

CHAPTER 25

SCIENCE AND TECHNOLOGY

The role of science is very important in technological advancements of any country. In Pakistan, the Ministry of Science and Technology (MoST) is the national focal point and enabling arm of government for planning, coordinating and directing efforts to initiate and launch scientific and technological programmes and projects as per national needs.

The Vision 2025 identified important technologies that may drive the development. These technologies include micro-electronics, computers, telecommunications, nano-technology, human-made materials, robotics, and biotechnology. Use of technologies increases productivity, however, in the context of Pakistan, there is a disconnect between the scientific organisations and the production disciplines. The Vision encourages identifying the indigenous solutions for the local problems. It also suggests revamping of the dormant S&T organisations to bring them in mainstream. Exploring possibilities of collaboration with private and public sector has been emphasised. Poor innovations and registration of patents are identified as major obstacle in success of science and technology in Pakistan.

In line with the strategy adopted in the 11th Five Year Plan 2013-18 to implement the Vision, R&D organisations of MoST have diverted their efforts and resources towards demand driven R&D and implementation of projects having significant economic impact. These organisations are encouraged and supported to transfer technology to the local industry and commercialise their products and processes to become sustainable over a period of time with the goal to achieve Knowledge Based Economic Development. The MoST programmes are mainly implemented by the following 15 institutions/ organisations working under its administrative control.

- Pakistan Council of Scientific and Industrial Research (PCSIR)
- Pakistan Council of Research in Water Resources (PCRWR)
- Pakistan Science Foundation (PSF)
- Pakistan Council for Science and Technology (PCST)
- Council for Works and Housing Research (CWHR)
- Pakistan Council for Renewable Energy Technologies (PCRET)
- National Institute of Electronics (NIE)
- National Institute of Oceanography (NIO)
- Pakistan Standards and Quality Control Authority (PSQCA)
- Pakistan National Accreditation Council (PNAC)
- Pakistan Engineering Council (PEC)
- National University of Sciences and Technology (NUST)
- COMSATS Institute of Information Technology (CIIT)
- Science and Technological Development Corporation (STEDEC)

Performance review 2014-15

The Global Competitiveness Index with regard to science and technology tells the country's technological readiness, capacity for innovation, higher education training, availability of scientists and engineers, university and industry linkages, spending on R&D and quality of scientific institutions. Unfortunately Pakistan is lagging behind than the regional peers in all parameters (Table1).

Table 1: Global Competitiveness Index 2014-15 Score

Parameters	Pakistan	China	India	Malaysia	Turkey
Technological Readiness	2.8	3.5	2.8	4.2	4.3
Capacity for Innovation	4	4.2	4	5.2	3.7
Higher Education & Training	2.8	4.4	3.9	4.8	4.7
Availability of Scientists & Engineers	4.3	4.4	4.4	5.2	4.2
University Industry Collaboration in R&D	3.2	4.4	3.9	5.3	3.7
Company Spending on R&D	2.9	4.3	3.8	4.9	2.9
Quality of Scientific Research Institutions	3.4	4.3	4	5.2	3.9

Scale of 1-7: 1=Very poor, 7=Very good

Source: Global Competitiveness Index Report 2014-15 (World Economic Forum)

In such a situation, it becomes difficult to get advantage of the new growth opportunities. However in recent past high emphasis on university education in Pakistan has generated a chance to leverage science for knowledge economy.

During the fiscal year 2014-15, an amount of Rs1211.357 Million was allocated against 39 development projects in the federal PSDP for advancement of scientific knowledge and technological advancement. Out of this, Rs547.999 Million have been released and utilised till March 2015 (Three quarters). Eight projects are expected to be completed during the year under consideration.

Realizing the financial constraints, MoST is focusing more on transfer of technology and commercialisation of the products and processes, developed over the years by its organisations to compete in the open market for direct contribution to the economy. Outreach activities and demand driven R&D with various sectors of local industry is the priority. Issues, problems and needs of various industrial sectors have been identified and are being addressed by the relevant R&D organisations. Following are some of the key highlights of these efforts:

- The MoST is encouraging the private sector through its public-private partnership programmes for viable R&D, in order to meet the future challenges of WTO. Universities and private sector are being persuaded to establish R&D facilities to inculcate innovation culture in the country. MoUs with leading academic institutions and chambers have been signed for collaborative efforts.
- **Technology Incubation Centre** has been established in National University of Science and Technology (NUST) which has emerged as a centre of excellence for advanced scientific and technological education and research in the country. NUST is ranked at 108th in Asia and 417th among world ranking of universities. COMSATS Institute of Information Technology (CIIT) with seven campuses, provided graduate and post graduate level education to more than 26,000 students in IT, engineering and emerging science and technology fields.

- **International Cooperation in the fields of Science and Technology** is being pursued both at policy and working levels with the main objectives of: (i) enabling Pakistani researchers to get access to technologies developed elsewhere in the world, (ii) mobilizing S&T capacity of national institutions and development of human resource for mutual benefits, and (iii) sharing of resources in areas of science and technology having excellence at home and abroad. The MoST has adopted two pronged strategy of developing linkages i.e. through bilateral agreements with friendly countries and coordination with intergovernmental, international and regional organisations dealing with science & technology.
- **The National Science, Technology and Innovation Policy** has been prepared and circulated among all stakeholders for implementation. The Technology Foresight Exercise for the facilitation of the strategist and policy planner is underway. Six foresight reports on sectors, that is, agriculture, energy, health, education, environment and IT have been compiled and circulated to all stake holders. Work on two reports on Biotechnology and Electronics is in progress.
- **Industry focused R&D** is the prime impetus at the Pakistan Council of Scientific and Industrial Research (PCSIR). Presently, the PCSIR is promoting lab scale development in areas of pharmaceutical and chemicals, food, herbal, minerals, cosmetics, etc. The PCSIR has developed processes and leased out to different industries, got patents registered and provided consultancy services to various industrial clients.
- In its efforts for Provision of Safe Drinking Water to Public, the Pakistan Council of Research in Water Resources (PCRWR) completed construction of 14 water quality monitoring lab buildings (Karachi, Hyderabad, Nawabshah, Sukkur, Multan, DG Khan, Sahiwal, Abbottabad, DI Khan, Sargodha, Sialkot, Mianwali, Gujranwala and Loralai) while three are in progress (Faisalabad, Gilgit, and Muzaffarabad). Moreover, up-gradation of six existing labs (Islamabad, Lahore, Peshawar, Quetta, Bahawalpur and Tandojam) has also been completed. PCRWR undertakes site-specific water sector R&D activities in almost all areas of Pakistan through its five Regional Offices and Research Centres located at Tandojam, Quetta, Bahawalpur, Lahore and Peshawar.
- Various alternate and renewable energy and green energy initiatives are being introduced by the Pakistan Council for Renewable Energy Technologies (PCRET) and more than 500 biogas plants of 5m³/day capacity in four provinces along with more than 100 micro hydel power plants in Khyber Pakhtunkhwa and earth quake affected areas of the country have been installed. These installations are electrifying more than 5000 houses. On R&D front, the PCRET indigenously produced third generation solar cells in its labs using organic materials which are a milestone achievement in the field of indigenous solar photovoltaic technology. PCRET also signed MOUs with some private stake-holders for commercialisation of PCRET designed renewable energy products.
- **Trade-related interventions** are being undertaken through Pakistan Standards and Quality Control Authority (PSQCA), Pakistan National Accreditation Council (PNAC) and National Physical and Standards Laboratory (NPSL). These organisations are actively involved in export enhancement, trade increasing and improving health and safety of consumers through mandatory and voluntary standards.

Outlook 2015-16

During 2015-16, policy focus will be on acquiring world-class expertise in emerging technologies, establish a nanotechnology parks/ innovation incubators as well as create a cadre of technically trained professionals.

Nanotechnology, Biotechnology and Fuel Cell Technology

For economic development, PCSIR, CIIT, NUST and CAMB are initiating coordinated effort with specific focus on the emerging technologies i.e. Nanotechnology, Biotechnology and Hydrogen Fuel Cell Technology.

Renewable energy technologies

To overcome energy crisis in the country, high-tech, low cost and sustainable energy solutions with renewable resources would be another thrust area during 2015-16. A total of 6 projects with an estimated outlay of approx. Rs856.00 million are in pipeline in this regard that will be initiated in 2015-16.

Human resource development

It is planned to introduce multidisciplinary science focused initiatives during 2015-16. The highly trained manpower in S&T organisations will essentially multiply the RoI (Return on Investment) ratio. Science talent farming scheme will be launched to identify and nurture the science talent in the country.

Development of Innovative Incubation Centres and Technology Cluster Centres

In addition to the above, the MoST in collaboration with the Provincial Governments has planned to launch Innovation Incubator Centres as well as Technology Cluster centres. The said activity will generate employment opportunities in the SMEs and technology companies. Feasibility is being undertaken for establishment of the Technology Park in Islamabad.

Halal Food Authority

To capture multibillion dollar halal food market of the world, halal food production, processing and export will be promoted. In this regard, Pakistan Halal Food Authority is being established.

Programmes

An amount of Rs1,060 million has been allocated for different projects of the MoST in PSDP 2015-16. Rs1,040 million will be spent on the ongoing portfolio, while the rest of Rs20 million has been allocated for new unapproved projects. Some of the key programmes/projects to be undertaken in 2015-16 are given below.

- Balancing, Modernisation and Refurbishment of PCSIR Laboratories, NPSL and National Institute of Electronics
- Computing Research and Development Centre
- Construction of Office Building for MoST and its Organisations
- Establishment of National Central Marine Research Laboratory at NIO, Karachi
- Scientific and Technological Cooperation with Friendly Countries.
- Participation of Scientists and Technologists in International Conferences
- Demarcation of Groundwater Quality Zones in Indus Plain

- National Capacity Building Institute (NCBI) for Water Quality Management
- Proficiency Testing Provider Facility for Analytical Laboratories, NPSL/PCSIR.
- Integrated Water Resources Management
- Discovery of new potent natural antiglycation agent
- Construction of Offices and Labs and purchase of lab equipment.
- Establishment of Technology Park
- Certification Incentive Programme for SMEs