

## **Draft Science Policy Document**

### **BACK**

#### **(Department of Science and Technology)**

A drafting committee set up by the Ministry of Science and Technology under the Chairmanship of Prof. Goverdhan Mehta, has prepared two draft documents, displayed below.

1. Science and Technology Policy Statement-2001
2. Action Plan/Implementation Strategy for STP-2001.

Comments on these drafts may be sent by e-mail /post to the following address:

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Responses may be sent before Dec. 8, 2001 to enable the committee to consider and incorporate suggestions received.

## **Science and Technology Policy –2001**

(Draft document-Version 3)

### **Preamble**

Science and technology have been an integral part of Indian civilization and culture. India's traditions in science and technology stretch over several millenia and have been founded on the principle of universal harmony and respect for all creation. In the half century since independence, India and its people have been committed to the task of promoting the spread of science and have recognized the key role of technology as one of the most important elements of national development. The Scientific Policy Resolution of 1958 and the Technology Policy Statement of 1983 enunciated the principles on which the growth of science and technology in India has been based over the past several decades and continue to inspire our endeavours even today. These policies have emphasized self reliance and sustainable and equitable development. We stand today on the threshold of a new century, at a time when the advance of science is both tumultuous and spectacular. We live in a world where political, social and economic equations have been dramatically transformed in the last decade. It is therefore necessary for the Government and people of India to reaffirm their commitment to the growth of science and technology, which in turn must spark and fuel the march of national development. Science has profoundly influenced modern civilization. Science has provided us remarkable insights into every aspect of the world we live in and intriguing glimpses of a larger universe. The major scientific revolutions of the 20<sup>th</sup> century have opened the doors to many remarkable technologies that promise to herald new eras in the fields of health, agriculture, communication and energy, among many others. Science and technology are but two sides of the same coin; unfettered and creative science invariably gives birth to innovative technologies. Over the past four centuries science has advanced rapidly and has become a part of modern culture, while technology holds the keys to prosperity. In the drive to provide basic needs and to raise the quality of life of our people, create wealth and to be globally competitive, in an increasingly technologically sophisticated world, and to harness our natural resources and to protect the environment in a sustainable manner, we recognize the central role of science and technology.

## **Policy Objectives**

Recognizing that science and technology are powerful instruments in the tasks of national reconstruction, economic resurgence and maintenance of national security the Government of India, therefore, enunciates the following elements of its science and technology policy:

- i. To promote the teaching and practice of all disciplines of science at school and college levels, reaching out to all creative talent in the country, to foster scientific research in the Universities and national institutions, which have a multiplier effect, and to emphasize the critical and essential role of science in the sphere of higher education.
- ii. To encourage the participation of all sections of the population in science and technology endeavours and to ensure the creation of conditions that permit the full participation of women scientists and technologists in all areas of research and development.
- iii. To ensure that academic and R & D institutions function with the greatest autonomy and accountability, so that an ambience for creative work of the highest order is encouraged and to build and maintain centres of excellence, which will raise the levels of work in selected areas to the highest international standards.
- iv. To integrate the teaching and practice of science and technology with the widely prevalent and extensive knowledge acquired over the long civilizational experience of India, with a view to ensure the creative participation of large sections of our society in innovation and wealth generation.
- v. To harness modern scientific and technological advances so that rapid progress is made in the field of agriculture, to ensure food and water security, in a sustainable way and in the field of health, to bring modern health care to the people of the country.
- vi. To encourage the highest level of innovation and research and development in industry and to promote close and productive interactions between private and public institutions in science and technology.
- vii. To integrate science and technology with all spheres of national activity in order to enhance India's global competitiveness, to ensure continued development of national infrastructure and to safeguard national security.
- viii. To exploit the full power of science and technology for the mitigation of natural hazards, particularly, earthquakes, floods, cyclones and drought.
- ix. To use science and technology as a vehicle for international cooperation and collaboration and to promote the pooling and sharing of material and intellectual resources in order to achieve common goals.

The Government of India clearly recognizes that these objectives will be best realized by a dynamic and flexible science and technology policy, which can readily adapt to a rapidly changing world environment. It is the purpose of this policy, to ensure that science and technology, as practiced by our high calibre scientists and technologists, contributes to the economic and social uplift of our people, while maintaining our many traditional values. Through this science and technology policy, the Government reiterates India's commitment to participate as an equal and vigorous partner in the task of harnessing the advances in science and technology for the benefit of mankind.

## **Science and Technology Policy-2001**

### **Implementation Strategy**

**(Draft Document : Action Plan-Version 3)-October 29, 2001**

#### **Preamble**

Enormous strides have been made in the areas of science and technology in India since 1947.

However, there is an urgent need to revitalize the scientific enterprise in the country and to raise the standards of science and technology in our institutions, in order to meet the challenges of a technologically sophisticated world. The University system in India is under severe strain and science departments have difficulties in attracting high quality, students and faculty. Science teaching at the undergraduate level is in a state of crisis, with students drifting away to other disciplines which offer better avenues for employment. Research laboratories are faced with the problems of an aging pool of scientists, a consequence of the slow pace of recruitment, inadequate infrastructure, declining numbers of research students and limited resources. Indeed, we appear to have lost an entire generation of scientists, as students over the last several years have moved away from fundamental science. Even the best of our national institutions do not have access to state-of-the-art facilities and the strategic departments like space, defence and atomic energy find it increasingly difficult to attract the best of human resources. The transfer of technology from academic institutions and national laboratories to industry has been limited. In spite of several governmental initiatives the participation of private industry, in promoting science and technology, has been extremely restricted. Our institutional structures and ambience have also limited the growth of intensely collaborative research, an almost essential ingredient for success in today's world.

In formulating the Science and Technology Policy-2001, the Government of India is conscious that a concerted plan of action is necessary to infuse a new sense of dynamism into our science and technology institutions. There is also a clearly felt need for restructuring the administrative and management structures associated with government science departments, agencies and many institutions. While the Government will make necessary budgetary commitments for higher education and the science and technology sector, it is essential to enhance the participation of the private sector, in order to ensure that the maximum benefit may be derived from the new Science and Technology Policy. The Government anticipates that investments on research and development will be enhanced to at least 2% of the GDP in the next five years.

#### **Blueprint for new initiatives**

A broad plan of action is envisaged below:

##### **1. Reconstruction of the Academic Science System**

A major initiative to modernize the infrastructure for science and engineering in Universities and academic institutions will be undertaken. The recognition that the University science and engineering departments are central to the scientific enterprise is essential for ensuring that the foundations of our science and technology establishment are strong. Among the strategies that may be considered, is the possibility that at least 25 Universities in the country and an equal number of technical institutions be selected for special support to raise the standard of science teaching and research. Schemes for the induction of new faculty in key areas of science, administered centrally, must be developed. It must be emphasized that any scheme to resuscitate science in the Universities must be considered as a long range strategic plan and constancy of support and attention will be necessary over at least a 10 year period.

Special attention will be paid to the modernization of engineering and medical institutions, with emphasis on integrating teaching and research.

##### **2. New Funding Mechanisms for Basic Science**

The Government will consider the institution of new funding mechanisms for the promotion of basic science and will ensure greater autonomy for organizations and departments charged with the

responsibility of furthering the objectives of the Science and Technology Policy-2001. In particular, administrative and financial procedures will be simplified to permit efficient operation of research projects in diverse institutions across the country. A key component of a new strategy would be the creation of an autonomous structure for funding basic science, on a substantial scale in our academic institutions. The revival and execution of a plan to set up a National Science and Engineering Research Board must merit serious consideration.

Special attention will be paid to the creation of world class research facilities within our major institutions, in areas where our scientists have already established a major presence. The creation of world class facilities in carefully selected fields will be designed to enhance our international competitiveness in areas where we have strengths, opportunities or natural advantages.

### **3. Human Resource Development**

Schemes for enhancing career prospects for scientists are essential for reversing the flow of talent away from science. It is also necessary to pay special attention to creating an atmosphere in our academic and research institutions which will attract and even more importantly, retain and nourish, young talented scientists. A major initiative to be considered would be a greater involvement and commitment of scientists in national institutions in the teaching and training of undergraduate science students. Initiatives to enhance the linkages between our vast network of national laboratories with teaching institutions are needed for a long term revival of science in colleges and universities. It is also critically important to ensure that higher education is available to the widest possible section of creative students, transcending social and economic barriers. The requirements of scientists and technologists in all spheres of national interest, notably health, education, agriculture, industry and defence must be continually assessed to ensure the constant supply of trained manpower. In specific areas like biodiversity mapping and exploitation of traditional knowledge, significant opportunities exist for involving a wide community of people in the scientific enterprise, by drawing upon their location specific knowledge of natural resources and their prudent use.

### **4. Technology Development, Transfer and Diffusion**

The development of technologies which address the basic needs of the people and those that make Indian industry-small, medium or large-globally competitive will be accorded the highest priority. Technology development programs, which seek to transform useful laboratory research into processes and products, will become more vibrant only when industry participation in collaborative research begins at an early stage in the project. New initiatives to promote close interactions between industry, academia and government institutions need to be initiated. This will require hard-hearted evaluation of existing programs and fresh ideas for new initiatives. The concept of technology incubators positioned within the precincts or in the vicinity of academic institutions needs to be strengthened. In the areas of information technology and biotechnology special opportunities exist for interactions with relatively small industries, which can lead to both front line research and high value products. Recognizing the inevitability of the processes of globalization and liberalization of the Indian economy, we need to pay special attention to the mechanisms for promoting, nurturing and rewarding innovation. Schemes for encouraging entrepreneurship will be devised and mechanisms like the National Science and Technology Entrepreneurship Development Board will be strengthened. The establishment of rigid quality standards and accreditation of testing and calibration laboratories will be expedited, in order to enhance global competitiveness of our industry.

5. **Promotion of Innovation** Innovations may be the consequence of traditional, scholarly research or may arise by unconventional processes of discovery. Innovation is risky and hence schemes for promotion of invention must have high rewards for success. Every technical ministry and department of government must have a specific earmarked budget for promoting the development of innovative technology. New mechanisms will be developed for channelling creative talent towards the processes of invention and discovery.

6. **Research and Development in Industry** While Government recognizes its prime responsibility in promoting science and technology as an important tool for national development, it is essential that the contribution of private industry to research and development (R & D) be dramatically enhanced. Efforts will be made to promote R & D in industry by fiscal measures and also by actively increasing linkages between private R & D establishments and publicly funded institutions. Measures to increase the active involvement of industry in promoting technical education and basic research will be put in place.
7. **Indigenous Resources and Traditional Knowledge** Many areas of indigenous knowledge based on a long and rich tradition need to be developed and harnessed, for the purpose of wealth and employment generation. Innovative systems will be developed to document, learn from and protect India's rich heritage of traditional knowledge of the natural resources of land, water and biodiversity. This knowledge will be applied towards conservation and sustainable use of these natural resources; creating important opportunities for involving the broader masses of people in the scientific endeavour. Encouragement will also be given to technologies that add value to India's indigenous resources. A concerted plan to enhance research on traditional medicine and to apply globally acceptable norms of validation and standardization will be undertaken. A purposeful program to enhance the Indian share of the herbal medicine market will be initiated.
8. **Technologies for Natural Hazard Mitigation** India has suffered from recurrent damage to life and property as a result of natural disasters such as, floods, cyclones, drought and earthquakes. There is a long term adverse impact on the economy, due to these frequent disasters. A concerted action plan to enhance predictive capabilities and preparedness for emergencies will be drawn up. Science and technology must be viewed as important components in a general strategy to address the problems of hazard mitigation. Concerted measures will be undertaken to promote research on natural phenomena that lead to disasters and in developing technological solutions to the problems of managing pre- and post- disaster situations.
9. **Generation and Management of Intellectual Property** The Government will encourage and promote R & D projects capable of generating competitive IPR and also their effective protection. The development of skills and competence to manage IPR and leveraging its influence will be given a major focus. One of India's concerns is that the process of globalization is threatening the appropriation of elements of the collective knowledge of societies into proprietary knowledge for the commercial profit of a few. Action will be taken to protect these indigenous knowledge systems through national policies and international agreements. IPR systems, which specially protect technology innovations, that have arisen out of traditional knowledge generation, will be evolved.
10. **Science and Technology Inputs in Planning and Governance**

The Government will evolve a stable and robust mechanism by which inputs on S & T policy issues are obtained from independent bodies of scientists and technologists, like the Academies and specialized professional bodies, among others. S & T inputs will be an integral part of decision making in the formulation of governmental policies in diverse areas, particularly in programs related to industrial development, national security, energy, environment and related areas of socio-economic sectors.

The participation of the socio-economic Ministries in supporting S & T will be raised significantly through special mechanisms. A substantial fraction of the S & T linked allocations to these Ministries is not currently utilized effectively in promoting R & D, because of the tenuous linkages of these sectors with the science and technology community in India. A greater integration and participation of these sectors of Government, with genuine R & D activities will go a long way in ensuring that S & T efforts have a wider and more visible impact.

In order to increase the participation in S & T efforts, the States will be encouraged to significantly enhance their involvement, by strengthening S & T Councils in the States and by providing linkages to national institutions for solving region specific problems.

11. **Public Awareness of Science and Technology**

There is a growing need to enhance public awareness of the importance of science and technology in everyday life. Substantial sections of the population must be able to consider emerging S & T options, in areas which impinge directly upon their lives. In recent years advances in biotechnology and information technology have dramatically increased public interest in technology options in areas as wide ranging as agriculture, health and communication.

Special schemes for strengthening science education at school level and a directed emphasis on developing technological skills in children will be introduced. Support for the wide dissemination of scientific knowledge, through the support of science museums, planetariums, botanical gardens and national preserves will be enhanced.

Government will also provide special support for programs that seek to popularize and promote science and technology in all parts of the country.

12. **International Cooperation**

Scientific research and technology development will benefit greatly by international cooperation and collaboration. Common goals can be effectively addressed by pooling both material and intellectual resources. International collaborative programs will be specifically encouraged between academic institutions and national laboratories in India and their counterparts in all parts of the world. Special emphasis will be placed on collaborations with countries of the South, with whom we share many common problems, for which scientific and technological solutions are desirable.

Once the broad contours of a new Science and Technology Policy are in place and there is a general consensus on the need for action in the broad directions summarized above, it will be necessary to identify specific action points, estimate the resources necessary and draw up a clear implementation procedure, complete with time targets.