Social Justice & Empowerment (MOSJE)
21. Ministry of Water Resources (MOWR)
22. Petroleum Conservation Research Association (PCRA)
23. University Grants Commission (UGC)

### List of CSIR Laboratories Biological Sciences

1. Centre for Biochemical Technology (CBT), Delhi - 110007
2. Centre for Cellular and Molecular Biology (CCMB), Hyderabad - 500007
3. Central Drug Research Institute (CDRI), Lucknow - 226001
4. Central Food Technological Research Institute (CFTRI), Mysore - 570013
5. Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow - 226016
6. Indian Institute of Chemical Biology (IICB), Calcutta – 700032
7. Institute of Microbial Technology (IMT), Chandigarh - 160036
8. Industrial Toxicology Research Centre (ITRC), Lucknow - 226001
9. National Botanical Research Institute (NBRI), Lucknow - 226001
10. Regional Research Laboratory (RRL, JM), Jammu Tawi – 180001
11. Institute of Himalayan Bioresources Technology (IHBT), Palampur - 176061

### Chemical Sciences

12. Central Electrochemical Research (CECRI), Karaikudi – 623006
13. Central Leather Research Institute (CLRI), Madras - 600020
14. Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar
15. Indian Institute of Chemical Technology (IICT), Hyderabad - 500007

16. Indian Institute of Petroleum (IIP), Dehradun - 248005
17. National Chemical Laboratory (NCL), Pune - 411008
18. Regional Research Laboratory (RRL,JOR), P.O. Jorhat - 785006

### **Engineering Sciences**

19. Central Mining Research Institute (CMRI), Dhanbad - 826001
20. Central Road Research Institute (CRRI), New Delhi - 110020
21. National Aerospace Laboratories (NAL), Bangalore - 560017
22. National Environmental Engineering Research Institute (NEERI), Nagpur
23. National Metallurgical Laboratory (NML), Jamshedpur - 831007
24. Regional Research Laboratory (RRL,BHO), Bhopal – 462026
25. Regional Research Laboratory (RRL,BHU), Bhubaneswar - 751013
26. Regional Research Laboratory (RRL,TVM), Triuvananthapuram - 695019
27. Structural Engineering Research Centre (SERC-G), Ghaziabad – 201001
28. Structural Engineering Research Centre (SERC-C), Madras – 600113
29. Central Building Research Institute (CBRI), Roorkee - 247667
30. Central Fuel Research Institute (CFRI), Dhanbad – 828108
31. Central Glass and Ceramic Research Institute (CGCRI), Calcutta – 700032
32. Central Mechanical Engineering Research Institute (CMERI), Durgapur -

### **Information Sciences**

33. National Institute of Science Communication & Information Resources (NISCAIR), New Delhi - 110012
34. National Institute of Science Technology and Development Studies (NISTADS), New Delhi – 110007

### **Physical Sciences**

35. Central Electronics Engineering Research Institute (CEERI), Pilani – 333031
36. Central Scientific Instruments Organization (CSIO), Chandigarh - 160020
37. National Geophysical Research Institute (NGRI), Hyderabad - 500007
38. National Institute of Oceanography (NIO), Goa - 403004
39. National Physical Laboratory (NPL), New Delhi – 110012

Annexure 2.2

### **List of DRDO Organizations**

1. Aeronautical Development Establishment (ADE), Bangalore
2. Advanced Numerical Research & Analysis Group (ANURAG), Hyderabad
3. Aerial Delivery Research & Development Establishment (ADRDE), Agra
4. Armament Research & Development Establishment (ARDE), Pune
5. Center for Artificial Intelligence & Robotics (CAIR), Bangalore
6. Center for Fire, Explosive and Environment Safety (CFEES)
7. Center for Military Airworthiness & Certification (CEMILAC), Bangalore
8. Centre for Air Borne Systems (CABS), Bangalore
9. Combat Vehicles Research & Development Estt. (CVRDE), Chennai
10. Defence Agricultural Research Laboratory (DARL), Pithoragarh

11. Defence Avionics Research Establishment (DARE), Bangalore
12. Defence Bio-Engineering & Electro Medical Laboratory (DEBEL), Bangalore
13. Defence Electronics Application Laboratory (DEAL), Dehradun
14. Defence Electronics Research Laboratory (DLRL), Hyderabad
15. Defence Food Research Laboratory (DFRL), Mysore
16. Defence Institute of Advanced Technology (Deemed University), Pune
17. Defence Institute of High Altitude Research (DIHAR)
18. Defence Institute of Physiology & Allied Sciences (DIPAS), Delhi
19. Defence Institute of Psychological Research (DIPR), Delhi
20. Defence Laboratory (DLJ), Jodhpur
21. Defence Materials & Stores Research & Development Establishment (DMSRDE), Kanpur
22. Defence Metallurgical Research Laboratory (DMRL), Hyderabad
23. Defence Research & Development Laboratory (DRDL), Hyderabad
24. Defence Research & Development Establishment (DRDE), Gwalior
25. Defence Research Laboratory (DRL), Tejpur
26. Defence Scientific Information & Documentation Centre (DESIDOC), Delhi
27. Defence Terrain Research Laboratory (DTRL), Delhi
28. Electronics & Radar Development Establishment (LRDE), Bangalore
29. Gas Turbine Research Establishment (GTRE), Bangalore
30. High Energy Materials Research Laboratory (HEMRL), Pune
31. Institute of Nuclear Medicine & Allied Sciences (INMAS), Delhi
32. Institute of Systems Studies & Analyses (ISSA), Delhi
33. Institute of Technology Management (ITM), Mussorie
34. Instruments Research & Development Establishment (IRDE), Dehradun
35. Integrated Test Range (ITR), Balasore
36. Laser Science & Technology Centre (LASTEC), Delhi
37. Microwave Tube Research & Development Center (MTRDC), Bangalore
38. Naval Materials Research Laboratory (NMRL), Ambernath
39. Naval Physical & Oceanographic Laboratory (NPOL), Cochin
40. Naval Science & Technological Laboratory (NSTL), Vishakapatnam
41. Proof & Experimental Establishment (PXE), Balasore
42. Research & Development Establishment (R&DE), Pune
43. Research Center Imarat (RCI), Hyderabad
44. Scientific Analysis Group (SAG), Delhi
45. Snow & Avalanche Study Estt (SASE), Chandigarh
46. Solid State Physics Laboratory (SSPL), Delhi
47. Terminal Ballistics Research Laboratory (TBRL), Chandigarh
48. Vehicle Research & Development Establishment (VRDE), Ahmednagar

### List of ICMR Institutions

1. National JALMA Institute for Leprosy & Other Mycobacterial Diseases (NJILOMD)
2. National Institute of Occupational Health (NIOH)
3. National Institute for Research in Environmental Health (NIREH)
4. National Institute for Research in Tuberculosis (NIRT)
5. National Institute of Epidemiology (NIE)
6. National Institute of Malaria Research (NIMR)
7. National Institute of Pathology (NIP)
8. National Institute of Medical Statistics (NIMS)
9. National Institute of Nutrition (NIN)
10. National Institute of Cholera and Enteric Diseases (NICED)
11. Centre for Research in Medical Entomology (CRME)
12. National Institute for Research in Reproductive Health (NIRRH)
13. National Institute of Immunohaematology (NIIH)
14. Enterovirus Research Centre (ERC)
15. Institute of Cytology and Preventive Oncology (ICPO)
16. Rajendra Memorial Research Institute of Medical Sciences (RMRIMS)
17. Vector Control Research Centre (VCRC)
18. National Institute of Virology (NIV)
19. National AIDS Research Institute (NARI)
20. Regional Medical Research Centre Bhubaneswar
21. Regional Medical Research Centre Dibrugarh
22. Regional Medical Research Centre Port Blair
23. Regional Medical Research Centre Jabalpur
24. Desert Medicine Research Centre Jodhpur
25. Regional Medical Research Centre Belgaum
26. Food & Drug Toxicology Research Centre, Hyderabad
27. National Centre of Laboratory Sciences, Hyderabad
28. ICMR Virus Unit, Kolkata
29. Genetic Research Centre, Mumbai
30. Microbial Containment Complex, Pune

### List of ISRO Centers

1. Vikram Sarabhai Space Centre, Thiruvananthapuram
2. ISRO Satellite Centre, Bangalore
3. Satish Dhawan Space Centre, Sriharikota
4. Liquid propulsions Centre, Bangalore
5. Space Applications Centre, Ahmedabad
6. National Remote Sensing Centre, Hyderabad
7. ISRO Telemetry, Tracking and Command Network, Bangalore
8. Master Control Facility, Bhopal
9. ISRO Inertial System Unit, Thiruvananthapuram
10. Laboratory for Electro Optic System, Bangalore.

11. Development and Educational Communication Unit, Ahmedabad
12. Regional Remote Sensing centres
13. Indian Institute of Space Sciences and Technology (IIST), Thiruvananthapuram
14. Physical Research Laboratory, Ahmedabad
15. National Atmospheric Research Laboratory, Gadanki
16. North Eastern Space Application Centre, Shillong
17. Semi-Conductor Laboratory, Chandigarh
18. Antrix Corporation Limited, Bangalore

Annexure 2.5

### **Aided Institutions and other Organizations of DAE**

1. Tata Institute of Fundamental Research
2. Saha Institute of Nuclear Physics
3. Tata Memorial Centre
4. Harish-Chandra Research Institute
5. Institute of Physics
6. National Institute of Science Education and Research
7. Institute of Mathematical Sciences
8. Institute of Plasma Research
9. Board of Research in Nuclear Sciences (BRNS)
10. National Board for higher Mathematics (NBHM)
11. Atomic Energy Education Society
12. Homi Bhabha National Institute

Annexure 2.6

### **Autonomous S&T Institutions of DST**

1. Agharkar Research Institute, Pune
2. Aryabhatta Research Institute of Observational-Sciences, Nainital
3. Birbal Sahni Institute of Palaeobotany, Lucknow
4. Bose Institute, Kolkata
5. Centre for Liquid Crystal Research, Jalahalli, Bangalore
6. Indian Association for the Cultivation of Science, Kolkata
7. Indian Institute of Astrophysics, Bangalore
8. Indian Institute of Geomagnetism, Mumbai
9. International Advanced Research Centre for Powder Metallurgy and New Materials, Hyderabad
10. The Institute of Advanced Study in Science & Technology
11. Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore
12. National Accreditation Board for Testing & Calibration Laboratories, New Delhi
13. Raman Research Institute, Bangalore
14. S.N. Bose National Centre for Basic Sciences, Kolkata
15. Sreechitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram
16. Technology Information, Forecasting & Assessment Council (TIFAC), New Delhi
17. Vigyan Prasar, New Delhi
18. Wadia Institute of Himalayan Geology, Dehradun



### Institutes of DSIR

- Autonomous Bodies
  - \* CSIR (Council of Scientific and Industrial Research)
  - \* CDC (Consultancy Development Cell)
- Public Enterprises
  - \* CEL (Central Electronics Limited)
  - \* NRDC (National Research Development Corporation)
- United Nations Agency
  - \* APCTT-UNESCAP (Asian and Pacific Centre for Transfer of Technology)

### Department of Biotechnology

1. Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad
2. Institute of Bioresources and Sustainable Development (IBSD), Imphal, Manipur
3. Institute of Life Sciences, Bhuvanesar
4. National Institute of Immunology, New Delhi
5. National Institute for Plant Genome Research (NIPGR), JNU, New Delhi
6. National Brain Research Centre (NBRC), Gurgaon
7. National Centre for Cell Sciences, Pune
8. Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram
9. National Agri-Food Biotechnology Institution (NABI)
10. International Centre for Genetic Engineering and Biotechnology (ICGEB)
11. Institute of Stem Cell Science and Regenerative Medicine (ISCRM), Bangalore
12. Translational Health Science and Technology Institute (THSTI), Faridabad
13. National Institute of Biomedical Genomics (NIBMG), Kalyani
14. UNESCO Regional Centre for Biotechnology Training and Education (URCB), Faridabad
15. Bharat Immunologicals & Biologicals Corporation Limited, Bulandshahar
16. Indian Vaccines Corporation Limited, Gurgaon

### Ministry of Environment and Forests

1. Govind Ballabh Pant Institute of Himalayan Environment & Development
2. Indian Council of Forestry Research and Education
3. Indian Institute of Forest Management
4. Indian Plywood Industries Research and Training Institute
5. Wildlife Institute of India
6. Central Zoo Authority
7. National Biodiversity Authority
8. National Ganga River Basin Authority
9. National Tiger Conservation Authority
10. Animal Welfare Board of India
11. Central Pollution Control Board
12. National Afforestation and Eco-development Board
13. Andaman & Nicobar Islands Forest & Plantation Development Corporation Ltd.

### Ministry of Food Processing Industries

1. National Institute of Food Technology Entrepreneurship & Management
2. Indian Institute of Crop Processing Technology (IICPT)
3. National Meat & Poultry Processing Board (NMPPB)
4. Indian Grape Processing Board (IGPB)

### Institutes of Department of AYUSH

1. North Eastern Institute of Folk Medicine, Pasighat, Arunachal Pradesh
2. All India Institute of Ayurveda, New Delhi
3. Institute of Post Graduate Teaching & Research in Ayurveda, Jamnagar
4. National Institute of Ayurveda, Jaipur
5. North Eastern Institute on Ayurveda & Homeopathy, Shillong, Meghalaya
6. Rashtriya Ayurveda Vidyapeeth, New Delhi
7. National Institute of Siddha, Chennai
8. National Institute of Homeopathy, Kolkatta
9. National Institute of Unani Medicine, Bangalore
10. Morarji Desai National Institute of Yoga, New Delhi
11. National Institute of Naturopathy, Pune

### Ministry of Communications & Information Technology

1. Controller of Certifying Authorities (CCA)
2. Cyber Appellate Tribunal (CAT)
3. Semiconductor Integrated Circuits Layout-Design Registry
4. Indian Computer Emergency Response Team (ICERT)
5. .in Registry (IR)
6. Standardization, Testing and Quality Certification (STQC) Directorate
7. National Informatics Centre (NIC)
8. Media Lab Asia
9. National Informatics Centre Services Inc.(NICSI) (PSE under control of NIC)
10. National Internet Exchange of India(NIXI)
11. Education & Research in Computer Networking(ERNET)
12. Centre for Development of Advanced Computing (C-DAC)
13. Centre for Materials for Electronics Technology (C-MET)
14. DOEACC Society
15. Society for Applied Microwave Electronics Engineering and Research (SAMEER)
16. Software Technology Parks of India (STPI)
17. Electronics and Computer Software Export Promotion Council (ESC)

### Ministry of Petroleum

#### Public Sector Undertakings

1. Balmer Lawrie & Co. Ltd.
2. Bharat Petroleum Corporation Ltd.
3. Biecco Lawrie Co. Ltd.
4. Bongaigaon Refinery and Petro-Chemicals Ltd.
5. Chennai Petroleum Corporation Limited
6. Cochin Refineries Ltd.
7. Engineers India Ltd.
8. Gas Authority of India Ltd.
9. Hindustan Petroleum Corporation Ltd.
10. IBP Co. Ltd.
11. Indian Oil Corporation Ltd.
12. Numaligarh Refinery Ltd.
13. Oil India Ltd
14. Oil & Natural Gas Corporation Ltd
15. Mangalore Refinery and Petrochemicals Limited
16. Centre For High Technology
17. Directorate General of Hydrocarbons.
18. Oil Industry Development Board.
19. Oil Industry Safety Directorate
20. O.N.G.C. VIDESH LIMITED
21. Petroleum Conservation Research Association.
22. Petroleum Planning And Analysis Cell
23. Petroleum Federation of India (PetroFed)

Annexure 2.14

### Ministry of New and Renewable Energy

1. Indian Renewable Development Agency
2. Alternate Hydro Energy Centre
3. National Institute of Renewable Energy
4. Centre for Wind Energy technology
5. Solar Energy Centre

Annexure 2.15

### Ministry of Power

1. Central Electricity Authority
2. National Thermal Power Corporation (NTPC)
3. National Hydroelectric Power Corporation (NHPC)
4. Rural Electrification Corporation (REC)
5. North Eastern Electric Power Corporation (NEEPCO)
6. Power Finance Corporation (PFC)
7. Power Grid Corporation of India (POWER GRID)
8. THDC India Limited
9. Satluj Jal Vidyut Nigam Ltd. (SJVN)
10. Central Power Research Institute (CPRI)

11. National Power Training Institute (NPTI)
12. Damodar Valley Corporation (DVC)
13. Bureau of Energy Efficiency (BEE)
14. Bhakra Beas Management Board(BBMB)

Annexure 2.16

### Department of Coal

1. Coal India Limited (CIL)
2. Neyveli Lignite Corporation (NLC)
3. Singareni Collieries Company Limited (SCCL)
4. Coal Mines Provident Fund Organization (CMFPO)
5. Coal Controller
6. Commissioner of Payments

Annexure 2.17

### Ministry of Water Resources

1. Upper Yamuna River Board
2. Central Water Commission, New Delhi
3. Central Ground Water Board, Faridabad
4. Central Water and Power Research Station, Pune
5. Central Soil and Materials Research Station, New Delhi
6. National Water Development Agency
7. National Institute of Hydrology, Roorkee
8. WAPCOS Limited
9. National Projects Construction Corporation Ltd, New Delhi
10. Narmada Control Authority, Indore
11. Sardar Sarovar Construction Advisory Committee(SSCAC)
12. Farakka Barrage Project, Farakka
13. Bansagar Control Board
14. Betwa River Board
15. Brahmaputra Board
16. Tungabhadra Board

Annexure 2.18

### Ministry of Earth Sciences

1. Indian National Centre for Ocean Information Services, Hyderabad
2. National Institute of Ocean Technology, Chennai
3. National Centre of Antarctic and Ocean Research , Goa
4. Indian Institute of Tropical Meteorology, Pune.
5. Integrated Coastal and Marine Area management, Chennai
6. Centre for Marine Living Resources and Ecology, Kochi
7. Earthquake Risk Evaluation Centre, New Delhi
8. National Centre for Medium Range Weather Forecasting, Noida.

## Indian Council of Agricultural Research

### Deemed Universities - 4

1. Indian Agricultural Research Institute, New Delhi
2. National Dairy Research Institute, Karnal
3. Indian Veterinary Research Institute, Izatnagar
4. Central Institute on Fisheries Education, Mumbai

### Institutions - 45

1. Central Rice Research Institute, Cuttack
2. Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora
3. Indian Institute of Pulses Research, Kanpur
4. Central Tobacco Research Institute, Rajahmundry
5. Indian Institute of Sugarcane Research, Lucknow
6. Sugarcane Breeding Institute, Coimbatore
7. Central Institute of Cotton Research, Nagpur
8. Central Research Institute for Jute and Allied Fibres, Barrackpore
9. Indian Grassland and Fodder Research Institute, Jhansi
10. Indian Institute of Horticultural Research, Bangalore
11. Central Institute of Sub Tropical Horticulture, Lucknow
12. Central Institute of Temperate Horticulture, Srinagar
13. Central Institute of Arid Horticulture, Bikaner
14. Indian Institute of Vegetable Research, Varanasi
15. Central Potato Research Institute, Shimla
16. Central Tuber Crops Research Institute, Trivandrum
17. Central Plantation Crops Research Institute, Kasargod
18. Central Agricultural Research Institute, Port Blair
19. Indian Institute of Spices Research, Calicut
20. Central Soil and Water Conservation Research & Training Institute, Dehradun
21. Indian Institute of Soil Sciences, Bhopal
22. Central Soil Salinity Research Institute, Karnal
23. ICAR Research Complex for Eastern Region including Centre of Makhana, Patna
24. Central Research Institute of Dryland Agriculture, Hyderabad
25. Central Arid Zone Research Institute, Jodhpur
26. ICAR Research Complex Goa
27. ICAR Research Complex for NEH Region, Barapani
28. National Institute of Abiotic Stress Management, Malegaon, Maharashtra
29. Central Institute of Agricultural Engineering, Bhopal
30. Central Institute on Post harvest Engineering and Technology, Ludhiana
31. Indian Institute of Natural Resins and Gums, Ranchi
32. Central Institute of Research on Cotton Technology, Mumbai
33. National Institute of Research on Jute & Allied Fibre Technology, Kolkata
34. Indian Agricultural Statistical Research Institute, New Delhi
35. Central Sheep and Wool Research Institute, Avikanagar, Rajasthan
36. Central Institute for Research on Goats, Makhdoom
37. Central Institute for Research on Buffaloes, Hissar
38. National Institute of Animal Nutrition and Physiology, Bangalore

39. Central Avian Research Institute, Izatnagar
40. Central Marine Fisheries Research Institute, Kochi
41. Central Institute Brackishwater Aquaculture, Chennai
42. Central Inland Fisheries Research Institute, Barrackpore
43. Central Institute of Fisheries Technology, Cochin
44. Central Institute of Freshwater Aquaculture, Bhubneshwar
45. National Academy of Agricultural Research & Management, Hyderabad

#### **National Research Centres - 17**

1. National Research Centre on Plant Biotechnology, New Delhi
2. National Centre for Integrated Pest Management, New Delhi
3. National Research Centre for Litchi, Muzaffarpur
4. National Research Centre for Citrus, Nagpur
5. National Research Centre for Grapes, Pune
6. National Research Centre for Banana, Trichi
7. National Research Centre Seed Spices, Ajmer
8. National Research Centre for Pomegranate, Solapur
9. National Research Centre on Orchids, Pakyong, Sikkim
10. National Research Centre Agroforestry, Jhansi
11. National Research Centre on Camel, Bikaner
12. National Research Centre on Equines, Hisar
13. National Research Centre on Meat, Hyderabad
14. National Research Centre on Pig, Guwahati
15. National Research Centre on Yak, West Kameng
16. National Research Centre on Mithun, Medziphema, Nagaland
17. National Centre for Agril. Economics & Policy Research, New Delhi

#### **National Bureaus - 6**

1. National Bureau of Plant Genetics Resources, New Delhi
2. National Bureau of Agriculturally Important Micro-organisms, Mau, Pradesh
3. National Bureau of Agriculturally Important Insects, Bangalore
4. National Bureau of Soil Survey and Land Use Planning, Nagpur
5. National Bureau of Animal Genetic Resources, Karnal
6. National Bureau of Fish Genetic Resources, Lucknow

#### **Directorates/Project Directorates - 25**

1. Directorate of Maize Research, New Delhi.
2. Directorate of Rice Research, Hyderabad
3. Directorate of Wheat Research, Karnal
4. Directorate of Oilseed Research, Hyderabad
5. Directorate of Seed Research, Mau
6. Directorate of Sorghum Research, Hyderabad
7. Directorate of Groundnut Research, Junagarh
8. Directorate of Soybean Research, Indore
9. Directorate of Rapeseed & Mustard Research, Bharatpur
10. Directorate of Mushroom Research, Solan
11. Directorate on Onion and Garlic Research, Pune
12. Directorate of Cashew Research, Puttur
13. Directorate of Oil Palm Research, Pedavegi, West Godawari

14. Directorate of Medicinal and Aromatic Plants Research, Anand
15. Directorate of Floriculture Research, Pusa, New Delhi
16. Project Directorate for Farming Systems Research, Modipuram
17. Directorate of Water Management Research, Bhubaneswar
18. Directorate of Weed Science Research, Jabalpur
19. Project Directorate on Cattle, Meerut
20. Project Directorate on Foot & Mouth Disease, Mukteshwar
21. Project Directorate on Poultry, Hyderabad
22. Project Directorate on Animal Disease Monitoring and Surveillance, Hebbal, Bangalore
23. Directorate of Knowledge Management in Agriculture (DKMA), New Delhi
24. Directorate of Cold Water Fisheries Research, Bhimtal, Nainital
25. Directorate of Research on Women in Agriculture, Bhubaneswar

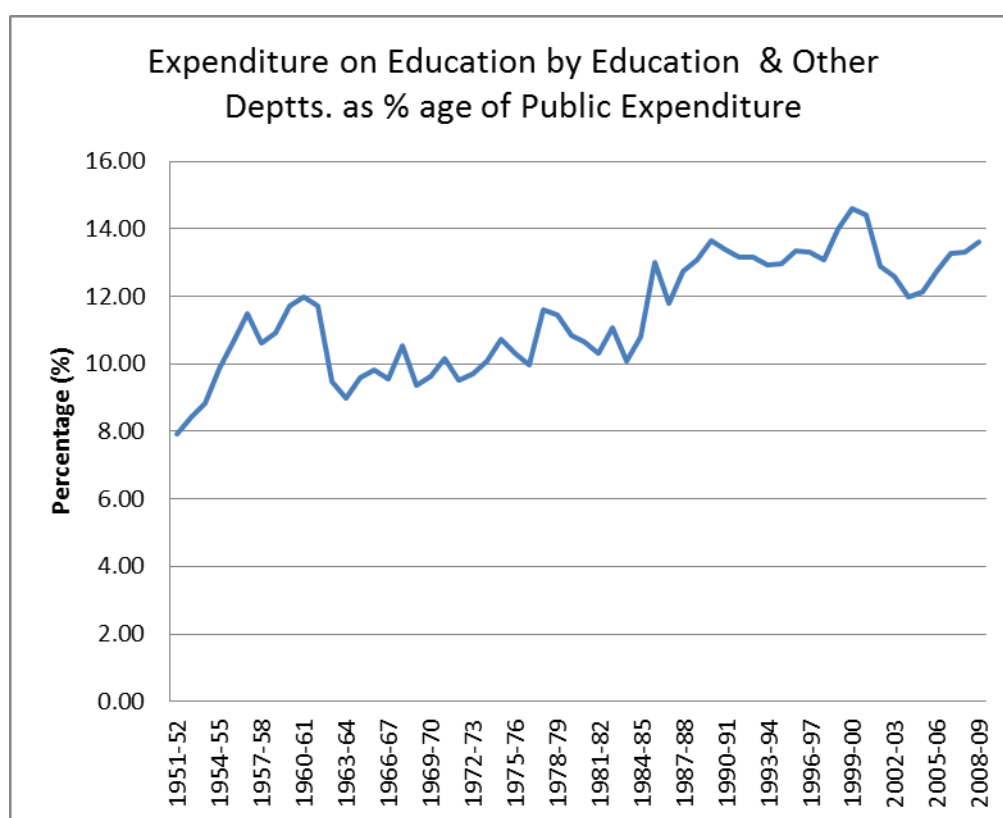
Annexure 2.20

### Colleges under Department of Agriculture Research and Education (DARE)

- 1 College of Agriculture, Iroisemba, Imphal Manipur
- 2 College of Vety. Sciences & A.H., Selesih, Aizawl Mizoram
- 3 College of Fisheries, Lembucherra, Agartala Tripura
- 4 College of Horticulture & Forestry, Pasighat Arunachal Pradesh
- 5 College of Home Science, Tura Meghalaya
- 6 College of Agricultural Engineering & Post-Harvest Technology, Sikkim
- 7 College of Post-Graduate Studies, Barapani, Meghalaya

Annexure 3.1

### Total Expenditure on Education by Various Departments



Indiastat.com

Expenditure on R&D by Different Departments

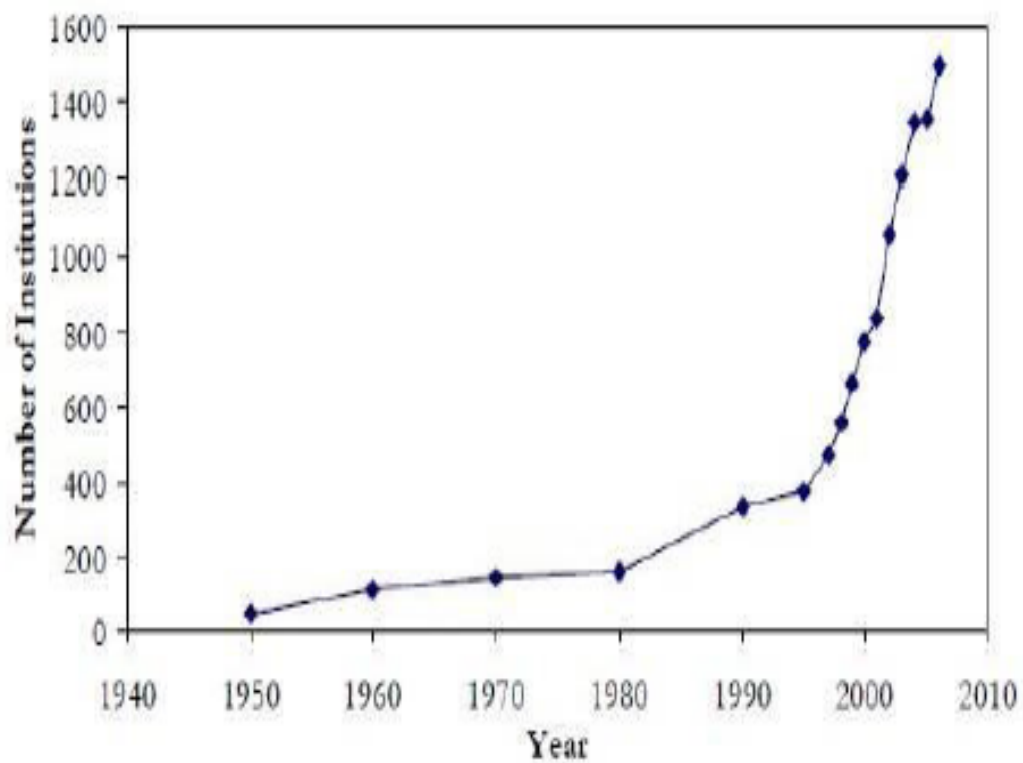
| Ministries /Departments | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 |
|-------------------------|---------|---------|---------|---------|---------|---------|
| DARE                    |         |         |         | 2826.46 | 3143.44 | 3592.5  |
| DAE                     | 872.74  | 1003    | 1215    | 3083.13 | 4025.37 | 4189.93 |
| MoES                    | 340     | 438     | 690     | 321.39  | 616.46  | 739     |
| DST                     | 1250    | 1367    | 1526    | 1805.2  | 2003.61 | 2329.33 |
| DSIR                    | 846     | 975     | 1070    | 2387.2  | 2685.44 | 2975    |
| DOS                     | 2800    | 3220    | 3420    | 3255.48 | 2685.44 | 5062.22 |
| DBT                     | 445     | 521     | 675     | -       | -       | -       |

*www.indiastat.com*

The above table provides a basic Idea about the various departments and ministries and the amount of expenditure incurred by them for the promotion and development of science and technology so that novel innovations could happen and which can subsequently be helpful to the society. High amount of expenditure is incurred by space and atomic energy departments for the promotion of R&D, which is growing rapidly in India

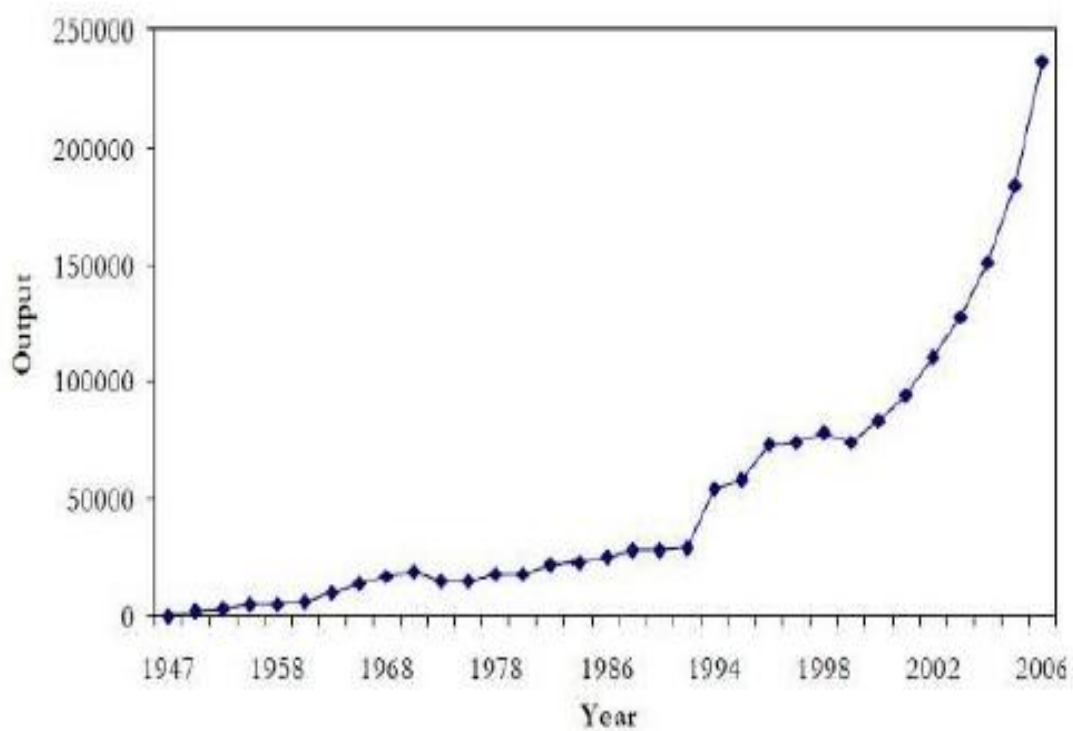


### Growth of Degree Institutions in India

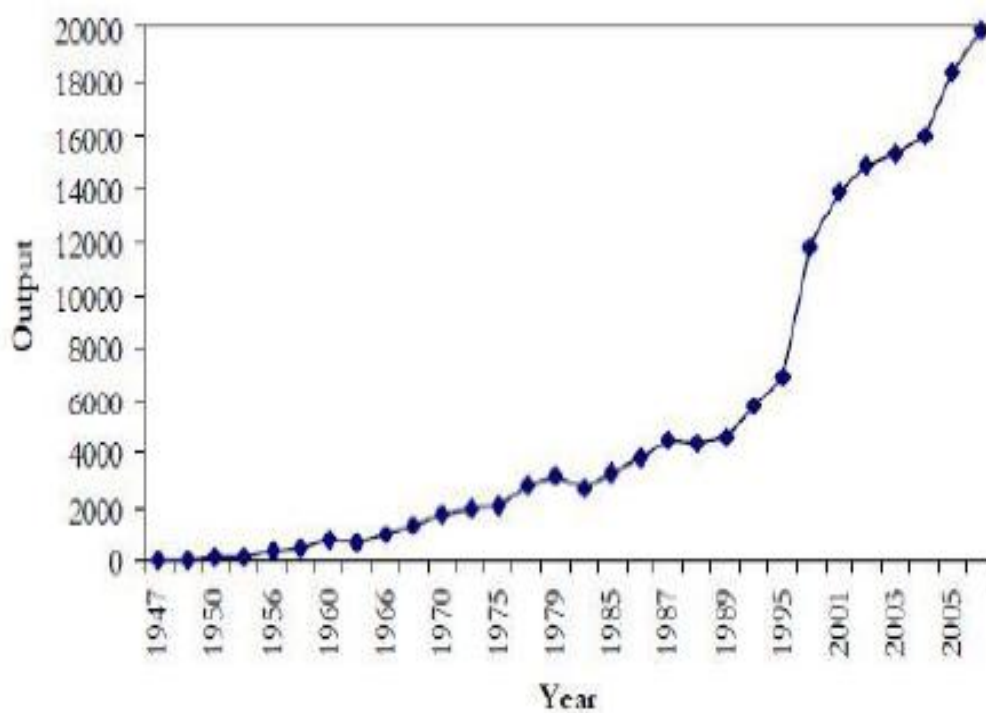


*Source: Higher Technical Education Report in India by Prof. Chopra and Prof. Sharma (2007)*

### Growth of Sanctioned intake of Graduates

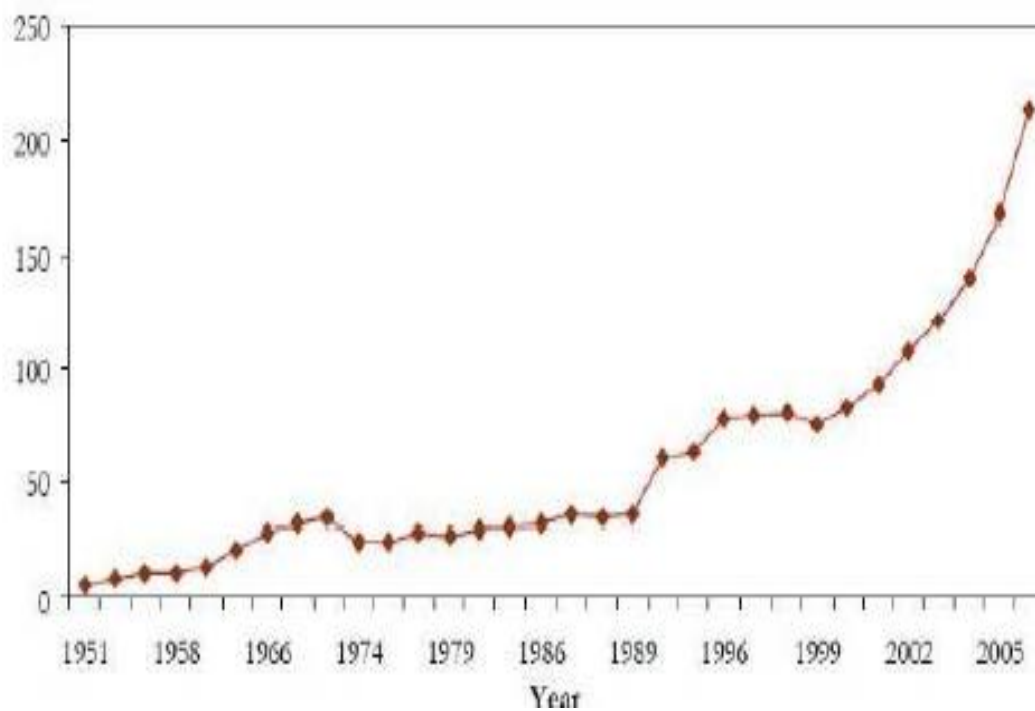


Source: Higher Technical Education Report in India by Prof. Chopra and Prof. Sharma (2007)

Total output of Engineering Graduates

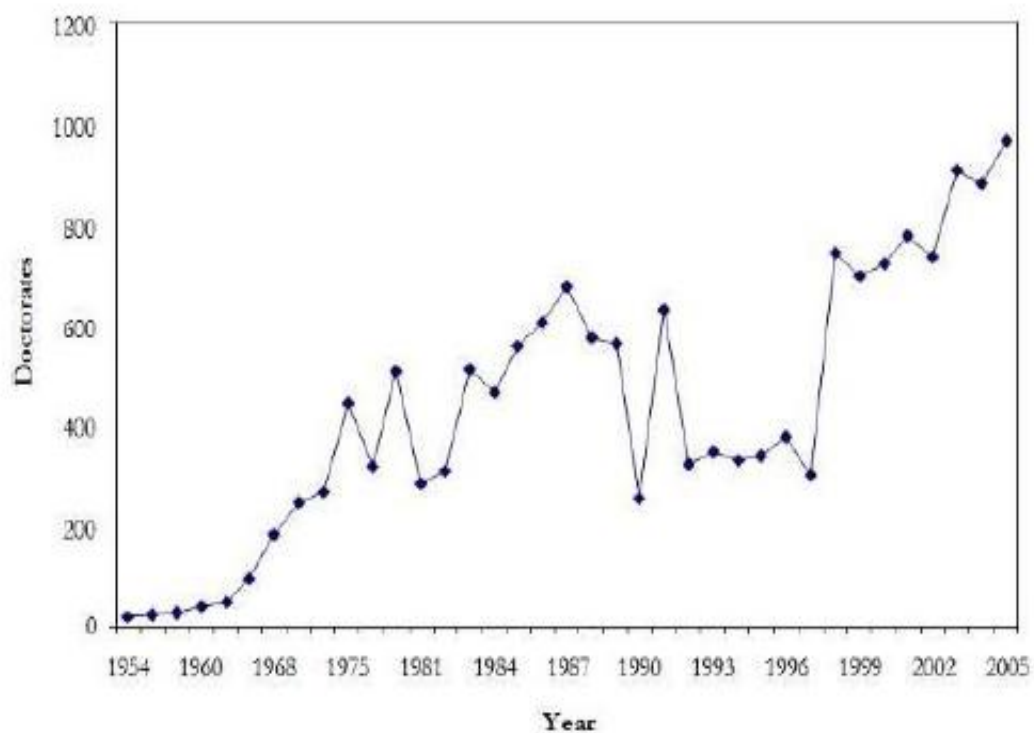
Source: Higher Technical Education Report in India by Prof. Chopra and Prof. Sharma (2007)

### Growth of Engineering Graduates per Million Population in India



Source: Higher Technical Education Report in India by Prof. Chopra and Prof. Sharma (2007)

### Engineering Doctorate Degrees Awarded in India



*Source: Higher Technical Education Report in India by Prof. Chopra and Prof. Sharma (2007)*

**Number of Seats in Technical (Vocational) Apprentices in India***(as on 30.06.2010)*

| Region/ States/UTs | Number of Govt. ITIs | Seating Capacity (Govt.) | Number of Pvt. ITCs | Seating Capacity (Pvt.) | Total ITIs/ ITCs | Total Seating Capacity |
|--------------------|----------------------|--------------------------|---------------------|-------------------------|------------------|------------------------|
| Maharashtra        | 388                  | 86124                    | 297                 | 35620                   | 685              | 121744                 |
| Andhra Pradesh     | 109                  | 22510                    | 506                 | 97644                   | 615              | 120154                 |
| Karnataka          | 150                  | 25682                    | 1046                | 78814                   | 1196             | 104496                 |
| Uttar Pradesh      | 300                  | 31500                    | 564                 | 63886                   | 864              | 95386                  |
| Orissa             | 26                   | 8464                     | 495                 | 84100                   | 521              | 92564                  |
| Rajasthan          | 114                  | 13264                    | 668                 | 76671                   | 782              | 89935                  |
| Tamil Nadu         | 60                   | 21832                    | 627                 | 62590                   | 687              | 84422                  |
| Gujarat            | 153                  | 56172                    | 350                 | 20744                   | 503              | 76916                  |
| Kerala             | 36                   | 15916                    | 482                 | 52890                   | 518              | 68806                  |
| Bihar              | 34                   | 11433                    | 225                 | 32569                   | 259              | 44002                  |
| Madhya Pradesh     | 160                  | 24862                    | 75                  | 9954                    | 235              | 34816                  |
| Punjab             | 94                   | 19316                    | 153                 | 15008                   | 247              | 34324                  |
| Haryana            | 82                   | 20824                    | 85                  | 9128                    | 167              | 29952                  |
| Jharkhand          | 20                   | 4672                     | 95                  | 24232                   | 115              | 28904                  |
| Delhi              | 16                   | 11132                    | 57                  | 4140                    | 73               | 15272                  |
| Himachal Pradesh   | 70                   | 8260                     | 82                  | 7004                    | 152              | 15264                  |
| West Bengal        | 51                   | 12700                    | 22                  | 1320                    | 73               | 14020                  |
| Chattishgarh       | 87                   | 10224                    | 29                  | 3376                    | 116              | 13600                  |
| Uttarakhand        | 59                   | 6395                     | 29                  | 2534                    | 88               | 8929                   |
| Assam              | 28                   | 5696                     | 3                   | 80                      | 31               | 5776                   |
| Jammu & Kashmir    | 37                   | 4087                     | 1                   | 110                     | 38               | 4197                   |
| Goa                | 10                   | 3264                     | 4                   | 380                     | 14               | 3644                   |
| Poducherry         | 6                    | 1352                     | 9                   | 508                     | 15               | 1860                   |
| Chandigarh         | 2                    | 968                      | 0                   | 0                       | 2                | 968                    |
| Nagaland           | 8                    | 944                      | 0                   | 0                       | 8                | 944                    |
| Tripura            | 8                    | 944                      | 0                   | 0                       | 8                | 944                    |
| Meghalaya          | 5                    | 622                      | 2                   | 320                     | 7                | 942                    |
| Manipur            | 7                    | 540                      | 0                   | 0                       | 7                | 540                    |
| Sikkim             | 2                    | 516                      | 0                   | 0                       | 2                | 516                    |
| Arunachal Pradesh  | 5                    | 512                      | 0                   | 0                       | 5                | 512                    |
| Daman & Diu        | 2                    | 388                      | 0                   | 0                       | 2                | 388                    |
| Mizoram            | 1                    | 294                      | 0                   | 0                       | 1                | 294                    |
| Andaman & Nicobar  | 1                    | 273                      | 0                   | 0                       | 1                | 273                    |
| Dadra & Nagar      | 1                    | 228                      | 0                   | 0                       | 1                | 228                    |
| Lakshdweep         | 1                    | 96                       | 0                   | 0                       | 1                | 96                     |
| India              | 2133                 | 432006                   | 5906                | 683622                  | 8039             | 1115628                |

### Number of University & University Level Institutions

| Sl. No.     | State                     | Central University | State University | Private University | Deemed University | Institution Established Under State legislature Act | Institution of National Importance | Total |
|-------------|---------------------------|--------------------|------------------|--------------------|-------------------|-----------------------------------------------------|------------------------------------|-------|
| 1           | Andhra Pradesh            | 3                  | 20               | 0                  | 4                 | 2                                                   | 1                                  | 30    |
| 2           | Arunachal Pradesh         | 1                  | 0                | 0                  | 1                 | 0                                                   | 0                                  | 2     |
| 3           | Assam                     | 2                  | 4                | 0                  | 0                 | 0                                                   | 2                                  | 8     |
| 4           | Bihar                     | 0                  | 13               | 1                  | 2                 | 1                                                   | 1                                  | 18    |
| 5           | Chhattisgarh              | 1                  | 7                | 0                  | 0                 | 0                                                   | 1                                  | 9     |
| 6           | Goa                       | 0                  | 1                | 0                  | 0                 | 0                                                   | 0                                  | 1     |
| 7           | Gujarat                   | 0                  | 16               | 5                  | 2                 | 0                                                   | 1                                  | 24    |
| 8           | Haryana                   | 0                  | 6                | 0                  | 3                 | 0                                                   | 1                                  | 10    |
| 9           | Himachal Pradesh          | 0                  | 3                | 1                  | 0                 | 0                                                   | 1                                  | 5     |
| 10          | Jammu & Kashmir           | 0                  | 6                | 0                  | 0                 | 1                                                   | 1                                  | 8     |
| 11          | Jharkhand                 | 0                  | 4                | 0                  | 2                 | 0                                                   | 1                                  | 7     |
| 12          | Karnataka                 | 0                  | 16               | 0                  | 11                | 0                                                   | 1                                  | 28    |
| 13          | Kerala                    | 0                  | 7                | 0                  | 1                 | 0                                                   | 2                                  | 10    |
| 14          | Madhya Pradesh            | 2                  | 13               | 0                  | 2                 | 0                                                   | 1                                  | 18    |
| 15          | Maharashtra               | 1                  | 19               | 0                  | 20                | 0                                                   | 2                                  | 42    |
| 16          | Manipur                   | 2                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 2     |
| 17          | Meghalaya                 | 1                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 1     |
| 18          | Mizoram                   | 1                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 1     |
| 19          | Nagaland                  | 1                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 1     |
| 20          | Odisha                    | 0                  | 10               | 0                  | 2                 | 0                                                   | 1                                  | 13    |
| 21          | Punjab                    | 0                  | 7                | 1                  | 2                 | 0                                                   | 2                                  | 12    |
| 22          | Rajasthan                 | 0                  | 14               | 0                  | 7                 | 0                                                   | 1                                  | 22    |
| 23          | Sikkim                    | 1                  | 0                | 2                  | 0                 | 0                                                   | 0                                  | 3     |
| 24          | Tamil Nadu                | 0                  | 17               | 0                  | 21                | 0                                                   | 3                                  | 41    |
| 25          | Tripura                   | 1                  | 0                | 1                  | 0                 | 0                                                   | 1                                  | 3     |
| 26          | Uttar Pradesh             | 4                  | 19               | 2                  | 8                 | 1                                                   | 2                                  | 36    |
| 27          | Uttarakhand               | 1                  | 3                | 4                  | 3                 | 0                                                   | 1                                  | 12    |
| 28          | West Bengal               | 1                  | 15               | 0                  | 1                 | 0                                                   | 3                                  | 20    |
| 29          | Andaman & Nicobar Islands | 0                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 0     |
| 30          | Chandigarh                | 0                  | 1                | 0                  | 1                 | 0                                                   | 1                                  | 3     |
| 31          | Dadra & Nagar Haveli      |                    |                  |                    |                   |                                                     |                                    |       |
| 32          | Daman & Diu               | 0                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 0     |
| 33          | Delhi                     | 4                  | 1                | 0                  | 11                | 0                                                   | 2                                  | 18    |
| 34          | Lakshadweep               | 0                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 0     |
| 35          | Puducherry                | 1                  | 0                | 0                  | 0                 | 0                                                   | 0                                  | 1     |
| Grand Total |                           | 28                 | 222              | 17                 | 104               | 5                                                   | 33                                 | 409   |

Number of Colleges & Polytechnics

| Sl. No.     | State                     | Arts, Fine Arts, Social Work, Science & Commerce | Engineering/Technology/Architecture | Medical | Education/Teacher Training | Others | Total Colleges | Polytechnics |
|-------------|---------------------------|--------------------------------------------------|-------------------------------------|---------|----------------------------|--------|----------------|--------------|
| 1           | Andhra Pradesh            | 2286                                             | 535                                 | 378     | 610                        | 1031   | 4840           | 187          |
| 2           | Arunachal Pradesh         | 13                                               | 3                                   | 1       | 1                          | 3      | 21             | 3*           |
| 3           | Assam                     | 337                                              | 7*                                  | 7*      | 40**                       | 153    | 544            | 13           |
| 4           | Bihar                     | 817                                              | 10                                  | 37      | 33                         | 106    | 1003           | 13           |
| 5           | Chhattisgarh              | 330*                                             | 51                                  | 4*      | 4*                         | 51*    | 440            | 15           |
| 6           | Goa                       | 24                                               | 4                                   | 7       | 2                          | 6      | 43             | 5            |
| 7           | Gujarat                   | 599                                              | 93                                  | 262*    | 343*                       | 569*   | 1866           | 67           |
| 8           | Haryana                   | 234                                              | 154                                 | 50*     | 739                        | 54     | 1231           | 32**         |
| 9           | Himachal Pradesh          | 90                                               | 8                                   | 20      | 72                         | 71     | 261            | 15           |
| 10          | Jammu & Kashmir           | 83                                               | 4                                   | 13      | 140                        | 23     | 263            | 14           |
| 11          | Jharkhand                 | 110                                              | 4                                   | 12      | 9                          | 26**   | 161            | 19**         |
| 12          | Karnataka                 | 344                                              | 141*                                | 423**   | 0                          | 13*    | 921            | 186*         |
| 13          | Kerala                    | 192                                              | 98**                                | 125**   | 21                         | 12     | 448            | 59**         |
| 14          | Madhya Pradesh            | 792                                              | 159                                 | 97**    | 102**                      | 149**  | 1299           | 44           |
| 15          | Maharashtra               | 2171                                             | 329                                 | 172     | 471                        | 536    | 3679           | 227          |
| 16          | Manipur                   | 58                                               | 3                                   | 1       | 6**                        | 5      | 73             | 3**          |
| 17          | Meghalaya                 | 57                                               | 1**                                 | 0       | 3                          | 2      | 63             | 3*           |
| 18          | Mizoram                   | 23                                               | 0                                   | 2       | 2                          | 2      | 29             | 2            |
| 19          | Nagaland                  | 41                                               | 0                                   | 0       | 3                          | 25     | 69             | 3            |
| 20          | Odisha                    | 700                                              | 47                                  | 66      | 14                         | 73     | 900            | 33           |
| 21          | Punjab                    | 234                                              | 44                                  | 72      | 115                        | 12     | 477            | 89*          |
| 22          | Rajasthan                 | 1017                                             | 96*                                 | 54**    | 111**                      | 214    | 1492           | 71           |
| 23          | Sikkim                    | 5                                                | 2                                   | 3       | 2*                         | 6      | 18             | 2            |
| 24          | Tamil Nadu                | 550                                              | 344                                 | 198**   | 160                        | 165*   | 1417           | 314          |
| 25          | Tripura                   | 17                                               | 2                                   | 2       | 1                          | 6      | 28             | 1            |
| 26          | Uttar Pradesh             | 2361                                             | 212                                 | 104     | 128**                      | 299    | 3104           | 136          |
| 27          | Uttarakhand               | 103                                              | 14**                                | 20**    | 24                         | 60**   | 221            | 42           |
| 28          | West Bengal               | 426                                              | 64*                                 | 68**    | 88*                        | 140    | 786            | 50           |
| 29          | Andaman & Nicobar Islands | 2                                                | 0                                   | 1       | 1                          | 1      | 5              | 2            |
| 30          | Chandigarh                | 15                                               | 7                                   | 7       | 6                          | 4      | 39             | 7            |
| 31          | Dadra & Nagar Haveli      | 1                                                | 0                                   | 1       | 1                          | 0      | 3              | 0            |
| 32          | Daman & Diu               | 1                                                | 0                                   | 0       | 2                          | 0      | 3              | 1            |
| 33          | Delhi                     | 89*                                              | 15*                                 | 8       | 2                          | 41*    | 155            | 79           |
| 34          | Lakshadweep               | 2*                                               | 0                                   | 0       | 1*                         | 0      | 3              | 0            |
| 35          | Puducherry                | 22                                               | 15                                  | 15      | 27                         | 6      | 85             | 5            |
| Grand Total |                           | 14146                                            | 2466                                | 2230    | 3284                       | 3864   | 25990          | 1742         |

\*\* - repeated from 2006-07, \* - repeated from 2007-08



**Enrolment (Excluding Open Universities) By Level/Courses (All Categories Of Students)**

| Sl. No. | States/UTs                | Ph.D/M.Phil |       |       | POST GRADUATE DEGREE |        |        |          |       |        |
|---------|---------------------------|-------------|-------|-------|----------------------|--------|--------|----------|-------|--------|
|         |                           |             |       |       | ARTS                 |        |        | COMMERCE |       |        |
|         |                           | Boys        | Girls | Total | Boys                 | Girls  | Total  | Boys     | Girls | Total  |
| 1       | Andhra Pradesh            | 2263        | 947   | 3210  | 8061                 | 4589   | 12650  | 3116     | 1385  | 4501   |
| 2       | Arunachal Pradesh         | 22          | 16    | 38    | 291                  | 288    | 579    | 29       | 21    | 50     |
| 3       | Assam                     | 440         | 339   | 779   | 4215                 | 3372   | 7587   | 880      | 229   | 1109   |
| 4       | Bihar                     | 1245        | 680   | 1925  | 28172                | 12467  | 40639  | 2142     | 816   | 2958   |
| 5       | Chhattisgarh              | 98          | 163   | 261   | 25069                | 44914  | 69983  | 1955     | 674   | 2629   |
| 6       | Goa                       | 8           | 21    | 29    | 89                   | 328    | 417    | 110      | 257   | 367    |
| 7       | Gujarat                   | 1132        | 782   | 1914  | 21177                | 22520  | 43697  | 13706    | 12498 | 26204  |
| 8       | Haryana                   | 866         | 746   | 1612  | 1843                 | 3163   | 5006   | 344      | 632   | 976    |
| 9       | Himachal Pradesh          | 1608        | 1223  | 2831  | 1006                 | 1866   | 2872   | 25       | 55    | 80     |
| 10      | Jammu & Kashmir           | 335         | 321   | 656   | 1602                 | 2900   | 4502   | 249      | 355   | 604    |
| 11      | Jharkhand                 | 237         | 133   | 370   | 3951                 | 2335   | 6286   | 3019     | 2104  | 5123   |
| 12      | Karnataka                 | 658         | 483   | 1141  | 1529                 | 1484   | 3013   | 249      | 419   | 668    |
| 13      | Kerala                    | 741         | 755   | 1496  | 2401                 | 6775   | 9176   | 1079     | 2281  | 3360   |
| 14      | Madhya Pradesh            | 2804        | 0     | 2804  | 20255                | 24309  | 44564  | 9770     | 7586  | 17356  |
| 15      | Maharashtra               | 5774        | 3735  | 9509  | 44449                | 41944  | 86393  | 29858    | 25959 | 55817  |
| 16      | Manipur                   | 480         | 470   | 950   | 409                  | 405    | 814    | 45       | 35    | 80     |
| 17      | Meghalaya                 | 331         | 308   | 639   | 344                  | 796    | 1140   | 44       | 46    | 90     |
| 18      | Mizoram                   | 118         | 126   | 244   | 249                  | 241    | 490    | 25       | 18    | 43     |
| 19      | Nagaland                  | 97          | 78    | 175   | 261                  | 258    | 519    | 19       | 17    | 36     |
| 20      | Odisha                    | 438         | 222   | 660   | 6420                 | 3607   | 10027  | 1982     | 287   | 2269   |
| 21      | Punjab                    | 576         | 923   | 1499  | 3191                 | 10929  | 14120  | 475      | 700   | 1175   |
| 22      | Rajasthan                 | 550         | 745   | 1295  | 12316                | 14077  | 26393  | 2088     | 1927  | 4015   |
| 23      | Sikkim                    | 4           | 0     | 4     | 0                    | 0      | 0      | 0        | 0     | 0      |
| 24      | Tamil Nadu                | 11391       | 8621  | 20012 | 14328                | 12421  | 26749  | 9398     | 9126  | 18524  |
| 25      | Tripura                   | 16          | 9     | 25    | 436                  | 510    | 946    | 79       | 9     | 88     |
| 26      | Uttar Pradesh             | 8252        | 5097  | 13349 | 97047                | 85834  | 182881 | 19899    | 7210  | 27109  |
| 27      | Uttarakhand               | 831         | 562   | 1393  | 3355                 | 6949   | 10304  | 1487     | 1446  | 2933   |
| 28      | West Bengal               | 2054        | 1208  | 3262  | 18985                | 17565  | 36550  | 1799     | 875   | 2674   |
| 29      | Andaman & Nicobar Islands | 6           | 3     | 9     | 17                   | 87     | 104    | 14       | 16    | 30     |
| 30      | Chandigarh                | 305         | 337   | 642   | 2083                 | 3565   | 5648   | 830      | 916   | 1746   |
| 31      | Dadra & Nagar Haveli      | 0           | 0     | 0     | 0                    | 0      | 0      | 0        | 0     | 0      |
| 32      | Daman & Diu               | 0           | 0     | 0     | 0                    | 0      | 0      | 0        | 0     | 0      |
| 33      | Delhi                     | 2358        | 2820  | 5178  | 3263                 | 2808   | 6071   | 6071     | 901   | 6972   |
| 34      | Lakshadweep               | 0           | 0     | 0     | 3                    | 23     | 26     | 0        | 0     | 0      |
| 35      | Puducherry                | 285         | 192   | 477   | 176                  | 194    | 370    | 11       | 6     | 17     |
| INDIA   |                           | 46323       | 32065 | 78388 | 326993               | 333523 | 660516 | 110797   | 78806 | 189603 |

**Enrolment (Excluding Open Universities) By Level/Courses (All Categories Of Students)**

| Sl. No. | States/UTs                | POST GRADUATE DEGREE |        |        |                                                  |       |       |          |       |       |
|---------|---------------------------|----------------------|--------|--------|--------------------------------------------------|-------|-------|----------|-------|-------|
|         |                           | SCIENCE              |        |        | ENGINEERING/ TECHNOLOGY/<br>ARCHITECTURE/ DESIGN |       |       | MEDICINE |       |       |
|         |                           | Boys                 | Girls  | Total  | Boys                                             | Girls | Total | Boys     | Girls | Total |
| 1       | Andhra Pradesh            | 53283                | 29377  | 82660  | 5666                                             | 2790  | 8456  | 281      | 186   | 467   |
| 2       | Arunachal Pradesh         | 25                   | 35     | 60     | 945                                              | 530   | 1475  | 0        | 0     | 0     |
| 3       | Assam                     | 2691                 | 1337   | 4028   | 44                                               | 7     | 51    | 197      | 100   | 297   |
| 4       | Bihar                     | 8378                 | 2824   | 11202  | 46                                               | 1     | 47    | 156      | 30    | 186   |
| 5       | Chhattisgarh              | 2132                 | 2485   | 4617   | 140                                              | 59    | 199   | 158      | 28    | 186   |
| 6       | Goa                       | 210                  | 319    | 529    | 28                                               | 7     | 35    | 47       | 81    | 128   |
| 7       | Gujarat                   | 9031                 | 5708   | 14739  | 8546                                             | 3108  | 11654 | 3781     | 2323  | 6104  |
| 8       | Haryana                   | 1234                 | 2547   | 3781   | 243                                              | 177   | 420   | 133      | 156   | 289   |
| 9       | Himachal Pradesh          | 324                  | 501    | 825    | 158                                              | 75    | 233   | 85       | 52    | 137   |
| 10      | Jammu & Kashmir           | 2846                 | 2854   | 5700   | 42                                               | 18    | 60    | 79       | 42    | 121   |
| 11      | Jharkhand                 | 1635                 | 913    | 2548   | 1188                                             | 291   | 1479  | 2        | 5     | 7     |
| 12      | Karnataka                 | 853                  | 1310   | 2163   | 2745                                             | 653   | 3398  | 4205     | 2527  | 6732  |
| 13      | Kerala                    | 1238                 | 6265   | 7503   | 1326                                             | 875   | 2201  | 593      | 758   | 1351  |
| 14      | Madhya Pradesh            | 6247                 | 8229   | 14476  | 2901                                             | 1105  | 4006  | 500      | 180   | 680   |
| 15      | Maharashtra               | 29263                | 21773  | 51036  | 4994                                             | 1992  | 6986  | 1384     | 436   | 1820  |
| 16      | Manipur                   | 280                  | 342    | 622    | 0                                                | 0     | 0     | 45       | 25    | 70    |
| 17      | Meghalaya                 | 241                  | 242    | 483    | 85                                               | 25    | 110   | 0        | 0     | 0     |
| 18      | Mizoram                   | 98                   | 34     | 132    | 20                                               | 12    | 32    | 0        | 0     | 0     |
| 19      | Nagaland                  | 92                   | 43     | 135    | 0                                                | 0     | 0     | 0        | 0     | 0     |
| 20      | Odisha                    | 2809                 | 1167   | 3976   | 1352                                             | 467   | 1819  | 528      | 269   | 797   |
| 21      | Punjab                    | 3002                 | 7282   | 10284  | 6391                                             | 1521  | 7912  | 1276     | 1195  | 2471  |
| 22      | Rajasthan                 | 7728                 | 8256   | 15984  | 396                                              | 206   | 602   | 1400     | 526   | 1926  |
| 23      | Sikkim                    | 103                  | 66     | 169    | 10                                               | 3     | 13    | 74       | 12    | 86    |
| 24      | Tamil Nadu                | 32799                | 29545  | 62344  | 17291                                            | 9824  | 27115 | 1655     | 829   | 2484  |
| 25      | Tripura                   | 139                  | 141    | 280    | 19                                               | 22    | 41    | 263      | 134   | 397   |
| 26      | Uttar Pradesh             | 41570                | 16081  | 57651  | 2460                                             | 558   | 3018  | 1440     | 587   | 2027  |
| 27      | Uttarakhand               | 1449                 | 2099   | 3548   | 844                                              | 109   | 953   | 35       | 14    | 49    |
| 28      | West Bengal               | 9116                 | 5855   | 14971  | 4342                                             | 1410  | 5752  | 571      | 157   | 728   |
| 29      | Andaman & Nicobar Islands | 15                   | 23     | 38     | 0                                                | 0     | 0     | 0        | 0     | 0     |
| 30      | Chandigarh                | 592                  | 1368   | 1960   | 90                                               | 120   | 210   | 35       | 40    | 75    |
| 31      | Dadra & Nagar Haveli      | 0                    | 0      | 0      | 0                                                | 0     | 0     | 0        | 0     | 0     |
| 32      | Daman & Diu               | 0                    | 0      | 0      | 0                                                | 0     | 0     | 0        | 0     | 0     |
| 33      | Delhi                     | 1779                 | 2232   | 4011   | 5327                                             | 1416  | 6743  | 707      | 703   | 1410  |
| 34      | Lakshadweep               | 0                    | 0      | 0      | 0                                                | 0     | 0     | 0        | 0     | 0     |
| 35      | Puducherry                | 119                  | 45     | 164    | 120                                              | 45    | 165   | 0        | 0     | 0     |
|         | INDIA                     | 221321               | 161298 | 382619 | 67759                                            | 27426 | 95185 | 19630    | 11395 | 31025 |

**Enrolment (Excluding Open Universities) By Level/Courses (All Categories Of Students)**

| Sl. No. | States/UTs                | POST GRADUATE DEGREE |       |       |                                               |       |        |                             |       |       |
|---------|---------------------------|----------------------|-------|-------|-----------------------------------------------|-------|--------|-----------------------------|-------|-------|
|         |                           | AGRICULTURE & ALLIED |       |       | MANAGEMENT/ HOTEL/ TRAVEL/ TOURISM MANAGEMENT |       |        | EDUCATION/ TEACHER TRAINING |       |       |
|         |                           | Boys                 | Girls | Total | Boys                                          | Girls | Total  | Boys                        | Girls | Total |
| 1       | Andhra Pradesh            | 248                  | 195   | 443   | 11239                                         | 5749  | 16988  | 649                         | 312   | 961   |
| 2       | Arunachal Pradesh         | 0                    | 0     | 0     | 54                                            | 25    | 79     | 43                          | 57    | 100   |
| 3       | Assam                     | 118                  | 45    | 163   | 263                                           | 202   | 465    | 280                         | 264   | 544   |
| 4       | Bihar                     | 22                   | 9     | 31    | 672                                           | 161   | 833    | 2078                        | 985   | 3063  |
| 5       | Chhattisgarh              | 176                  | 63    | 239   | 371                                           | 166   | 537    | 1369                        | 1846  | 3215  |
| 6       | Goa                       | 0                    | 0     | 0     | 81                                            | 46    | 127    | 14                          | 23    | 37    |
| 7       | Gujarat                   | 651                  | 106   | 757   | 6246                                          | 2965  | 9211   | 156                         | 169   | 325   |
| 8       | Haryana                   | 207                  | 28    | 235   | 1031                                          | 507   | 1538   | 70                          | 133   | 203   |
| 9       | Himachal Pradesh          | 159                  | 111   | 270   | 934                                           | 268   | 1202   | 40                          | 120   | 160   |
| 10      | Jammu & Kashmir           | 145                  | 47    | 192   | 1103                                          | 775   | 1878   | 1047                        | 1474  | 2521  |
| 11      | Jharkhand                 | 96                   | 27    | 123   | 269                                           | 149   | 418    | 134                         | 462   | 596   |
| 12      | Karnataka                 | 664                  | 323   | 987   | 558                                           | 130   | 688    | 53                          | 74    | 127   |
| 13      | Kerala                    | 122                  | 86    | 208   | 79                                            | 47    | 126    | 45                          | 179   | 224   |
| 14      | Madhya Pradesh            | 557                  | 66    | 623   | 162                                           | 18    | 180    | 930                         | 632   | 1562  |
| 15      | Maharashtra               | 1255                 | 420   | 1675  | 20192                                         | 8861  | 29053  | 3640                        | 2766  | 6406  |
| 16      | Manipur                   | 45                   | 29    | 74    | 37                                            | 25    | 62     | 20                          | 30    | 50    |
| 17      | Meghalaya                 | 0                    | 0     | 0     | 42                                            | 11    | 53     | 146                         | 140   | 286   |
| 18      | Mizoram                   | 10                   | 9     | 19    | 9                                             | 11    | 20     | 5                           | 35    | 40    |
| 19      | Nagaland                  | 32                   | 24    | 56    | 0                                             | 0     | 0      | 0                           | 0     | 0     |
| 20      | Odisha                    | 109                  | 52    | 161   | 4696                                          | 1504  | 6200   | 39                          | 73    | 112   |
| 21      | Punjab                    | 319                  | 237   | 556   | 2050                                          | 1270  | 3320   | 129                         | 750   | 879   |
| 22      | Rajasthan                 | 430                  | 106   | 536   | 6285                                          | 4127  | 10412  | 410                         | 189   | 599   |
| 23      | Sikkim                    | 0                    | 0     | 0     | 75                                            | 47    | 122    | 3                           | 13    | 16    |
| 24      | Tamil Nadu                | 53                   | 116   | 169   | 10649                                         | 5161  | 15810  | 330                         | 290   | 620   |
| 25      | Tripura                   | 5                    | 1     | 6     | 49                                            | 10    | 59     | 6                           | 14    | 20    |
| 26      | Uttar Pradesh             | 2637                 | 399   | 3036  | 11480                                         | 4594  | 16074  | 637                         | 339   | 976   |
| 27      | Uttarakhand               | 74                   | 11    | 85    | 1216                                          | 552   | 1768   | 54                          | 62    | 116   |
| 28      | West Bengal               | 480                  | 150   | 630   | 3598                                          | 1398  | 4996   | 308                         | 362   | 670   |
| 29      | Andaman & Nicobar Islands | 0                    | 0     | 0     | 0                                             | 0     | 0      | 0                           | 0     | 0     |
| 30      | Chandigarh                | 0                    | 0     | 0     | 31                                            | 62    | 93     | 152                         | 473   | 625   |
| 31      | Dadra & Nagar Haveli      | 0                    | 0     | 0     | 95                                            | 24    | 119    | 0                           | 0     | 0     |
| 32      | Daman & Diu               | 0                    | 0     | 0     | 0                                             | 0     | 0      | 0                           | 0     | 0     |
| 33      | Delhi                     | 138                  | 32    | 170   | 1731                                          | 840   | 2571   | 167                         | 446   | 613   |
| 34      | Lakshadweep               | 0                    | 0     | 0     | 0                                             | 0     | 0      | 0                           | 0     | 0     |
| 35      | Puducherry                | 10                   | 7     | 17    | 0                                             | 0     | 0      | 18                          | 12    | 30    |
| INDIA   |                           | 8762                 | 2699  | 11461 | 85297                                         | 39705 | 125002 | 12972                       | 12724 | 25696 |

**Enrolment (Excluding Open Universities) By Level/Courses (All Categories of Students)**

| Sl. No. | States/UTs                | POST GRADUATE DEGREE |       |       |        |       |       |
|---------|---------------------------|----------------------|-------|-------|--------|-------|-------|
|         |                           | LAW                  |       |       | OTHERS |       |       |
|         |                           | Boys                 | Girls | Total | Boys   | Girls | Total |
| 1       | Andhra Pradesh            | 314                  | 123   | 437   | 56     | 20    | 76    |
| 2       | Arunachal Pradesh         | 0                    | 0     | 0     | 0      | 0     | 0     |
| 3       | Assam                     | 196                  | 208   | 404   | 42     | 48    | 90    |
| 4       | Bihar                     | 76                   | 54    | 130   | 1597   | 586   | 2183  |
| 5       | Chhattisgarh              | 207                  | 40    | 247   | 184    | 218   | 402   |
| 6       | Goa                       | 0                    | 0     | 0     | 3      | 6     | 9     |
| 7       | Gujarat                   | 681                  | 307   | 988   | 7319   | 5347  | 12666 |
| 8       | Haryana                   | 104                  | 57    | 161   | 276    | 300   | 576   |
| 9       | Himachal Pradesh          | 16                   | 36    | 52    | 170    | 115   | 285   |
| 10      | Jammu & Kashmir           | 387                  | 183   | 570   | 99     | 100   | 199   |
| 11      | Jharkhand                 | 32                   | 5     | 37    | 272    | 0     | 272   |
| 12      | Karnataka                 | 46                   | 26    | 72    | 313    | 92    | 405   |
| 13      | Kerala                    | 168                  | 205   | 373   | 157    | 161   | 318   |
| 14      | Madhya Pradesh            | 370                  | 164   | 534   | 0      | 0     | 0     |
| 15      | Maharashtra               | 1806                 | 1197  | 3003  | 2140   | 1022  | 3162  |
| 16      | Manipur                   | 12                   | 12    | 24    | 41     | 60    | 101   |
| 17      | Meghalaya                 | 371                  | 241   | 612   | 21     | 29    | 50    |
| 18      | Mizoram                   | 0                    | 0     | 0     | 50     | 47    | 97    |
| 19      | Nagaland                  | 0                    | 0     | 0     | 0      | 0     | 0     |
| 20      | Odisha                    | 52                   | 25    | 77    | 4347   | 2883  | 7230  |
| 21      | Punjab                    | 150                  | 73    | 223   | 175    | 205   | 380   |
| 22      | Rajasthan                 | 271                  | 134   | 405   | 252    | 145   | 397   |
| 23      | Sikkim                    | 81                   | 27    | 108   | 0      | 0     | 0     |
| 24      | Tamil Nadu                | 237                  | 113   | 350   | 775    | 865   | 1640  |
| 25      | Tripura                   | 188                  | 128   | 316   | 368    | 250   | 618   |
| 26      | Uttar Pradesh             | 1193                 | 172   | 1365  | 6251   | 2346  | 8597  |
| 27      | Uttarakhand               | 42                   | 26    | 68    | 78     | 48    | 126   |
| 28      | West Bengal               | 443                  | 357   | 800   | 667    | 470   | 1137  |
| 29      | Andaman & Nicobar Islands | 0                    | 0     | 0     | 19     | 9     | 28    |
| 30      | Chandigarh                | 25                   | 21    | 46    | 33     | 153   | 186   |
| 31      | Dadra & Nagar Haveli      | 0                    | 0     | 0     | 0      | 0     | 0     |
| 32      | Daman & Diu               | 0                    | 0     | 0     | 0      | 0     | 0     |
| 33      | Delhi                     | 115                  | 71    | 186   | 2891   | 154   | 3045  |
| 34      | Lakshadweep               | 0                    | 0     | 0     | 0      | 0     | 0     |
| 35      | Puducherry                | 31                   | 6     | 37    | 119    | 36    | 155   |
|         | INDIA                     | 7614                 | 4011  | 11625 | 28715  | 15715 | 44430 |

**Enrolment (Excluding Open Universities) By Level/Courses (All Categories of Students)**

| Sl. No. | States/UTs                | UNDER GRADUATE DEGREE |         |         |          |        |         |         |        |         |
|---------|---------------------------|-----------------------|---------|---------|----------|--------|---------|---------|--------|---------|
|         |                           | ARTS                  |         |         | COMMERCE |        |         | SCIENCE |        |         |
|         |                           | Boys                  | Girls   | Total   | Boys     | Girls  | Total   | Boys    | Girls  | Total   |
| 1       | Andhra Pradesh            | 65091                 | 33922   | 99013   | 138544   | 78317  | 216861  | 221245  | 115567 | 336812  |
| 2       | Arunachal Pradesh         | 4953                  | 4284    | 9237    | 439      | 199    | 638     | 363     | 362    | 725     |
| 3       | Assam                     | 87351                 | 58221   | 145572  | 14316    | 2392   | 16708   | 26170   | 5362   | 31532   |
| 4       | Bihar                     | 269420                | 144702  | 414122  | 49287    | 10013  | 59300   | 112037  | 39858  | 151895  |
| 5       | Chhattisgarh              | 52520                 | 43017   | 95537   | 17174    | 14342  | 31516   | 12540   | 13659  | 26199   |
| 6       | Goa                       | 1116                  | 3180    | 4296    | 3363     | 4804   | 8167    | 1660    | 2052   | 3712    |
| 7       | Gujarat                   | 87120                 | 94963   | 182083  | 69521    | 48481  | 118002  | 33643   | 26245  | 59888   |
| 8       | Haryana                   | 89072                 | 91407   | 180479  | 19809    | 17312  | 37121   | 9802    | 9784   | 19586   |
| 9       | Himachal Pradesh          | 20760                 | 30237   | 50997   | 5280     | 3189   | 8469    | 6487    | 8572   | 15059   |
| 10      | Jammu & Kashmir           | 48540                 | 43052   | 91592   | 1491     | 1261   | 2752    | 6531    | 6152   | 12683   |
| 11      | Jharkhand                 | 61297                 | 35268   | 96565   | 24475    | 10774  | 35249   | 18961   | 8443   | 27404   |
| 12      | Karnataka                 | 81795                 | 77122   | 158917  | 48505    | 41399  | 89904   | 20998   | 27592  | 48590   |
| 13      | Kerala                    | 26505                 | 53536   | 80041   | 15770    | 19733  | 35503   | 18479   | 45922  | 64401   |
| 14      | Madhya Pradesh            | 138406                | 144938  | 283344  | 60564    | 44663  | 105227  | 66615   | 52863  | 119478  |
| 15      | Maharashtra               | 293778                | 287640  | 581418  | 191605   | 160731 | 352336  | 173336  | 89750  | 2630 86 |
| 16      | Manipur                   | 7047                  | 5997    | 13044   | 769      | 499    | 1268    | 5485    | 3953   | 9438    |
| 17      | Meghalaya                 | 10748                 | 14980   | 25728   | 1729     | 781    | 2510    | 1758    | 1550   | 3308    |
| 18      | Mizoram                   | 3137                  | 3058    | 6195    | 217      | 171    | 388     | 1142    | 549    | 1691    |
| 19      | Nagaland                  | 9793                  | 8984    | 18777   | 1926     | 1085   | 3011    | 1001    | 651    | 1652    |
| 20      | Odisha                    | 87720                 | 32777   | 120497  | 27342    | 4659   | 32001   | 32242   | 8953   | 41195   |
| 21      | Punjab                    | 51359                 | 68287   | 119646  | 10908    | 10777  | 21685   | 7123    | 14114  | 21237   |
| 22      | Rajasthan                 | 143520                | 104944  | 248464  | 33724    | 17214  | 50938   | 25833   | 20343  | 46176   |
| 23      | Sikkim                    | 1775                  | 2233    | 4008    | 294      | 209    | 503     | 370     | 247    | 617     |
| 24      | Tamil Nadu                | 117386                | 106285  | 223671  | 58811    | 57726  | 116537  | 116194  | 118351 | 234545  |
| 25      | Tripura                   | 11594                 | 10384   | 21978   | 1330     | 105    | 1435    | 1651    | 944    | 2595    |
| 26      | Uttar Pradesh             | 633341                | 487947  | 1121288 | 113776   | 60800  | 174576  | 192255  | 94378  | 2866 33 |
| 27      | Uttarakhand               | 23286                 | 39709   | 62995   | 12630    | 7904   | 20534   | 9223    | 8946   | 18169   |
| 28      | West Bengal               | 291399                | 275626  | 567025  | 67442    | 22019  | 89461   | 60207   | 38818  | 99025   |
| 29      | Andaman & Nicobar Islands | 807                   | 1056    | 1863    | 268      | 197    | 465     | 137     | 200    | 337     |
| 30      | Chandigarh                | 11691                 | 9039    | 20730   | 4162     | 4602   | 8764    | 2054    | 4247   | 6301    |
| 31      | Dadra & Nagar Haveli      | 79                    | 86      | 165     | 398      | 319    | 717     | 309     | 223    | 532     |
| 32      | Daman & Diu               | 81                    | 147     | 228     | 86       | 60     | 146     | 23      | 25     | 48      |
| 33      | Delhi                     | 19042                 | 25613   | 44655   | 44655    | 9731   | 54386   | 28926   | 13226  | 42152   |
| 34      | Lakshadweep               | 37                    | 93      | 130     | 51       | 59     | 110     | 28      | 37     | 65      |
| 35      | Puducherry                | 5819                  | 8114    | 13933   | 737      | 1338   | 2075    | 1183    | 2425   | 3608    |
|         | INDIA                     | 2757385               | 2350848 | 5108233 | 1041398  | 657865 | 1699263 | 1216011 | 784363 | 2000374 |

## Enrolment (Excluding Open Universities) By Level/Courses (All Categories of Students)

| Sl. No. | States/UTs                | UNDER GRADUATE DEGREE                            |        |         |          |        |        |                      |       |       |
|---------|---------------------------|--------------------------------------------------|--------|---------|----------|--------|--------|----------------------|-------|-------|
|         |                           | ENGINEERING/ TECHNOLOGY/<br>ARCHITECTURE/ DESIGN |        |         | MEDICINE |        |        | AGRICULTURE & ALLIED |       |       |
|         |                           | Boys                                             | Girls  | Total   | Boys     | Girls  | Total  | Boys                 | Girls | Total |
| 1       | Andhra Pradesh            | 238520                                           | 117480 | 356000  | 4333     | 2447   | 6780   | 1722                 | 1471  | 3193  |
| 2       | Arunachal Pradesh         | 1332                                             | 494    | 1826    | 46       | 98     | 144    | 0                    | 0     | 0     |
| 3       | Assam                     | 2168                                             | 830    | 2998    | 1760     | 796    | 2556   | 498                  | 261   | 759   |
| 4       | Bihar                     | 7895                                             | 950    | 8845    | 7299     | 2555   | 9854   | 372                  | 36    | 408   |
| 5       | Chhattisgarh              | 15124                                            | 4306   | 19430   | 2270     | 2839   | 5109   | 3341                 | 457   | 3798  |
| 6       | Goa                       | 2087                                             | 1289   | 3376    | 359      | 997    | 1356   | 0                    | 0     | 0     |
| 7       | Gujarat                   | 67345                                            | 14414  | 81759   | 13527    | 9478   | 23005  | 2275                 | 362   | 2637  |
| 8       | Haryana                   | 91585                                            | 35475  | 127060  | 4136     | 4171   | 8307   | 580                  | 75    | 655   |
| 9       | Himachal Pradesh          | 6225                                             | 1746   | 7971    | 1110     | 1501   | 2611   | 334                  | 278   | 612   |
| 10      | Jammu & Kashmir           | 2840                                             | 1072   | 3912    | 1734     | 1765   | 3499   | 641                  | 149   | 790   |
| 11      | Jharkhand                 | 8235                                             | 2058   | 10293   | 387      | 158    | 545    | 223                  | 52    | 275   |
| 12      | Karnataka                 | 112717                                           | 65440  | 178157  | 33248    | 30012  | 63260  | 2489                 | 1160  | 3649  |
| 13      | Kerala                    | 63757                                            | 32834  | 96591   | 5327     | 11682  | 17009  | 412                  | 367   | 779   |
| 14      | Madhya Pradesh            | 35686                                            | 10353  | 46039   | 2405     | 490    | 2895   | 2062                 | 616   | 2678  |
| 15      | Maharashtra               | 182336                                           | 56710  | 239046  | 14501    | 7493   | 21994  | 8019                 | 2977  | 10996 |
| 16      | Manipur                   | 265                                              | 130    | 395     | 57       | 43     | 100    | 368                  | 237   | 605   |
| 17      | Meghalaya                 | 221                                              | 66     | 287     | 9        | 85     | 94     | 0                    | 0     | 0     |
| 18      | Mizoram                   | 0                                                | 0      | 0       | 75       | 298    | 373    | 129                  | 88    | 217   |
| 19      | Nagaland                  | 0                                                | 0      | 0       | 0        | 0      | 0      | 102                  | 83    | 185   |
| 20      | Odisha                    | 43047                                            | 6365   | 49412   | 6493     | 3297   | 9790   | 294                  | 238   | 532   |
| 21      | Punjab                    | 35901                                            | 10066  | 45967   | 2135     | 6057   | 8192   | 582                  | 193   | 775   |
| 22      | Rajasthan                 | 51654                                            | 11432  | 63086   | 8176     | 3531   | 11707  | 2406                 | 483   | 2889  |
| 23      | Sikkim                    | 1509                                             | 471    | 1980    | 370      | 287    | 657    | 0                    | 0     | 0     |
| 24      | Tamil Nadu                | 119505                                           | 61963  | 181468  | 17304    | 24392  | 41696  | 329                  | 376   | 705   |
| 25      | Tripura                   | 1265                                             | 383    | 1648    | 20       | 10     | 30     | 80                   | 48    | 128   |
| 26      | Uttar Pradesh             | 47679                                            | 11461  | 59140   | 6802     | 2922   | 9724   | 20152                | 1212  | 21364 |
| 27      | Uttarakhand               | 4819                                             | 758    | 5577    | 1344     | 418    | 1762   | 347                  | 34    | 381   |
| 28      | West Bengal               | 39201                                            | 10015  | 49216   | 8917     | 4034   | 12951  | 19022                | 2265  | 21287 |
| 29      | Andaman & Nicobar Islands | 0                                                | 0      | 0       | 0        | 0      | 0      | 0                    | 0     | 0     |
| 30      | Chandigarh                | 3834                                             | 993    | 4827    | 326      | 612    | 938    | 0                    | 0     | 0     |
| 31      | Dadra & Nagar Haveli      | 0                                                | 0      | 0       | 87       | 101    | 188    | 0                    | 0     | 0     |
| 32      | Daman & Diu               | 0                                                | 0      | 0       | 0        | 0      | 0      | 0                    | 0     | 0     |
| 33      | Delhi                     | 6613                                             | 1103   | 7716    | 1674     | 1674   | 3348   | 789                  | 260   | 1049  |
| 34      | Lakshadweep               | 0                                                | 0      | 0       | 0        | 0      | 0      | 0                    | 0     | 0     |
| 35      | Puducherry                | 6486                                             | 3111   | 9597    | 855      | 2037   | 2892   | 120                  | 64    | 184   |
|         | INDIA                     | 1199851                                          | 463768 | 1663619 | 147086   | 126280 | 273366 | 67688                | 13842 | 81530 |

## Enrolment (Excluding Open Universities) By Level/Courses (All Categories of Students)

| Sl. |                              | UNDER GRADUATE DEGREE                          |       |        |                               |        |        |        |       |        |
|-----|------------------------------|------------------------------------------------|-------|--------|-------------------------------|--------|--------|--------|-------|--------|
|     |                              | MANAGEMENT/HOTEL/<br>TRAVEL/TOURISM MANAGEMENT |       |        | EDUCATION/TEACHER<br>TRAINING |        |        | LAW    |       |        |
|     |                              | Boys                                           | Girls | Total  | Boys                          | Girls  | Total  | Boys   | Girls | Total  |
| 1   | Andhra Pradesh               | 30114                                          | 13828 | 43942  | 36622                         | 15695  | 52317  | 4812   | 2097  | 6909   |
| 2   | Arunachal Pradesh            | 0                                              | 0     | 0      | 43                            | 57     | 100    | 84     | 11    | 95     |
| 3   | Assam                        | 140                                            | 73    | 213    | 1431                          | 957    | 2388   | 5593   | 1584  | 7177   |
| 4   | Bihar                        | 890                                            | 460   | 1350   | 2665                          | 1605   | 4270   | 11722  | 2647  | 14369  |
| 5   | Chhattisgarh                 | 231                                            | 124   | 355    | 1307                          | 1599   | 2906   | 1345   | 1145  | 2490   |
| 6   | Goa                          | 545                                            | 551   | 1096   | 26                            | 209    | 235    | 340    | 392   | 732    |
| 7   | Gujarat                      | 11189                                          | 6058  | 17247  | 23327                         | 20443  | 43770  | 6394   | 3737  | 10131  |
| 8   | Haryana                      | 17681                                          | 5384  | 23065  | 25973                         | 31566  | 57539  | 2835   | 980   | 3815   |
| 9   | Himachal Pradesh             | 1094                                           | 578   | 1672   | 1530                          | 5407   | 6937   | 723    | 408   | 1131   |
| 10  | Jammu & Kashmir              | 719                                            | 355   | 1074   | 23345                         | 15192  | 38537  | 996    | 588   | 1584   |
| 11  | Jharkhand                    | 623                                            | 345   | 968    | 335                           | 478    | 813    | 1624   | 217   | 1841   |
| 12  | Karnataka                    | 10932                                          | 5394  | 16326  | 4534                          | 4828   | 9362   | 5477   | 1419  | 6896   |
| 13  | Kerala                       | 1565                                           | 1624  | 3189   | 450                           | 2867   | 3317   | 1261   | 1675  | 2936   |
| 14  | Madhya Pradesh               | 671                                            | 523   | 1194   | 6829                          | 7257   | 14086  | 17147  | 5016  | 22163  |
| 15  | Maharashtra                  | 5917                                           | 2267  | 8184   | 26829                         | 30254  | 57083  | 19177  | 12986 | 32163  |
| 16  | Manipur                      | 22                                             | 19    | 41     | 319                           | 485    | 804    | 320    | 177   | 497    |
| 17  | Meghalaya                    | 314                                            | 253   | 567    | 360                           | 280    | 640    | 435    | 370   | 805    |
| 18  | Mizoram                      | 0                                              | 0     | 0      | 51                            | 120    | 171    | 121    | 77    | 198    |
| 19  | Nagaland                     | 10                                             | 3     | 13     | 117                           | 160    | 277    | 242    | 126   | 368    |
| 20  | Odisha                       | 5632                                           | 2085  | 7717   | 442                           | 258    | 700    | 4374   | 868   | 5242   |
| 21  | Punjab                       | 247                                            | 41    | 288    | 1361                          | 3779   | 5140   | 196    | 85    | 281    |
| 22  | Rajasthan                    | 870                                            | 647   | 1517   | 23916                         | 22479  | 46395  | 6881   | 2060  | 8941   |
| 23  | Sikkim                       | 96                                             | 20    | 116    | 87                            | 111    | 198    | 128    | 157   | 285    |
| 24  | Tamil Nadu                   | 21582                                          | 19222 | 40804  | 7867                          | 13547  | 21414  | 5942   | 2544  | 8486   |
| 25  | Tripura                      | 56                                             | 35    | 91     | 198                           | 159    | 357    | 168    | 111   | 279    |
| 26  | Uttar Pradesh                | 1102                                           | 608   | 1710   | 53171                         | 19109  | 72280  | 39857  | 7895  | 47752  |
| 27  | Uttarakhand                  | 28                                             | 6     | 34     | 704                           | 1378   | 2082   | 608    | 162   | 770    |
| 28  | West Bengal                  | 2661                                           | 1540  | 4201   | 5103                          | 3413   | 8516   | 3465   | 2639  | 6104   |
| 29  | Andaman & Nicobar<br>Islands | 33                                             | 45    | 78     | 42                            | 174    | 216    | 0      | 0     | 0      |
| 30  | Chandigarh                   | 704                                            | 386   | 1090   | 362                           | 1421   | 1783   | 1339   | 730   | 2069   |
| 31  | Dadra & Nagar Haveli         | 51                                             | 17    | 68     | 33                            | 13     | 46     | 0      | 0     | 0      |
| 32  | Daman & Diu                  | 0                                              | 0     | 0      | 18                            | 142    | 160    | 0      | 0     | 0      |
| 33  | Delhi                        | 1678                                           | 914   | 2592   | 811                           | 238    | 1049   | 4774   | 1770  | 6544   |
| 34  | Lakshadweep                  | 13                                             | 30    | 43     | 0                             | 0      | 0      | 0      | 0     | 0      |
| 35  | Puducherry                   | 286                                            | 146   | 432    | 1512                          | 3090   | 4602   | 374    | 150   | 524    |
|     | INDIA                        | 117696                                         | 63581 | 181277 | 251720                        | 208770 | 460490 | 148754 | 54823 | 203577 |

**Enrolment (Excluding Open Universities) By Level/Courses (All Categories of Students)**

| Sl. No. | States/UTs                | POST GRADUATE DIPLOMA |       |        |
|---------|---------------------------|-----------------------|-------|--------|
|         |                           | Boys                  | Girls | Total  |
| 1       | Andhra Pradesh            | 1142                  | 755   | 1897   |
| 2       | Arunachal Pradesh         | 448                   | 131   | 579    |
| 3       | Assam                     | 643                   | 439   | 1082   |
| 4       | Bihar                     | 916                   | 298   | 1214   |
| 5       | Chhattisgarh              | 794                   | 368   | 1162   |
| 6       | Goa                       | 7                     | 32    | 39     |
| 7       | Gujarat                   | 3335                  | 3530  | 6865   |
| 8       | Haryana                   | 380                   | 731   | 1111   |
| 9       | Himachal Pradesh          | 22                    | 24    | 46     |
| 10      | Jammu & Kashmir           | 230                   | 104   | 334    |
| 11      | Jharkhand                 | 20                    | 5     | 25     |
| 12      | Karnataka                 | 2852                  | 1302  | 4154   |
| 13      | Kerala                    | 216                   | 89    | 305    |
| 14      | Madhya Pradesh            | 121                   | 20    | 141    |
| 15      | Maharashtra               | 5386                  | 5020  | 10406  |
| 16      | Manipur                   | 81                    | 22    | 103    |
| 17      | Meghalaya                 | 0                     | 0     | 0      |
| 18      | Mizoram                   | 0                     | 0     | 0      |
| 19      | Nagaland                  | 0                     | 0     | 0      |
| 20      | Odisha                    | 570                   | 199   | 769    |
| 21      | Punjab                    | 120                   | 1360  | 1480   |
| 22      | Rajasthan                 | 0                     | 7     | 7      |
| 23      | Sikkim                    | 0                     | 0     | 0      |
| 24      | Tamil Nadu                | 0                     | 0     | 0      |
| 25      | Tripura                   | 0                     | 0     | 0      |
| 26      | Uttar Pradesh             | 1078                  | 735   | 1813   |
| 27      | Uttarakhand               | 34                    | 38    | 72     |
| 28      | West Bengal               | 2317                  | 1082  | 3399   |
| 29      | Andaman & Nicobar Islands | 0                     | 0     | 0      |
| 30      | Chandigarh                | 679                   | 648   | 1327   |
| 31      | Dadra & Nagar Haveli      | 0                     | 0     | 0      |
| 32      | Daman & Diu               | 0                     | 0     | 0      |
| 33      | Delhi                     | 40168                 | 27515 | 67683  |
| 34      | Lakshadweep               | 0                     | 0     | 0      |
| 35      | Puducherry                | 605                   | 402   | 1007   |
| INDIA   |                           | 62164                 | 44856 | 107020 |



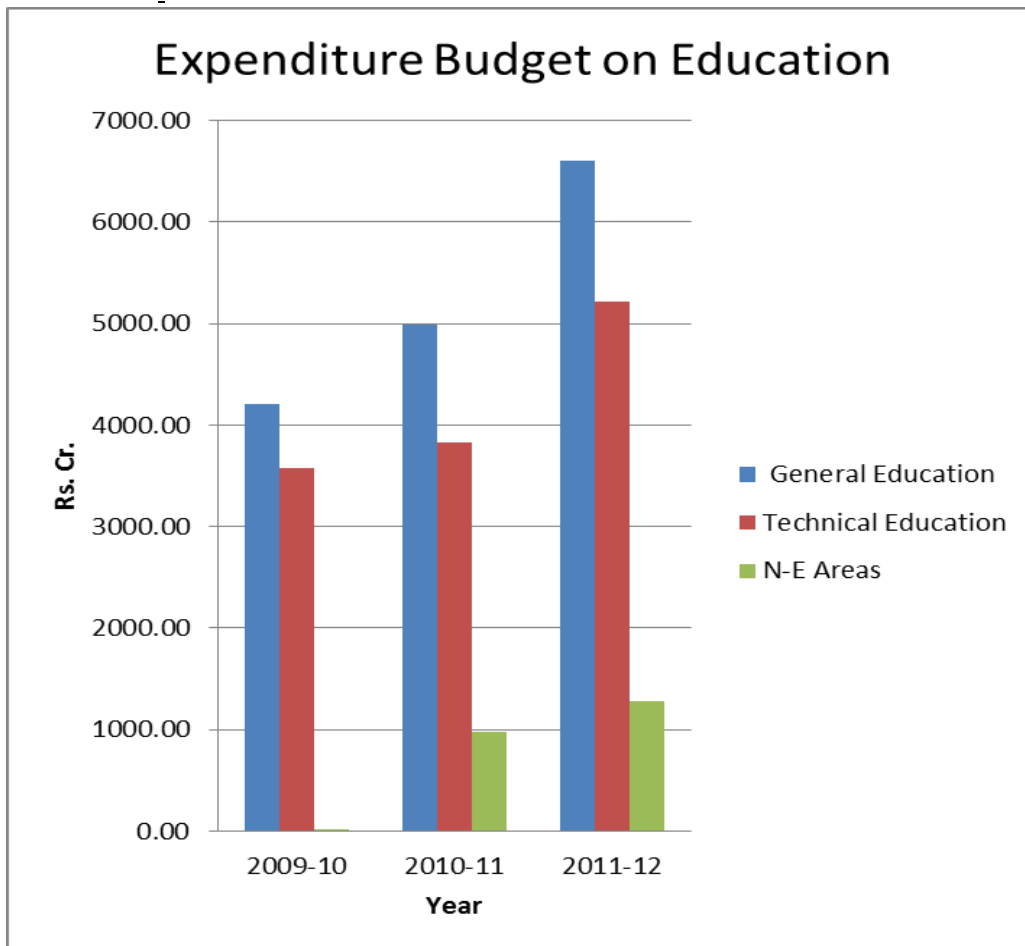
**Pupil Teacher Ratio In Higher Education**

| Sl. No. | States/UTs                | Number of Teachers* | ENROLMENT** |         |          | Pupil Teacher Ratio |
|---------|---------------------------|---------------------|-------------|---------|----------|---------------------|
|         |                           |                     | Boys        | Girls   | Total    |                     |
| 1       | 2                         | 3                   | 4           | 5       | 6        | 7                   |
| 1       | Andhra Pradesh            | 79049               | 827391      | 427288  | 1254679  | 16                  |
| 2       | Arunachal Pradesh         | 559                 | 9194        | 6664    | 15858    | 28                  |
| 3       | Assam                     | 15417               | 149489      | 77161   | 226650   | 15                  |
| 4       | Bihar                     | 24099               | 515021      | 227265  | 742286   | 31                  |
| 5       | Chhattisgarh              | 9296                | 138612      | 132555  | 271167   | 29                  |
| 6       | Goa                       | 1671                | 10171       | 14671   | 24842    | 15                  |
| 7       | Gujarat                   | 20207               | 392500      | 285928  | 678428   | 34                  |
| 8       | Haryana                   | 19552               | 268409      | 205489  | 473898   | 24                  |
| 9       | Himachal Pradesh          | 5547                | 49800       | 57442   | 107242   | 19                  |
| 10      | Jammu & Kashmir           | 4882                | 95064       | 78784   | 173848   | 36                  |
| 11      | Jharkhand                 | 8656                | 127461      | 64286   | 191747   | 22                  |
| 12      | Karnataka                 | 63743               | 356339      | 282667  | 639006   | 10                  |
| 13      | Kerala                    | 26194               | 142017      | 189061  | 331078   | 13                  |
| 14      | Madhya Pradesh            | 25128               | 380086      | 310869  | 690955   | 27                  |
| 15      | Maharashtra               | 76602               | 1080657     | 780787  | 1861444  | 24                  |
| 16      | Manipur                   | 3348                | 16199       | 12995   | 29194    | 9                   |
| 17      | Meghalaya                 | 2892                | 17212       | 20218   | 37430    | 13                  |
| 18      | Mizoram                   | 906                 | 5565        | 5290    | 10855    | 12                  |
| 19      | Nagaland                  | 1741                | 14568       | 12304   | 26872    | 15                  |
| 20      | Odisha                    | 22086               | 242146      | 76214   | 318360   | 14                  |
| 21      | Punjab                    | 20867               | 128154      | 140185  | 268339   | 13                  |
| 22      | Rajasthan                 | 27627               | 329773      | 213851  | 543624   | 20                  |
| 23      | Sikkim                    | 234                 | 4984        | 3917    | 8901     | 38                  |
| 24      | Tamil Nadu                | 77270               | 566023      | 484163  | 1050186  | 14                  |
| 25      | Tripura                   | 1253                | 18121       | 13571   | 31692    | 25                  |
| 26      | Uttar Pradesh             | 67007               | 1306632     | 815827  | 2122459  | 32                  |
| 27      | Uttarakhand               | 4750                | 62886       | 71487   | 134373   | 28                  |
| 28      | West Bengal               | 24650               | 543623      | 392102  | 935725   | 38                  |
| 29      | Andaman & Nicobar Islands | 134                 | 1358        | 1810    | 3168     | 24                  |
| 30      | Chandigarh                | 2536                | 29449       | 30434   | 59883    | 24                  |
| 31      | Dadra & Nagar Haveli      |                     | 1052        | 783     | 1835     | 0                   |
| 32      | Daman & Diu               | 36                  | 208         | 374     | 582      | 16                  |
| 33      | Delhi                     | 11555               | 173993      | 95768   | 269761   | 23                  |
| 34      | Lakshadweep               | 14                  | 132         | 242     | 374      | 27                  |
| 35      | Puducherry                | 3157                | 18866       | 21420   | 40286    | 13                  |
|         | INDIA                     | 652665              | 8023155     | 5553872 | 13577027 | 21                  |

\*- Data has been taken from UGC for the year 2007-08

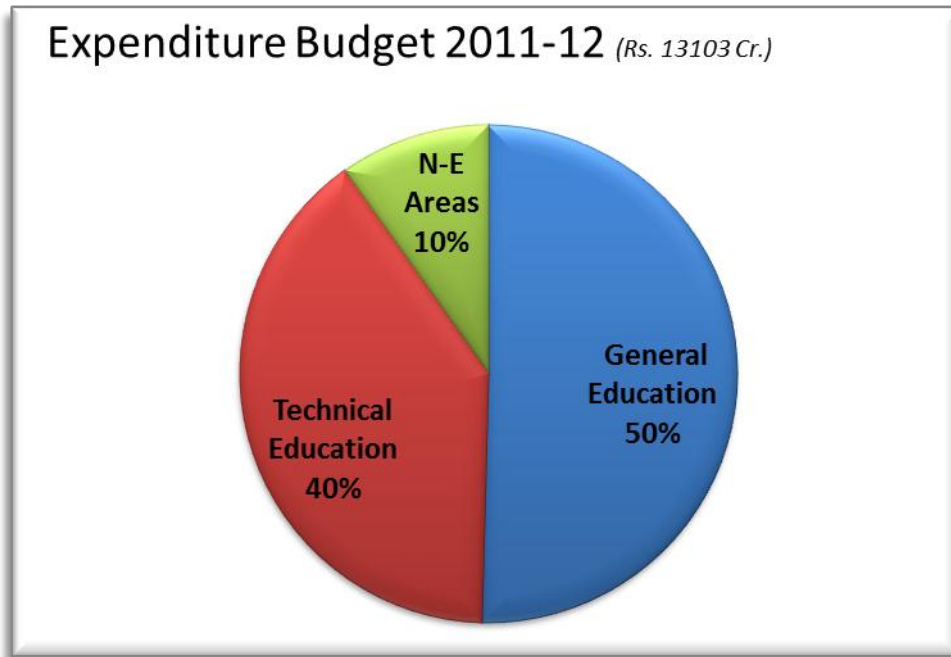
\*\*- Excluding enrolment in Open Universities &amp; Polytechnics (Post School Diploma)

**Expenditure on Higher Education by Ministry of Human Resource**  
**Development, Department of higher Education**



*Indiabudget.com*

Major components/split of the budget



*Indiabudget.com*

The above graphs provide a basic idea about the distribution of expenditure in technical and non-technical areas. Reasonably good amount of expenditure is incurred for the overall development of S&T and education in the North Easter States which is about 10% of the total expenditure.

**HRD Schemes of DST**

| Scheme                                                                                         | For                                                                                                                                                           | Support                                                                                                                              |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| JC Bose National Fellowships                                                                   | active scientists and engineers for their outstanding performance and contributions                                                                           | Rs. 20,000 per month in addition to the Fellow' s regular income. In addition, it carries a research grant of Rs.5.00 lakh per annum |
| Ramanujan Fellowships                                                                          | Brilliant scientists and engineers from all over the world to take up scientific research positions in India                                                  | Rs.75,000 per month for the first 3 years and Rs.60,000 per month during the last two years.                                         |
| SwarnaJayanti Fellowship Scheme                                                                | Outstanding young scientists upto 40 years as recognition of the research work done by them in Science & Engineering                                          | fellowship of Rs.25,000/p.m. is provided under the scheme apart from the salary drawn by the fellow from his institute               |
| FAST track scheme for Young Scientists                                                         | Young Scientists to take up R&D in innovative and challenging areas                                                                                           | Fellowship of Rs. 20,000 per month apart from grants under travel, contingency, consumables and minor equipments                     |
| Better Opportunities for Young Scientists in Chosen Areas of Science and Technology (BOYSCAST) | young Indian scientists/technologists below the age of 35 years                                                                                               | Fellowship amountof US \$ 3000 per month, air fare, and one time contingency grant of Rs.15,000/-                                    |
| The Kishore VaigyanikProtsahanYojana (KVPY)                                                    | School students after 10 <sup>th</sup><br><br>During BSc<br><br>Integrated MSc                                                                                | Rs 4000/mth, Rs 16,000 cont./annum<br><br>Rs 5000/mth, Rs 20,000 cont./annum<br><br>Rs 7000/mth, Rs 28,000 cont./annum               |
| Science Olympiad Programmes                                                                    | Promote excellence in science among pre-university students and selecting teams to represent India at respective International Olympiads                      |                                                                                                                                      |
| Assistance for Participation in International Conference                                       | Scientists working in educational/academic institutions and National R&D laboratories enabling them to participate in the International Conferences/Workshops | Travel grants to participate in International Conferences/Workshops, training Programmes                                             |
| Training programmes/workshops                                                                  | Research students, teachers and personnel from academic institutions, R&D labs and industries                                                                 |                                                                                                                                      |
| Utilization of Scientific Expertise of Retired Scientists (USERS)                              | Retired eminent scientists                                                                                                                                    | Honorarium of 15,000/month                                                                                                           |

| Scheme                                                                                                                                                                                                                                     | For                                                                                                                                                                                                                                                                                                                                                                                        | Support                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FIST” - Fund for improvement of S&T infrastructures                                                                                                                                                                                        | universities and higher educational institutions                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                            |
| PURSE PROGRAMME                                                                                                                                                                                                                            | Universities<br>Research fellowships are available under this special scheme                                                                                                                                                                                                                                                                                                               | MSc; the first two years @Rs.14,000/- p.m. + HRA for the third year (JRF and SRF)<br><br>M.E./M.Tech./M.Arch./M.Plan. @Rs.14,000/- p.m. + HRA for the first two years @Rs.15,000/- p.m. + HRA for the third year (JRF and SRF)<br><br>Fellowship in Science, Engineering & Technology i) B.E./B.Tech./B.Arch. ii) M.Sc./M.Phil. @Rs. 8,000/- p.m. consolidated for 3 years |
| INDIA-UK Science Bridges Awards & Next Generation Network                                                                                                                                                                                  | Scientists of UK and India                                                                                                                                                                                                                                                                                                                                                                 | Up to £4m (at 80% full economic cost) is available from RCUK to support Science Bridge Awards in each of 3 countries (USA, China, India). Up to £4m is available from DST to support partner bids in India and a parallel submission and review process will operate.                                                                                                      |
|                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                            |
| INSPIRE Program (For attraction of talent to science)<br><br>a) Scheme for Early Attraction of Talents for Science (SEATS),<br><br>b) Scholarship for Higher Education (SHE) and<br><br>c) Assured Opportunity for Research Careers (AORC) | Two lakh school children in the age-group of 10 to 15 years i.e., 6th to 10th standards are being identified for the INSPIRE Award.<br><br>For undertaking Bachelor and Masters level education in the Natural & Basic sciences<br><br>Doctoral studies and opening up partnerships with private sector for topping the Government's efforts in nurturing talents for scientific research. | Each INSPIRE Award envisions an investment of Rs.5,000/- per child<br><br>10,000 scholarships every year @ Rs.80,000/- each<br><br>INSPIRE JRFs and SRFs                                                                                                                                                                                                                   |

### HRD Schemes of CSIR

| Scheme                                                                                                                                            | For                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Support                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Junior Research Fellowships (JRF) through CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Eligibility for lectureship | MSc or equivalent degree holders with minimum 55% marks to pursue PhD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Rs 16000/ p.m.+HRA for the first two years and Rs. 18000/ p.m.+HRA for the next three years on up-gradation of the fellowship to Senior Research Fellowship (SRF). In addition, annual contingent grant of Rs. 20,000/- per fellow is also provided.                                                                                                                                                                                                                                              |
| Shyama Prasad Mukherjee Fellowship (SPMF)                                                                                                         | Nurturing the budding scientific talent and to nourish the objective of pursuit of scientific research. The following candidates are eligible to be considered for the SPM fellowships <ul style="list-style-type: none"> <li>• top 15 rankers of CSIR-UGC NET from June and December exam of preceding year,</li> <li>• top 5 GATE score holders in the subject area of NET of the current year</li> <li>• top 3 students in each of the above disciplines of integrated MS programme of IISERs, of the current year.</li> <li>• IIT graduates of current year with CGPA 9.5 &amp; above</li> <li>• B.Tech students of IIT who have completed 3<sup>rd</sup> year with 9.5 CGPA &amp; above</li> </ul> | Stipend Rs.20000/- + HRA per month during the first two years, may be raised to Rs.24000/- + HRA per month from third year onwards on the basis evaluation of research work by SPM Core Committee. In addition, an annual contingency grant of Rs.70000/- p.a. per fellow is also provided.                                                                                                                                                                                                       |
| JRF-GATE Fellowship                                                                                                                               | Promoting higher studies leading to PhD in Engineering and Pharmaceutical Sciences. The candidates possessing the following qualifications are eligible:<br><br>Fresh BE/ B Tech degree holders with valid GATE score.<br><br>OR<br><br>Those who are starting the thesis semester of ME/ MTech programme and having valid GATE score and desirous of pursuing PhD.                                                                                                                                                                                                                                                                                                                                     | Rs 16000/ p.m.+HRA for the first two years and Rs. 18000/ p.m.+HRA for next three years on up-gradation of the fellowship to Senior Research Fellowship (SRF). In addition, annual contingent grant of Rs. 20,000/- per fellow is provided. The fellowship is tenable in CSIR laboratories.                                                                                                                                                                                                       |
| Senior Research Fellowship (SRF-Direct)                                                                                                           | Candidates having M.Sc./BE/B.Tech. or equivalent degree with at least 55% marks & one publication in SCI Journal and should have completed at least 2 years of post M.Sc. /BE/B.Tech. research experience;<br><br>OR<br><br>ME/ M.Tech or equivalent degree in engineering/technology with at least 60% marks;<br><br>OR<br><br>B.Tech./ B.E. or equivalent degree with at least 60% marks and 2 years of research experience;<br><br>OR<br><br>MBBS/BDS or equivalent degree with at least 60% marks and one year of internship;<br><br>OR                                                                                                                                                             | Rs. 18000/-p.m.+HRA to SRF having master degree in basic sciences and graduate degree in professional courses for three years. Rs. 18000/ p.m. to SRF having master degrees in professional courses for first two years and Rs. 20000/- p.m.+ HRA after two years. In addition, annual contingency grant of Rs. 20,000/- per fellow is provided. (Tenure of fellowship is 4 years for candidates possessing professional degrees, and 3 years for those having master degrees in basic sciences). |

| Scheme                                                               | For                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Support                                                                                                                                                            |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                      | <p>B.Pharm/ BVSc/ B.Sc(Ag) or equivalent degree with at least 55% marks and one publication in SCI Journal and should have completed at least 3 years of research experience;</p> <p style="text-align: center;">OR</p> <p>MVSc/MSc(Ag) or equivalent degree with at least 55% marks and one publication in SCI Journal and should have at least one year of research experience;</p> <p style="text-align: center;">OR</p> <p>M Pharm. or equivalent degree with at least 55% marks and one publication in SCI Journal and should have at least one year research experience;</p> <p style="text-align: center;">OR</p> <p>M Pharm or equivalent degree in pharmaceutical sciences with at least 60% marks.</p> |                                                                                                                                                                    |
| <b>Senior Research Fellowship (SRF)-Extended</b>                     | meritorious candidates who have submitted their PhD thesis and are awaiting the award of PhD degree.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The fellowship tenure is one year only. A fellowship amount of Rs. 20000/-p.m.+ HRA and annual contingent grant of Rs. 20,000/- per fellow is provided.            |
| <b>CSIR Research Associateship (RA)</b>                              | young research workers who have shown promise in original research and propose to pursue research work in science, engineering, medicine or technology on specific projects and possessing PhD/MD/MS/MDS or equivalent degree or having 3 years of research, teaching and design and development experience after MVSc/MPharm/ME/MTech.                                                                                                                                                                                                                                                                                                                                                                          | A fellowship amount of Rs. 22000/-p.m. or Rs. 23000/-p.m. or Rs. 24000/- p.m. +HRA and annual contingent grant of Rs. 20,000/- per fellow is provided.             |
| <b>CSIR-Nehru Science Postdoctoral Research Fellowship Scheme</b>    | promising young researchers with innovative ideas, and to provide them with training and research opportunities in niche areas of basic science, engineering, medicine and agriculture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Rs. 35,000/- per month plus House Rent Allowance (HRA) as admissible and a contingency grant of Rs. 3.0 lakh per annum for two years, extendable for one more year |
| <b>Senior Research Associateship (SRA) (Scientist's Pool Scheme)</b> | Qualified Indian scientists, engineers, technologists, and medical personnel, who are not holding any employment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Basic pay of a SRA is fixed between Rs. 21,000/- and 25,810/- per month, with Contingent Grant of Rs.20000 per annum                                               |
| <b>CSIR Research Grants</b>                                          | Promoting research work in the fields of Science & Technology, including Agriculture, Engineering and Medicine. The assistance is provided by way of grants to Professors/Experts in regular employment, in the universities, IITs, post-graduate institutions, recognised R&D laboratories both in public and private sectors to pursue state-of-art R&D.                                                                                                                                                                                                                                                                                                                                                       | Support is provided in the form of contingency, equipments grant, and manpower in the form of JRF, SRF and RA.                                                     |

| Scheme                                                                                                           | For                                                                                                                                                                                                                                                                                                                                                                                  | Support                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                  | Promoting scientific interaction between CSIR laboratories and universities/R&D institutions through research projects sponsored by CSIR laboratories and tenable in universities and R&D institutions.                                                                                                                                                                              |                                                                                                                                                                                                                                                                                |
| <b>Emeritus Scientist</b>                                                                                        | Superannuated outstanding scientists                                                                                                                                                                                                                                                                                                                                                 | Grant consists of (i) honorarium of Rs.20,000/- p.m. to the Emeritus Scientist (ES) for the duration of his/her tenure, (ii) suitable contingent grant per annum, and (iii) technical assistance in the form of research fellows/associates.                                   |
| <b>Visiting Associateship</b>                                                                                    | Middle level scientists from universities/R&D institutions                                                                                                                                                                                                                                                                                                                           | TA&DA for two visits to a CSIR lab for maximum of 60 days in a year for 3 years                                                                                                                                                                                                |
| <b>Indian Language Journal</b>                                                                                   | Only journals brought out in Indian languages with the sole objective of popularizing science                                                                                                                                                                                                                                                                                        | Rs. 10,000/- and Rs. 1,00,000/- per annum                                                                                                                                                                                                                                      |
| <b>Travel Grant</b>                                                                                              | Young Indian Researchers working in an academic or research institution in India for participating in Conferences, Symposia, etc. held abroad                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                |
| <b>Grant for Holding Symposium/Seminar</b>                                                                       | Bonafide societies/associations of scientists and engineers, academic and R&D institutions are eligible                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                |
| <b>CSIR Young Scientist Awards</b>                                                                               | Promoting in-house excellence in science and engineering. The awards are given in five disciplines: (1) Biological, (2) Chemical, (3) Earth, Atmosphere, Ocean and Planetary, (4) Engineering, and (5) Physical Sciences (including instrumentation).                                                                                                                                | The award carries a cash prize of Rs 50000/- , citation and a plaque. An honorarium of Rs, 75,00/- p.m. is also given till the age of 45 years. Awardees are also entitled for a research grant of Rs. 5,00,000/- p.a. for a period of 5 years.                                |
| <b>Shanti Swarup Bhatnagar Prize (SSB) for science &amp; technology</b>                                          | Outstanding contributions to science and technology, applied or fundamental made through work done primarily in India during the five years preceding the year of the Prize. The awards are given in the following disciplines: (1) Biological, (2) Chemical, (3) Earth, Atmosphere, Ocean and Planetary, (4) Engineering, (5) Mathematical, (6) Medical, and (7) Physical Sciences. | The award carries a cash prize of Rs 5,00,000/-, citation and a plaque. An honorarium of Rs, 15,000/- p.m. is also given till superannuation.                                                                                                                                  |
| <b>Prof GN Ramachandran Gold Medal for Excellence in Biological Sciences &amp; Technology</b>                    | Recognition of outstanding work in the interdisciplinary subject/field of Biological Sciences & Technology.                                                                                                                                                                                                                                                                          | A Gold Medal and a citation are presented to the recipient on CSIR Foundation Day.                                                                                                                                                                                             |
| <b>Technology Led Entrepreneurship Programme (TLEP) for Research Scholars:</b>                                   | Inculcating the spirit of technological entrepreneurship in research scholars.                                                                                                                                                                                                                                                                                                       | Research scholars are provided first hand information on elements of entrepreneurship, formulation of business plan, IPR, team work etc. to enable them to learn how to take knowledge based innovation through a commercial outcome, managing all the major steps on the way. |
| Details of the HRD Schemes of CSIR can be seen on <a href="http://www.csirhrdg.res.in">www.csirhrdg.res.in</a> . |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                |



**HRD Schemes of Department of Atomic Energy**

| Scheme                                                                                                                                                                                                                                                                                                                                                                                       | For                                                                                                                                                                                                | Support                                                                                                                                                     |
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| Department of Atomic energy<br>(Excellence in science, engineering and<br>technology) awards<br>1. Young Scientist Award 50<br>2. Young Engineer Award 50<br>3. Young Applied Scientist/<br>technologist Award 50<br>4. Homi Bhabha Science &<br>Technology Award<br>5. Scientific & Technical<br>Excellence Award 50<br>6. Special Contributions Award<br>100<br>7. Group Achievement Award | < 35 years<br>< 35 years<br>< 35 years<br>< 50 years<br>< 50 years<br>Any Number                                                                                                                   | Rs. 50,000/- each<br>Rs. 50,000/- each<br>Rs. 50,000/- each<br>10 Rs. 5 Lakh each<br>Rs.1 Lakh each<br>Upto a maximum of<br>Rs.50,000/- each<br>Rs. 50 lakh |
| Training Schools                                                                                                                                                                                                                                                                                                                                                                             | Orientation Course for Engineering<br>Graduates & Science Post-Graduates (OCES)<br>and DAE Graduate Fellowship Scheme (DGFS)                                                                       |                                                                                                                                                             |
| AMD studentship programme                                                                                                                                                                                                                                                                                                                                                                    | M.Sc./M.Tech. students of different<br>Universities                                                                                                                                                |                                                                                                                                                             |
| 1-year Pre-Doctoral Course followed by<br>a Ph.D. programme                                                                                                                                                                                                                                                                                                                                  | Postgraduate students                                                                                                                                                                              |                                                                                                                                                             |
| Clinical Training Programme                                                                                                                                                                                                                                                                                                                                                                  | M.D. and M.Sc. students                                                                                                                                                                            |                                                                                                                                                             |
| Associateship Programme and<br>Refresher Courses                                                                                                                                                                                                                                                                                                                                             | College teachers                                                                                                                                                                                   |                                                                                                                                                             |
| Olympiad Programme                                                                                                                                                                                                                                                                                                                                                                           | For organizing Olympiad programmes and<br>for participation in International Olympiads<br>in Physics, Chemistry, Biology, Mathematics,<br>Astronomy & Astrophysics, and Junior<br>Science Olympiad |                                                                                                                                                             |
| Dr. K. S. Krishnan Research<br>Associateship                                                                                                                                                                                                                                                                                                                                                 | Highly talented young scientists and<br>technologists                                                                                                                                              | Stipend of Rs.26,000/-<br>+ benefits for a<br>maximum period of 2<br>years                                                                                  |
| DAE Graduate Fellowship Scheme<br>(DGFS)                                                                                                                                                                                                                                                                                                                                                     | Graduate Level students doing M.Tech. at the<br>IITs                                                                                                                                               | Rs.18000/- per month<br>besides house rent<br>and medical benefits                                                                                          |
| Raja Ramanna Fellowship                                                                                                                                                                                                                                                                                                                                                                      | Eminent retired scientists                                                                                                                                                                         | Honorariums.<br>20,000/- per month<br>Contingency: Rs.<br>50,000/- p.a.                                                                                     |
| Advanced Training in Mathematics<br>(ATM)                                                                                                                                                                                                                                                                                                                                                    | To encourage M.Sc / M.Tech / M.Sc Tech<br>students to take up field-oriented project<br>work                                                                                                       | Grant of Rs.5,000/-                                                                                                                                         |

**HRD Schemes of Department of Biotechnology**

| Scheme                                                        | Beneficiaries                                                                                                                          | Support                                                                                                              |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Postgraduate Programme                                        | PG Students of M.Sc./M.Tech. and M.Sc.(Ag)/ MVSc, biotech                                                                              | Grants for infrastructure and other support                                                                          |
| Star Colleges                                                 | Under graduate students of life sciences stream                                                                                        | Financial support upto Rs 7.0 lakhs per department                                                                   |
| Short term training courses                                   | Mid-career scientists, faculty involved in under graduate and post graduate teaching                                                   | Financial support upto Rs 3.0 lakhs                                                                                  |
| Biotech Industrial Training Programme                         | Fresh B.E./B.Tech. /M.Sc./ M.Tech/ M.V.Sc/ M.Sc.Ag biotech students                                                                    | Stipend of Rs. 8000/- p.m. is paid to trainees and Rs. 50000/- to company                                            |
| Student Research Projects                                     | fellowships for student research projects in life sciences including Biotech, Agriculture, Veterinary, Fisheries and Physical sciences |                                                                                                                      |
| Entrepreneurship Development Programme (EDP) in Biotechnology | To train the prospective entrepreneurs on different aspects of business management                                                     |                                                                                                                      |
| DBT Junior Research Fellowship (DBT-JRF)                      | Fresh B.E./B.Tech. /M.Sc./ M.Tech/ M.V.Sc biotech students                                                                             | Fellowship of Rs. 12,000/- to 18,000/- per month                                                                     |
| DBT-Research Associateship (DBT- RA)                          | For pursuing Post-Doctoral training                                                                                                    | Fellowship of Rs. 22,000/- to 24,000/- per month                                                                     |
| DBT-TWAS Fellowship                                           | Post Doctoral research in India for foreign scientists                                                                                 | Fellowship including contingencies and cost of international travel                                                  |
| Ramalingaswami Re-entry Fellowship                            | To attract scientific talent of Indian origin working abroad                                                                           | Fellowship of Rs. 75,000/- per month and contingency grant of Rs. 5.0 lakhs per annum for five years.                |
| Tata Innovation Fellowship                                    | To reward interdisciplinary and innovative work in biotechnology and related disciplines                                               | Fellowship of Rs. 20,000/- per month in addition to regular salary and contingency grant of Rs. 5.00 lakhs per annum |

| <b>Scheme</b>                                                                                      | <b>Beneficiaries</b>                                                                                                                                                                                                                                                | <b>Support</b>                                                                                                                                        |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Biotechnology Career Advancement and Reorientation Programme for Women Scientist (Bio-CARe)</b> | For employed/unemployed women scientists                                                                                                                                                                                                                            | For unemployed women stipend of Rs.25,000/- p.m. and employed scientists get an amount of Rs.5,000/- p.m as an incentive in addition to their salary. |
| <b>Distinguished Biotechnologists Research Professorship</b>                                       | to recognize eminent scientists who had superannuated and have made outstanding contribution                                                                                                                                                                        | award of Rs. 60,000/- per month and a research grant uptoRs. 20.00 lakhs for a period of five years or till the awardee attains the age of 70 years   |
| <b>Programmes for North-Eastern Region DBT-RA programme BITP</b>                                   | support to universities/colleges in NER for strengthening and up-gradation of their biotechnology teaching, training and research activities                                                                                                                        | Fellowship of Rs. 22,000/- to 24,000/- per month                                                                                                      |
| <b>Biotech Product, Process Development and Commercialization Award 5-6 awards</b>                 | scientists/innovators/entrepreneurs/Indian institutions & companies both in public as well as private sector for a new process, product development &commercialization of a technology or a product in the areas of biotechnology and biological sciences           | Rs.2.00 lakhs along with a citation. Rs.5.00lakhs                                                                                                     |
| <b>National Women Bioscientists Award</b>                                                          | Senior Category (One), awarded to senior woman biologist for life time contributions, and Young Category (Two) - given for outstanding contributions of women scientists below 45 years of age in basic and applied research for product and technology development | Cash prize of Rs.1.00 lakh along with citation and a medal                                                                                            |
| <b>National Bioscience Awards for Career Development 10 awards per year</b>                        | Young scientists below 45 years of age in basic and applied for application/product and technology development                                                                                                                                                      | Cash prize ofRs.1.00 lakh and a citation along with project research grant of Rs.9.00 lakh @ Rs.3.00 lakh per year for a period of three years        |
| <b>DBT Biology Scholarship</b>                                                                     | Biology/Biotechnology at Higher Secondary/Intermediate/10+2 level                                                                                                                                                                                                   | Cash prize of Rs.20,000/- and a Certificate of merit                                                                                                  |

| Scheme                                                                                  | Beneficiaries                                                                                                                                                                                             | Support                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Innovative Young Biotechnologist Award (IYBA)</b><br>25 awards per year              | Outstanding young scientists with innovative ideas and desire to pursue research in frontier areas of biotechnology                                                                                       | cash award of Rs. 1.00 lakh per annum as an add on salary and the awardees not in regular job get a fellowship of Rs.40,000/- p.m. for pursuing a project for 3years, extendable by two years |
| <b>Rapid Grant for Young Investigators (RGYI) Scheme</b>                                | Young scientists (below the age of 40 years) for the establishment of their laboratory and initiate research in the frontier areas of biotechnology                                                       | Grant is based on project goals and activities                                                                                                                                                |
| <b>Cutting-Edge Research Enhancement and Scientific Training Award (DBTCREST Award)</b> | Biotechnology Overseas Associateship Award' and 'Associateship for Specialized Training of Young Scientists' in niche areas of biotechnology                                                              | Fellowship amount to US \$ 3,000 and preparatory allowance of Rs. 1.00 lakhs                                                                                                                  |
| <b>Visiting Scientists from Abroad Programme (VSAP)</b>                                 | Eminent scientists/ experts in the front line areas of Biotechnology from overseas institutions would be invited for visits to research institutions in India for a period of three weeks to three months | Stipend of Rs. 15,000/- per month and the cost of air passage with research contingency grant of Rs. 10,000/- per month                                                                       |
| <b>Biotechnology Entrepreneurship Student Teams (BEST)</b>                              | To encourage young doctoral students in developing biotechnology entrepreneurship in a competitive mode, to submit as team business plans for scientific ideas which can be commercialized                | Three awards of Rs 5.00 lakh, 3.00 lakh and 2.00 lakh are awarded to the first three teams, respectively                                                                                      |
| <b>Khorana program for scholars</b>                                                     | Indian Students to undertake research at University of Wisconsin-Madison (UW) for 10 weeks                                                                                                                | Stipend, Accommodation, Airfare                                                                                                                                                               |