Science, Technology and Innovation Policy 2013

Government of India
Ministry of Science and Technology
New Delhi

Science, Technology and Innovation Policy 2013

Government of India
Ministry of Science and Technology
New Delhi

Science, Technology and Innovation Policy 2013

Shaping the Future of an Aspiring India

Science, Technology and Innovation (STI) have emerged as the major drivers of national development globally. As India aspires for faster, sustainable and inclusive growth, the Indian STI system, with the advantages of a large demographic dividend and the huge talent pool, will need to play a defining role in achieving these national goals. The national STI enterprise must become central to national development.

Changing Phases of National Policies in S&T

India's Scientific Policy Resolution (SPR) of 1958 resolved to "foster, promote and sustain" the "cultivation of science and scientific research in all its aspects". Technology was then expected to flow from the country's established science infrastructure. The Technology Policy Statement (TPS) of 1983 emphasized the need to attain technological competence and self-reliance. The Science and Technology Policy (STP) of 2003 brought science and technology (S&T) together and emphasized the need for investment in R&D. It called for integrating programmes of socio-economic sectors with the national R&D system to address national problems as well as creating a national innovation system.

The Need for a Science, Technology and Innovation Policy

Scientific research utilizes money to generate knowledge and, by providing solutions, innovation converts knowledge into wealth and/or value. Innovation thus implies S&T-based solutions that are successfully deployed in the economy or the society. It has assumed centre stage in the developmental goals of nations. Paradigms of innovation have become country and context specific. India has, hitherto not accorded due importance to innovation as an instrument of policy. The national S&T enterprise must now embrace S&T led innovation as a driver for development.

India has declared 2010-20 as the "Decade of Innovation". The Government has stressed the need to enunciate a policy to synergize science, technology and innovation and has also established the National Innovation Council (NInC). The STI Policy 2013 is in furtherance of these pronouncements. It aims to bring fresh perspectives to bear on innovation in the Indian context.

STI Policy: A New Paradigm

Science, technology and innovation can exist separately on their own in disconnected spaces. But, it is their integration that leads to new value creation. India's global competitiveness will be determined by the extent to which the STI enterprise contributes social good and/or

economic wealth. There is, therefore, the need to create the necessary framework for enabling this integration in identified priority areas by exploiting endogenous resources, strengths and capacities. New structural mechanisms and models are needed to address the pressing challenges of energy and environment, food and nutrition, water and sanitation, habitat, affordable health care and skill building and unemployment. ***"Science technology and innovation for the people"*** is the new paradigm of the Indian STI enterprise. The national STI system must, therefore, recognize the Indian society as its major stake holder. Global innovation systems tend to bypass large sections of the community. Innovation for inclusive growth implies ensuring access, availability and affordability of solutions to as large a population as possible. Innovation, therefore, must be inclusive. The instruments of the STI policy will enable this to be realized. The policy will drive both investment in science and investment of science-led technology and innovation in select areas of socio-economic importance. Emphasis will be to bridge the gaps between the STI system and the socio-economic sectors by developing a symbiotic relationship with economic and other policies.

Capturing Aspirations

The key elements of the STI policy are:

- Promoting the spread of scientific temper amongst all sections of society.

- Enhancing skill for applications of science among the young from all social strata.
- Making careers in science, research and innovation attractive enough for talented and bright minds.
- Establishing world class infrastructure for R&D for gaining global leadership in some select frontier areas of science.
- Positioning India among the top five global scientific powers by 2020.
- Linking contributions of science, research and innovation system with the inclusive economic growth agenda and combining priorities of excellence and relevance.
- Creating an environment for enhanced Private Sector Participation in R&D.
- Enabling conversion of R&D outputs into societal and commercial applications by replicating hitherto successful models as well as establishing of new PPP structures.
- Seeding S&T-based high-risk innovations through new mechanisms.
- Fostering resource-optimized, cost-effective innovations across size and technology domains.
- Triggering changes in the mindset and value systems to recognize, respect and reward performances which create wealth from S&T derived knowledge.
- Creating a robust national innovation system.

Investment in Research and Development

Global investments in science, technology and innovation are estimated at $1.2 trillion as of 2009. India's R&D investment is less than 2.5% of this and is currently under 1% of the GDP. Increasing Gross Expenditure in Research and Development (GERD) to 2% of the GDP has been a national goal for some time. Achieving this in the next five years is realizable if the private sector raises its R&D investment to at least match the public sector R&D investment from the current ratio of around 1:3. This seems attainable as the industrial R&D investment grew by 250% and the sales by 200% between 2005 and 2010. Increased private investment is necessary for translating R&D outputs into commercial outcomes. While maintaining current rates of growth in public R&D investments, a conducive environment will be created for enhancing private sector investment in R&D.

The gross budgetary support for the science and technology sector has significantly increased during the last decade. The impact of such increase is becoming evident. India ranks ninth globally in the number of scientific publications and 12th in the number of patents filed. The Composite Annual Growth Rate (CAGR) of Indian publications is around 12±1% and India's global share has increased from 1.8% in 2001 to 3.5% in 2011. But the percentage of Indian publications in the top 1% impact making journals is only 2.5%. By 2020, the global share

of publications must double and the number of papers in the top 1% journals must quadruple from the current levels. The citation impact of Indian publications must improve and match at least the world average. Initiatives under the new policy should enable these macro indicators of research to be achieved by 2020.

According to the Global Science Report of the UNESCO, India's current global ranking is commensurate with its number of Full-Time Equivalent (FTE) of R&D personnel. It is imperative that the total number of FTE of R&D personnel increases by at least 66% of the present strength within the next five years.

Promoting Excellence and Relevance in R&D

Nourishing the Roots

Ensuring sustainable pipeline of talented youth for science is a challenge. India has mounted some significant initiatives for attracting talent to science and careers with research. Empowering stakeholders for local actions is a key element of these initiatives. The policy framework will further enable school science education reforms by improving teaching methods, science curricula, motivating science teachers and schemes for early attraction of talent to science. Also special incentive mechanisms will be devised to stimulate research in the universities and develop young leaders in science and engineering.

Excellence and Relevance

Investment in basic research will be enhanced for fostering excellence against global benchmarks and focusing on relevance for addressing national challenges.

Gender Parity

Participation of women in STI activities is important. New and flexible schemes to address the mobility challenges of employed women scientists and technologists will be put in place. A broad scope for re-entry of women into R&D and facilitation mechanisms for special career paths in diverse areas will be sought.

Inter-University Centres

The few inter-university centres that have been set up have proved the concept to be a successful and viable one. Such centres need to be multiplied in different fields to enable a wider cross section of university researchers access advanced research facilities and equipment which are otherwise not available in university environments. These will be discipline-specific as well as multi-disciplinary, including humanities, to address the grand challenges in S&T and its applications.

Participation in Global R&D Infrastructure and Big Science

Modern science is increasingly becoming resource intensive. It has become necessary to

create high-cost global infrastructures in some fields through international consortia models. Indian participation in such international projects will be encouraged and facilitated to gain access to facilities for advanced research in cutting edge areas of science. This will also enable the Indian industry to gain global experience and competitiveness in some high-technology areas with spin-off benefits.

Performance-Linked Rewards and Investments

Transparent centrally implementable Performance Related Incentive Scheme (PRIS), based on past and proven track record in research, will be put in place to enable grant-based investments in such performers. For R&D leading to technology development and knowledge services, the criteria would, however, be institution specific. Centrally instituted incentives to public-funded R&D centres for outcomes leading to public and strategic goods could be introduced.

National Agenda and the STI System

Macro indicators of R&D do not really reflect the innovation capability of a nation. Appropriate indicators, which integrate measures of excellence and inventiveness with relevance and affordable innovation, are necessary for evidence based policy actions. Supply side interventions have hitherto been the main

strategy for public investment in R&D. This needs to change. There should be equal emphasis on both supply side interventions and demand based investments.

Around 10 sectors of high impact potential will be identified for directed STI intervention and deployment of requisite resources. Enabling policy instruments that facilitate both institutional research and R&D enterprises to focus their efforts in these areas will be put in place.

The complex value chain of innovation – from idea to market – often calls for STI intervention at all levels: research, technology inputs, manufacturing and services. In the priority areas of socio-economic importance, the policy will enable a holistic approach to intervention, support and investment. Measures taken in this direction will be in consonance with the programmes initiated by the NInC.

R&D policy for agriculture is articulated by the Indian Council of Agriculture Research (ICAR). Integration of the agriculture R&D policy with the national R&D system and the STI policy will be brought about.

STI inputs to the manufacturing sector can lead to enhanced employment generation. The innovation ecosystem for the sector, however, depends on the nature and size of the enterprise and the context. India's share of global trade in high technology products is at present only

around 8% and the present technology intensity of the sector is a low of 6-7%. The aim is to double these through greater technology inputs from R&D. A strategic selection of some industry sectors, where India can aspire for leadership, would be made for stepping up R&D intensity and increase India's share in high-technology trade. Small and Medium Enterprises (SME) generally have low R&D intensity. Special schemes to support R&D as well as related services at the firm or collective level, will be devised and put in place.

The R&D intensity of the service sector is generally low. This needs to be enhanced considerably and the skill base also expanded significantly. For rapidly accomplishing the tasks of modernization of technology-based services, missions in some select service sector areas, will be identified. Deployment of technology-led services for transparent Government machinery will also be supported.

Climate variability and change is of global concern and India has articulated a National Action Plan for Climate Change (NAPCC) and identified several national missions. The STI system will have an active role in these missions. It will also serve as a source of strategic knowledge to cope with the challenges of climate variability and change as well as to meet equity-based differentiated and shared responsibilities of India.

Attracting Private Sector Investments in R&D

Public funds for partnerships with the private sector for social and public good objectives will be earmarked as a new policy initiative. A National Science, Technology and Innovation Foundation will be established as a Public-Private Partnership (PPP) initiative for investing critical levels of resources in innovative and ambitious projects.

The focus of the policy will be:

- Facilitating private sector investment in R&D centres in India and overseas.
- Promoting establishment of large R&D facilities in PPP mode with provisions for benefits sharing.
- Permitting multi stakeholders participation in the Indian R&D system.
- Treating R&D in the private sector at par with public institutions for availing public funds.
- Bench marking of R&D funding mechanisms and patterns globally.
- Modifying IPR policy to provide for marching rights for social good when supported by public funds and for co-sharing IPRs generated under PPP.
- Launching newer mechanisms for nurturing Technology Business Incubators (TBIs) and science-led entrepreneurship.
- Providing incentives for commercialization of innovations with focus on green manufacturing.

Delivery Systems for STI Outputs to Stake Holders and Society

Diffusion of scientific outputs and technology interventions into social systems is a multi-layered process. Except for the mission-oriented strategic sectors, the delivery mechanism involves a large number of intermediaries both from the public and private sectors. This requires strengthening of linkages between the scientific and socio-economic sectors. The STI policy will leverage the R&D allocations of socio-economic ministries through a shared vision, mission-oriented approach and adoption of new delivery models with provisions for accountability. The state governments constitute important stakeholders. Measures will be taken to ensure that state-specific S&T vision and plans are informed and guided by the new STI Policy towards which State S&T Councils/Boards will be strengthened. NGOs will be accorded a pivotal role in the delivery of STI outputs, especially rural technologies, to the grassroots level.

Ecosystem Changes for Science, Technology and Innovation

Special and innovative mechanisms for fostering academia-research-industry partnerships will be devised. Mobility of experts from academia to industry and *vice-versa* will be facilitated. Success stories in S&T-based innovations from Indian experience would be replicated and

scaled up. Regulatory and legal framework for sharing of IPRs between inventors and investors will be put in place. Measures to close gaps in the translation of new R&D findings and grassroot innovations into the commercial space will be taken.

Rigidity of centrally developed plans for investments often does not suit frontline science, technology development and innovation. A flexible approach that allows for fine tuning the Five Year Plan schemes in response to rapid changes in S&T would be put in place with speed, scale and sustainability as key governance parameters.

"Risks" are an integral part of a vibrant innovation system. Risk sharing by the government will significantly increase private sector investment in R&D and technology development. New financing mechanisms for investing in enterprises without fear of failure and options for foreclosing unsuccessful ventures are essential part of an enabling innovation ecosystem. A public procurement policy that favours first of its kind products developed through indigenous innovation and measures to promote such products globally are necessary.

General rules of expenditure control of publicly funded institutions do not suit non-linear growth sectors like science and technology, and more so the innovation sector. Auditing principles

should be more aligned to “performance” than “compliance to procedure”. The system should be able to differentiate between genuine failures and process deficits.

Specifically the policy will focus on:

- Prioritizing critical R&D areas like agriculture, telecommunications, energy, water management, health and drug discovery, materials, environment and climate variability and change.
- Promoting inter-disciplinary research, including traditional knowledge.
- Fostering the delivery and use in the society of innovations in the strategic sectors with civilian application potential.
- Promoting mechanisms such as “small idea-small money” and “Risky Idea Fund” to support innovation incubators.
- Establishing of a Fund for Innovations for Social Inclusion.
- Leveraging traditional knowledge through modern science for finding solutions to national challenges.
- Supporting STI driven entrepreneurship with viable and highly scalable business models.
- Investing in young innovators and entrepreneurs through education, training and mentoring.

Gaining Global Competitiveness through Collaboration

Open source approaches for public and social goods form interesting innovation systems. Knowledge commons is an emerging theme for managing IPRs created through multi-stake holder participation. The STI Policy will seek to establish a new regulatory framework for data access and sharing as also for creation and sharing of IPRs. The new policy framework will enable strategic partnerships and alliances with other nations through both bilateral and multilateral cooperation in science, technology and innovation. Science diplomacy, technology synergy and technology acquisition models will be judiciously deployed based on strategic relationships.

Public Awareness and Public Accountability of Indian STI Sector

Public understanding of science is an important dimension for introducing and reaching the benefits of modern science and technology to the people. The civilizational aspect of science, or scientific temper, needs to be promoted across all sections of the society systematically. Effective science communication methods, by using tools such as the National Knowledge Network, will be initiated.

Public and political understanding of science should be based on evidence and debates with

open mind. People and decision makers must be made aware of the implications of emerging technologies, including their ethical, social and economic dimensions. White papers on mission-oriented programmes, with specific deliverables and timelines, will be published. Mechanisms for assessing the performance of the national STI enterprise through an autonomous and robust evaluation system, which includes social scientists, will be established. The national science academies will be accorded a major role in this endeavour of public accountability.

Policy Vision

The guiding vision of aspiring Indian STI enterprise is to accelerate the pace of discovery and delivery of science-led solutions for faster, sustainable and inclusive growth. ***A strong and viable Science, Research and Innovation System for High Technology-led path for India (SRISHTI) is the goal of the new STI policy.***

The guiding vision of aspiring Indian STI enterprise is to accelerate the pace of discovery and delivery of science-led solutions for faster, sustainable and inclusive growth.

Printed at: Paras Offset Pvt. Ltd.