

Chapter**17****Education for the Knowledge Society****17.1 School and College Education**

The Medium Term Development Framework (MTDF- 2005-10) recognized education as a critical input in human resource development and in the country's economic growth. The MTDF focuses on elementary education and literacy by emphasizing that the targets of universal primary education and gender parity must be achieved. For improving the general standard of education, special emphasis has been laid on the improvement of quality of teachers. Provision of quality education is another aim that has been given due importance by establishment of quality education institutions including cadet colleges and revamping of science education through improvement in laboratory and library facilities. In order to introduce the modern trends of education, computer education has been introduced as a compulsory subject for class-VI onwards. Technical education has also been given due importance and polytechnic institutes for boys as well as girls, have been established. For the upgradation of college education especially in science subjects, lab equipment, library books, furniture and qualified teachers have been provided all over the country.

Policy

Under EFA (Education Sector Reform) program, comprehensive activities for the improvement of literacy in the country are under implementation at all levels of the government. The National Commission for Human Development (NCHD), National and Provincial Education Foundations (NPEF) are showing commendable performance by establishing primary schools in various localities, where such facilities were not earlier available. The MTDF emphasizes that access to quality education at all levels under EFA will be provided up to 2015 to meet Dakar Goals and MDGs.

Strategy

In the MTDF 2005-10, sub-sector wise allocations have been made for the expansion and development of education at all levels. The Action Plan prepared in the light of the MTDF has been translated into specific programs and projects. The Federal Ministry of Education and Provincial/Area Governments are actively involved in the implementation process.

The following innovative approaches have been adopted for development of the education sector:

- a) Community involvement in literacy, basic education especially through National Education Foundation, Provincial Education Foundations and the National Commission for Human Development (NCHD)
- b) Promotion of public-private partnership and active encouragement of private entrepreneurs and NGOs.

- c. Adopting measures to encourage girls education like provision of food items and targeted cash transfers by Pakistan Bait-ul-Mal. Provision of free textbooks has also been introduced.

Review of PSDP 2006-07

During FY 2006-07 an amount of Rs 6,598.6 million was provided for Basic and College Education in the Federal PSDP. This included an allocation of Rs 6560.2 million for Projects of Ministry of Education and Rs 23.0 million for Schools & Colleges of Cantonments & Garrisons and Rs 15.2 million for the Projects like “Centre of Excellence for Urdu informatics development of standards” and “Production of scientific, technical and model general reading material in the National Language Authority Islamabad” of Cabinet Division.

Achievements

Under Basic Education Community Schools Project, 10185 Schools were provided textual material and salaries to teachers. About 350 Community Schools were established with the assistance of NORAD in hard to reach areas of FATA. An amount of Rs 2250.0 million was provided for Education Sector Reforms (ESR) programs. This amount was transferred to Provinces/Areas Governments for implementing programs of Education For All (EFA). Under special initiatives of the NCHD, enrollment of children aged 5-7 years increased from 54 percent to 80 percent in 48 districts of Pakistan.

Numerous Polytechnic Institutes/ Colleges of Technology are under construction in remote areas of Balochistan like Turbat, Gwadar, Khanozai, Muslim Bagh and one Polytechnic at Gilgit. Five Projects of Canadian Debt Swap have been launched for the rehabilitation and improvement of Teachers Training Institutions and teachers training at the Federal and Provincial level. For quality assurance, Teachers Training Resource Centres were also established. In order to introduce information technology as a compulsory subject from Class VI, computer labs and allied facilities have been provided to 300 institutions in the ICT. The National Institute of Science & Technical Education (NISTE) trained 429 Science and 330 Technical teachers in FY 2006-07 (Figures 17.1.1 and 17.1.2).

Fig: 17.1.1 Science Teachers Trained at NISTE 2006-07

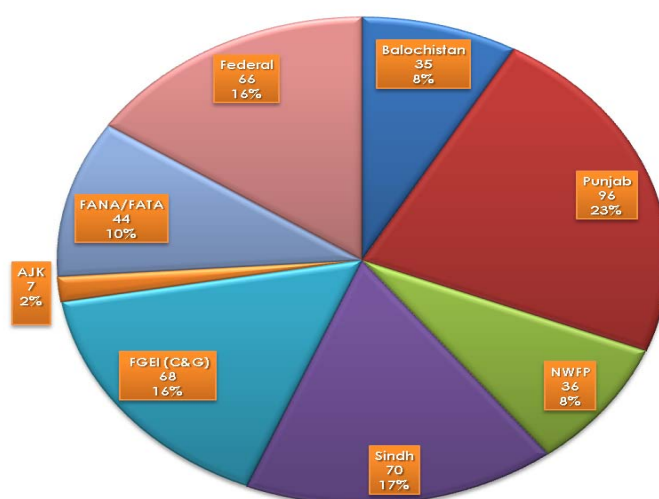
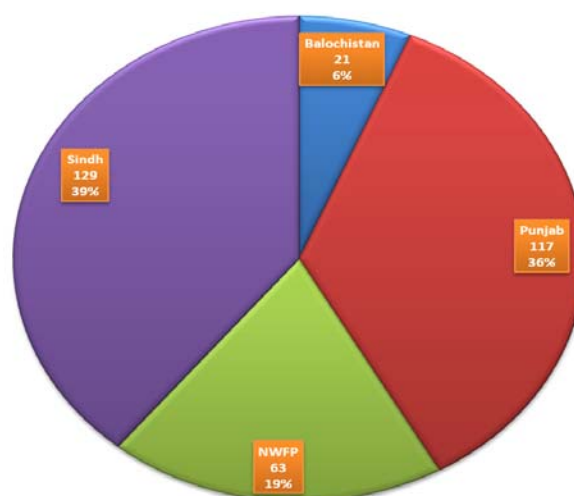


Fig: 17.1.2 Technical Teachers Trained at NISTE 2006-07

Adult Literacy Program remained a focal area at the Federal and Provincial levels. The literacy rate has risen rapidly from 53 percent in FY04 to 56 percent in FY07. It is likely to increase to 58 percent in FY08. The growth in literacy rate beside others also resulted from National Commission for Human Development (NCHD) initiatives in 114 districts of Pakistan by establishing 41,022 adult literacy centers. More than 85 percent of the beneficiaries of these initiatives are female.

An important innovation for providing quality education facilities is the establishment of Cadet Colleges. The total cost of the current Cadet Colleges under construction comes to Rs 2803.0 Million (Table 17.1.1).

Table 17.1.1 On-going Projects of Cadet Colleges in Pakistan

Punjab	Okara, Pasroor, Choa Saiden Shah and Mianwali
Sindh	Ghotki
NWFP	Swabi
Balochistan	Zhob, Panjgur, Jaffarabad, Kohlu and Noshki
AJ&K	Pallandri and Muzaffarabad

Proposed PSDP 2007-08

An allocation of Rs 7,077.9 million has been made for the FY 2007-08 for Basic and College Education. This includes Rs 7,039.8 million for the Projects of Ministry of Education and Rs 22.9 million for the Projects of Schools and Colleges in Cantonments & Garrisons under Ministry of Defence.

Targets

An allocation of Rs 1387.9 million has been made for Education Sector Reforms (ESR) specific programs which include Adult Literacy Program, Education For All (EFA), Revamping of Science Education and Establishment of Polytechnic Institutes at District level. NCHD intervention to enroll children aged 5-7 year will cover all districts of Pakistan by the end of year 2007. For 13 new Cadet Colleges Rs 613.3 million has been allocated. For Madrassa Reforms Project Rs 500 million are earmarked and for the rehabilitation and reconstruction of earthquake damaged Schools of National Education Foundation, an amount of Rs 45.188 million has been provided.

Under German Debt-Swap-II, an amount of Rs 250 million has been allocated for rehabilitation of existing Secondary Schools. Under Punjab Debt Swap-II, an amount of Rs 566.2 million has been allocated for establishment of 590 libraries in the Middle Schools of Punjab Province. An amount of Rs 1 billion has been allocated against Canadian Debt Swap for improving Teachers Training Institutions in the provinces and the Federal areas.

The National Institute of Science and Technical Education (NISTE) would impart training to 520 Science Teachers and 421 Technical Teachers at the National level (Figures 17.1.3 and 17.1.4).

Fig: 17.1.3 Science Teachers to be Trained during FY 2007-08

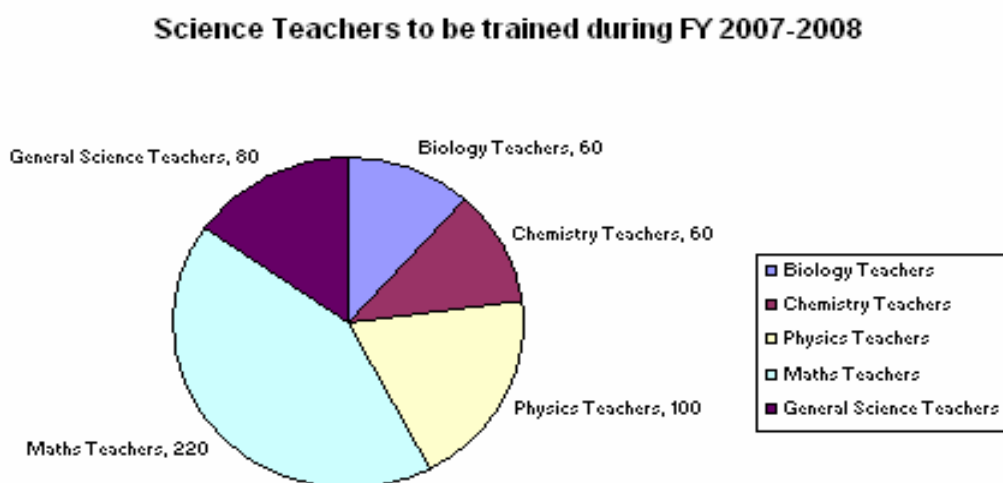
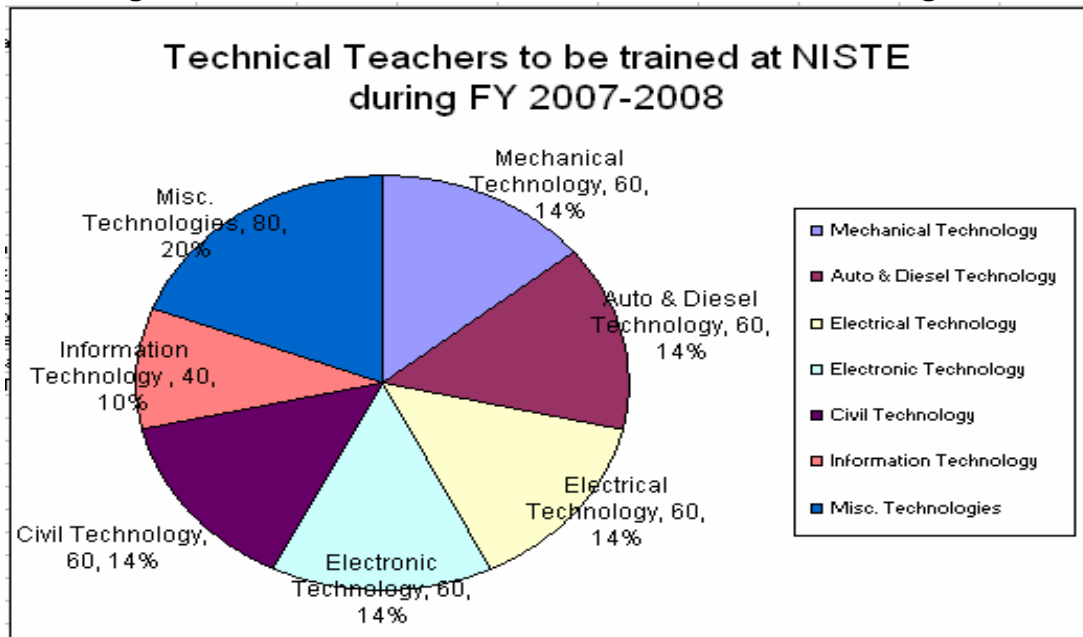


Fig: 17.1.4 Technical Teachers to be trained at NISTE during FY 2007-08

Work on 13 cadet colleges would continue. In ICT, model colleges will be set up 3,000 new Basic Education Community Schools would be established in the school-less settlements. At the same time, 119 computer labs would be provided to the remaining educational institutions in the ICT. Moreover, 27 Earthquake damaged schools which were established by National Education Foundation (NEF) would be rehabilitated. Missing facilities in 985 Elementary Schools would be provided under President's ESR Program.

Under a special package approved by the President / Prime Minister, 330 students of Balochistan and FATA would be enrolled in quality institutions and provided scholarships.

17.2 Higher Education

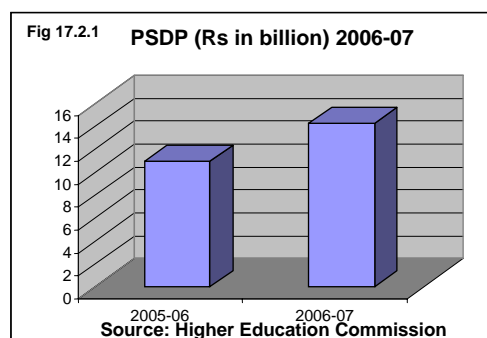
Introduction

The importance of education, especially Higher Education has been constantly growing and knowledge-based industries are now occupying the centre stage in the development. In this regards, key issues are the quality of education imparted to the graduate, and its relevance to the economy. The strategy of the Medium Term Development Framework (MTDF 2005-10) has thus been to assist institutions of higher learning in providing an environment conducive to quality education. The faculty, the infrastructure and support provided to the faculty and students for teaching and research, and the efficiency of operation of university programs, define this environment. The strategy and implementation plans would lead to improved quality of higher education, as well as, improved access to education, while laying the foundations of a strong knowledge-based economy. The focus of attention covers five areas: (a) faculty development (b) higher education infrastructure development (c) focus area support (d) industrial linkages (e) higher education sector reforms.

Review of 2006-07

Financial

In the year 2006-07, an amount of Rs 16.3 billion was allocated to the Higher Education Commission (HEC) which was reduced to Rs 14.30 billion by diverting Rs 2 billion to recurring budget. The total funds allocated this year were more than 30% higher than the previous year 2005-06 (Fig 17.2.1). The portfolio of the HEC during this period consisted of over 332 development projects, of which 119 have been successfully completed, with the remaining in various stages of implementation. It is expected that 80% of the total allocation would be utilized in 2007.



Physical Activities / Achievements

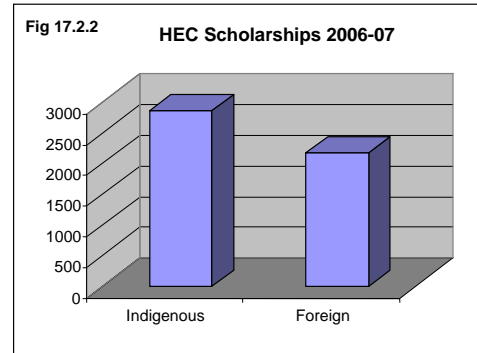
Higher Education Commission has undertaken a systematic approach to meet the objectives identified in the MTDF. This has been accomplished through the implementation of the HEC's Medium Term Development Framework which identified *Access*, *Quality* and *Relevance* as the key challenges being faced by the higher education sector in Pakistan. Today, the country is moving towards knowledge-base economy. A revolution has taken place in Information Technology and Telecom sectors. The Government is keenly making fruitful efforts to attract foreign investment in the fields of power/energy, mining, shipping, engineering, automobile, water/dams and pharmaceuticals. WTO challenges require value addition, quality improvement and competitive prices of our products and services. Progresses of the HEC are targeted towards developing the manpower required to attract and sustain investment in these key economic sectors.

Human Resource Development

To date, 2,861 scholarships have been awarded for Ph.D. studies under the Indigenous Scholarship Programs. These scholars have been placed at local universities working with carefully scrutinized local professors with a demonstrated and consistent record of excellence in research and a pool of 224 highly qualified foreign professors placed on long term assignments with universities across the country under the Foreign Faculty Hiring Program. A set of carefully devised measures have been put in place to ensure that international standards of quality are met at each stage in this process. Nearly 50 of these scholars have already graduated under this scheme.

Under the Overseas Scholarships Schemes, 2,165 Pakistani candidates have already been granted scholarships, out of which 1,153 scholars are currently abroad while the cases of 1,012 scholars are currently under process (Fig 17.2.2).

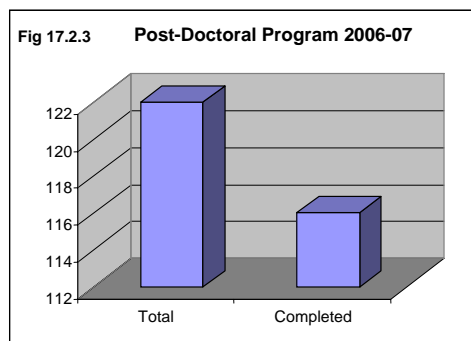
During the year 2006-07, the Cuban Government offered 1000 undergraduate scholarships for Pakistani students in the field of Medical Sciences. Under this program 358 candidates have been selected and sent to Havana, Cuba. These scholars have started their 6 month intensive Spanish language program before pursuing their Medical studies.



Source: Higher Education Commission

Faculty Development/Teachers Training (Short-Term)

Faculty development program continued in the present fiscal year to provide an opportunity to faculty members to update their knowledge and skills and to interact with the researchers of other developed countries. A total of 122 researchers have already been sent abroad to pursue their Post Doctoral endeavors, out of these 116 have already completed their research and have joined their parent institutions in Pakistan (Fig 17.2.3).



Source: Higher Education Commission

210 faculty members have been professionally trained under the 3-month Faculty Development Program. Moreover, HEC has initiated a new and dynamic feature in the teachers learning programs with Open and Customized Short Courses/Workshops/Seminars relating to all academic disciplines. So far more than 570 faculty members have benefited from such seminars and workshops. Series of workshops have been held in entrepreneurship, case study methodology, research skills etc in this regard.

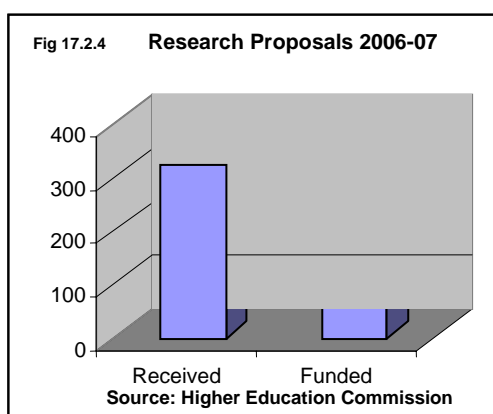
A pilot workshop for senior university management officials was recommended by both Asian Institute of Technology (AIT), Bangkok and HEC on the area of 'Good University Governance in 21st Century'. It is very important to mention here that the first group of 15 Vice Chancellors is leaving in May 2007. This would be a regular activity and the rest of the Vice Chancellors would go after two months.

Supporting Universities Research

To encourage world-class research and innovation in the universities, over 323 research projects were received during the FY 2006-07. These projects were reviewed by the experts in the field and out of these research proposals, 179 proposals were funded. During this year, Rs 450 million were allocated for research activities, out of which Rs 385.385 million have been released (Fig 17.2.4).

Measures for Quality Education

The Higher Education Commission has established 20 more Quality Enhancement Cells in public sector universities/institutions during the FY 2006-07 making all together 30 QEC. Extensive capacity building programs (Training/ Workshops/ seminars and meetings) have been designed and carried out for the Quality Enhancement Cells on regular basis to enable the higher education institutions of Pakistan to meet the global challenges of Quality Assurance in higher learning



For implementation of Quality Assurance at program level, Professional Councils such as Pakistan Medical and Dental Council, Pakistan Engineering Council, Pakistan Veterinary and Medical Council, Pharmacy Council, Architect and Town Planner Council were already working in the country. Active coordination with these Councils is being developed to have mutually agreed parameters for ensuring adherence to the approved quality standards in their respective fields. HEC has signed formal MOU with Pakistan Council of Architects and Town Planning (PCATP) and Pakistan Bar Council, a draft has been circulated to all other councils for signing formal contract with them on the same pattern. National Computing Education Accreditation Council (NCEAC), National Agricultural Education Accreditation Council (NAEAC), Accreditation

Council for Teachers Education (ACTE) and Pakistan Business Education Accreditation Council (PBEAC) have been established. Policy document on "Good Practices of Quality Assurance for Accreditation Councils in Pakistan" has been handed over for adoption at the universities and the Councils to achieve the uniformity of standards across board.

Improving Access to Information

HEC has provided the impetus for academic, research and development sectors through the access to the world-class scientific and research database to help the researchers through National Digital Library Program. The great promise of the Digital Library is in the ability for human interaction with vast amounts of data and with numerous other students and researchers from around the globe. The value of many minds exploring the same problem is rapidly enhanced by a unified approach. Through National Digital Library an effort is underway to develop and strengthen a system that could serve as a model for reshaping the educational process on the national grid and in so doing, supports and encourages the creation of new avenues of socio-economic development.

On its part, Digital Library acquired e-journals from world renowned publishers such as Elsevier, Science Direct, JSTOR, Blackwell, Springer Link, etc as well as

e-databases from IEEE, Royal Society of Chemistry, American Institute of Physics, Association of Computing Machinery, American Society of Mechanical Engineers, to name a few. Presently, over 25,000 journals are available through Digital Library. The response from the end users was equally overwhelming as reflected in number of articles downloaded risen sharply from approximately 25000 to over 2 million in the same period. A very good indicator of the impact of Digital library on the educational sector in Pakistan is manifested through the research output originating from Pakistani institutions which has grown from meager little over 700 articles in year 2004 to over 1600 by the year 2006.

Pakistan Education and Research Network - PERN is an educational and research intranet, based on telecommunication infrastructure providing connectivity of 155 MB across the network and at present, sixty (60) universities/ institutes are interconnected through National Telecommunication Corporation to form the only research and education network of Pakistan. PERN has now planned to out-reach to another 25 universities. After completion of this project in June 2007, there will be a total of 85 universities connected on PERN.

HEC has also initiated project to setup a dedicated IP-based Research and Education Network with gigabit connectivity to all universities and 10 Gbps backbone across the country and in the metropolitan cities of Pakistan.

Higher Education Commission initiated a video conferencing project, aimed at bringing universities in Pakistan closer to interact and collaborate through IP based Video Conferencing System. HEC has provided Video Conferencing facilities to 18 universities in the first phase, out of which 14 universities/institutes are operational now and actively participating in various interactive lectures, discussions and conferences being arranged on national as well as international basis. In second phase, the video conferencing facility will be provided to remaining universities / institutions / Government functionaries. Glimpses from some of the landmark projects are given below:



Textile Laboratory at MUET, Jamshoro

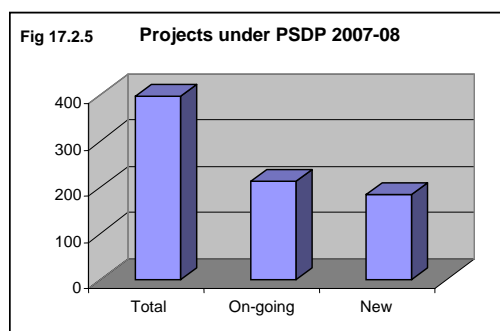


Digital Library at Dow UHS, Karachi

Program for 2007-08

Financial

An amount of Rs 18 billion has been allocated for the development projects of the universities under HEC PSDP for the fiscal year 2007-08 representing a budgetary increase of 26% over the previous year's allocation of 14.3 billion. A total of 398 projects will be carried out during the next financial year, with 214 on-going and 184 projects under new initiatives (Fig 17.2.5).



Source: Higher Education Commission

Physical

The significant increase in the budgetary allocation for the higher education sector for 2007-08 has been necessary not only to facilitate the on-going implementation of the major HEC projects, but to fund several new mega projects. These projects include the establishment of 4 new Engineering Universities, one Media University and one University of Medical and Health Sciences.

The Engineering, Applied Sciences and Technology sectors will continue to receive priority through the on-going implementation of a host of development programs. Furthermore, in order to improve access and widen participation in higher education, satellite campuses of existing universities are to be established in towns where opportunities for quality higher education are currently not available to residents.

The following activities have been planned in the fiscal year 2007-08.

- 4 new engineering universities in collaboration with South Korea, Germany, China and Italy will be established. These will be in addition to the three engineering universities established in collaboration with Sweden, France and Austria.
- 1000 indigenous scholarships will be awarded to students for Ph.D. studies in local universities totaling to 3861 scholarships under the scheme.
- 570 scholars will be placed in foreign universities for postgraduate studies under the overseas scholarship scheme.
- 170 scholarships will be awarded to students of Balochistan and FATA under President Directive for undergraduate and postgraduate studies in the universities throughout the country against 2000 scholarships scheme.
- 75 faculty members will be hired under foreign faculty hiring programs to overcome the shortage of qualified Ph.D. faculty in universities. With this additional/induction, the total number of foreign faculty will become 300 in various universities in the country.
- 100 research proposals will be funded under faculty research programs.
- 5 new Accreditation Councils in various disciplines will be established under HEC quality assurance program.

- 15 faculty development programs will be organized for the training of 540 faculty members.
- 70 vice chancellors, principals, senior deans and managers of the public and private universities will get short term training on good governance and e-learning of university

In order to meet the ever growing demand of Ph.Ds in economics for teaching and research, the PIDE has initiated the Ph.D program in 2000. Detail of the program is presented in Box 17.2.

Box 17.2 The Ph.D Program at PIDE

The Ph.D. program was initiated in year 2000 in response to a long-felt need for a high quality Ph.D program in Economics. The program is designed and run strictly in accordance with global academic standards. Given the existing asymmetrical situation whereby only a small percentage of the population has access to higher education, the Ph.D. program at PIDE is a step forward in the critical field of 'knowledge and expertise'. The program offers specialization in a range of fields including:

- Public Policy
- International Trade
- Public Finance
- Agricultural and Resource Economics
- Industrial Organization
- Economics of Institutions and Governance
- Statistics and Econometrics

The existing Ph.D programs at different universities in Pakistan are constrained to meet international standards due to lack of qualified faculty and research facilities. PIDE is an internationally recognized institution with high standards of research and training. It has the largest faculty in the country with Ph.Ds from reputable universities abroad. Its state-of-the-art infrastructure includes a well-equipped library, a modern computer center, and a well established publication facility. As a center of excellence in Economics, PIDE is uniquely positioned to offer both research and teaching at par with international standards. Recently, it has got the degree awarding status. At present, 51 students are enrolled in the program out of which 30 have already completed their course work and are working on their dissertations. Research articles of many students have been published in journals of international repute. PIDE's students are in great demand and many of them, near completion of Ph.D are already serving in prominent public and private research and teaching institutions.

Pakistan Education & Research Network - PERN2 is focused to design the network that aligns with international standards for NRENs (National Research and Education Networks), based on dark fiber and dedicated infrastructure solely for education and research purpose. This will ensure the availability of Gigabit bandwidth for education and research including areas not limited to grid computing, telemedicine, high energy physics and enterprise level video conferencing.

- **Video Conference** - Interactive Distant Learning facilities will be provided to arrange any time and on demand lectures from across the country and abroad. It is expected that 400 – 500 live lectures by eminent scientists and researchers will be arranged annually on key topics to develop fundamental concepts and enhance the critical thinking for under-graduates and graduate students, faculty

members and researchers. These lectures will be delivered on interactive basis to all public sector universities and other allied bodies across the country, taking the overall coverage to 72 universities/ institutes/ organizations.

- **Campus Management Solution** – CMS will provides a supports nationwide standard framework for the services delivery for the administration, students and faculty members. CMS is an integrated solution that will serve as the enabler for the institutions on how to deliver more competitive services to the sophisticated traditional and non-traditional students. Modules include recruiting & admission, student records, grade book, campus self service, academic advisement, contributor relations, student financials and student administration. As a pilot project six universities across Pakistan will be selected for implementation i.e. Quaid-i-Azam University (Islamabad), Punjab University (Lahore), University of Engineering & Technology (Peshawar), BUITMS (Balochistan), DOW University of Health Sciences (Karachi), Islamia University (Bahawalpur).

17.3 Science and Technology

Introduction

Science and Technology (S&T) is widely recognized as an important tool for fostering and strengthening the economic and social development of the country. Given the rapid pace of globalization, fast-depleting material resources, increasing competition among nations and the growing need to protect intellectual property, the importance of strengthening the knowledge base is an important issue that needs to be recognised. Recognizing the global economic order, the strategies that shall be pursued are: a) modernization/up gradation of S&T infrastructure, b) development of S&T manpower, c) accelerating technology transfer and utilization, d) strengthening linkages among industry academia and R&D organizations, e) provision of support particularly to SME's.

Review of 2006-07

Financial

During the financial year 2006-07 a total amount of Rs 5499 million was allocated for Science and Technology sector including Rs 4431 million for Ministry of Science and Technology, Rs 646 million for Pakistan Atomic Energy Commission, Rs 375 million for SUPARCO, Rs 38 million for NESCOM and Rs 8.5 million for Pakistan Meteorological Department. The allocation for Ministry of Science and Technology was reduced to Rs 3172.6 million in the 3rd quarter review of PSDP. It is expected that 85% of the total allocation would be utilized by the end of financial year.

Physical Activities/Achievements

Ministry of Science & Technology (MoST) initiated a mega project for safe drinking water to all at a cost of Rs 1413 million, which includes establishment of 18 new monitoring laboratories in twenty four districts, water supply assessment survey, installation of 24 pilot demonstration water conditioning and filtration plants by federal and local governments and capacity building program of the technical staff of four provinces AJK, FATA and Northern Areas.

During the year, **Pakistan Council of Research in Water Resources (PCRWR)** up gradation of existing labs of working for sustainable management of water resources has completed at Quetta, Lahore, Peshawar, Tandojam, Bahawalpur and Islamabad, whereas 75% laboratory equipment is received and mostly installed. The sampling/diagnostic survey of 1173 water supply schemes completed. Manufacturing and installation of filtration plants is in process. Major programs of PCRWR are to introduce water conservation technologies e.g. bed and furrow, sprinkler, zero tillage, laser leveling, low cost lining, and skimming wells techniques to farmers and other stakeholders.

MoST initiated bilateral agreements/MoUs on S&T cooperation with friendly countries. The numbers of agreements/MoUs have been raised from 23 to 34 during the years 1999- 2007. To assist small manufacturers MoST established Cluster Centers for Fan Industry in Gujrat and Bed Sheet & Up- Holstery in Multan.

MoST has established **Pakistan National Accreditation Council (PNAC)** in the country to accredit certification bodies for ISO 9000/14000 testing and calibration services. To create awareness about the issues related to quality and standardization, PNAC has arranged 382 seminars, workshops and training courses in all parts of the country. Moreover, to comply with international requirements of TBT & SPS agencies of WTO, 25 testing and calibration laboratories have been accredited and more than 30 labs are under process for accreditation. National Quality Policy and Plan (NQP&P) has been approved. Under this program Metrology, Standards, Accreditation, Testing & Quality (MSTQ) infrastructure is being strengthened.

National Institute of Oceanography (NIO) is performing a scientific study for extension of Pakistan's Continental Shelf from 240,000 sq Km to 290,000 sq Km, by pursuing geological & geophysical survey and eventual approval of UNCLOS by 2009. NIO in collaboration with PQA is implementing project "Hydraulic and Hydrodynamic study of a Bundal Island and its Environs". The study will result in reclamation/stopping erosion of the Island covering an area of about 9000 acres land. NIO has established a Digital Tidal & Weather Observatory along the coast of Gwadar. Global Warming and Sea Level Rise study is being undertaken.

In line with MTFD 2005-10 goals, **Pakistan Council of Science and Industrial Research (PCSIR)** has set up quality control and technical backup facilities for food, textile, leather and pharmaceutical industries under its industrial linkages program. PCSIR has provided services to over 4000 SMEs and public/private organizations in quality control, analytical testing and calibration areas. To cater to the requirements of WTO, PCSIR has also brought in ISO 17025, 9000 and 14000 series of standards to monitor the quality assurance of products/services out of its laboratories. The Karachi Laboratories Complex (KLC), National Physical and Standards Laboratory Islamabad (NPSL) and Leather Research Centre Karachi are the first to get ISO-17025 accreditation in Pakistan from PNAC.

PCSIR has developed 1480 technological processes so far and out of these 1120 processes have been leased out to prospective entrepreneurs for exploitation on industrial scale. PCSIR has so far obtained 461 patents. PCSIR Laboratories have more than 50 pilot plants to test its technologies and products for market evaluation. Technology Business Incubators (TBIs) are being established at 3 main Laboratories to boost up the process of commercialization. The scientists/engineers of PCSIR have so far produced more than 7,000 publications at national and international level. PCSIR is offering 3-4 year diploma and degree courses as well as tailor made short courses in the fields of precision mechanics and instrumentation, dies and moulds, CAD/CAM technologies and electronics.

The significant achievements made by **Pakistan Council for Renewable Energy Technologies (PCRET)** are the LED based portable lights (prototype), 138 small wind turbine, 1500 biogas plants and 73 solar PV systems installed in various parts of the country, 360 micro hydropower plants installed in Northern Areas producing 4 MW electrical power.

To create awareness about the issues related to quality and standardization, PNAC has arranged 382 seminars, workshops and training courses in all parts of the country. Moreover, to comply with international requirements of TBT & SPS agencies of WTO, 25 testing and calibration laboratories have been accredited and more than 30 labs are under process for accreditation. National Quality Policy and Plan

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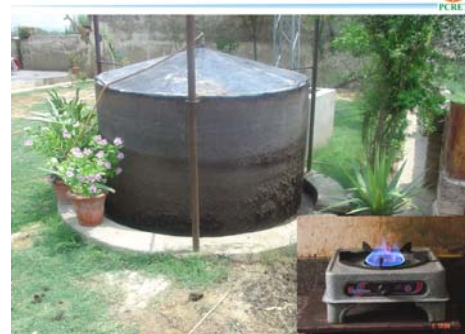
The Center for Applied Molecular Biology (CAMB) has expanded its facilities for the diagnosis of the most prevalent infectious diseases. The centre is performing diagnosis of Hepatitis C Virus (HCV), Hepatitis B Virus (HBV) and Tuberculosis (TB). Forensic DNA typing facility and Stem Cell culture techniques have also been established to study their potential in the repair of damaged tissues. Two Bt genes were transformed into local basmati rice to develop sustainable insect resistance. To control genetic diseases, CAMB has identified three new loci linked to deafness and two loci linked to vision impairment in our population

Council for Works and Housing Research (CWHR) has developed a pre-cast reinforced plain cement concrete lining unit for irrigation channels, more effective and 30% cheaper than that of conventional brick masonry lining. The other research activity was undertaken on Non Destructive Testing, Production of Modified Mortars, Fiber Cement and Ferrocement etc.

The National Institute of Electronics (NIE) has recently established new laboratories in four cutting-edge disciplines of electronics i.e. Automation & Control Engineering, Secure Communication Technologies, Large Scale Electronic Display Technology and Software Development and Training in Advanced Databases. Following figures indicate some achievements in the Science & Technology Sector.



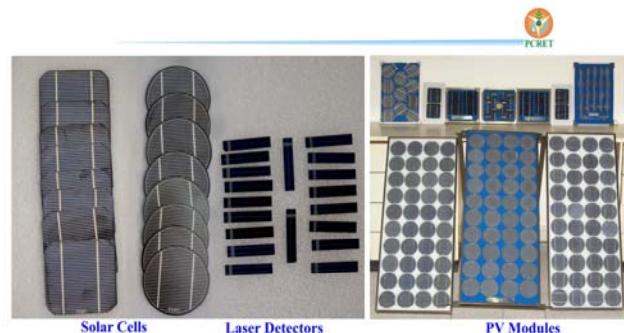
A model filtration plant installed under Development and promotion



Provision of Safe drinking Water" (PCRWR) of Biogas Technology (PCRET)



PCSIR Laboratory Complex Lahore (PITMAEM)



Solar Cells Laser Detectors PV Modules

Fabricated at PCRET under project "Pilot Production of Silicon Solar Cells and Modules"

Pilot Production of Silicon Solar Cells and Modules (PCRET)

Major achievements of science & technology during 2006-07, in brief are presented in Box 17.3.1.

Box 17.3.1	Major Achievements Science and Technology 2006-07
	<ul style="list-style-type: none"> • A total of 25514 water samples were collected and diagnostic tests completed by PCRWR. • Ten water quality laboratories have been established in various cities. • Mapping of Thal Doab has been completed and water quality zones/map have been prepared. • The National Institute of Oceanography is performing a scientific study for Extension of Continental Shelf from 240000 sq Km to 290000 sq Km. • Bundal Island's Hydrography, Oceanography survey has been completed. • 3 years diploma (DAE) in the fields of Precision Mechanics, Instrumentation, Dyes and Moulds, CAD/CAM, Technologies and Electronics at PSTC Lahore has been started. • Calibration services for instruments were provided in various sectors to 4500 clients. • Advisory services regarding ISO certification were provided to 15 Organizations for their accreditation. • Accredited '25' laboratories and '2' Certification Bodies and started accreditation of medical labs. • Field Trial of CEMB Bt cotton showed excellent field performance at various sites in cotton growing area of Pakistan. • 142 cases of rape, murder, sodomy, paternity, dead body identification, bomb blast, etc., were solved through DNA tests. • Corneal Stem Cell Therapy for visual deficiencies was started and PCR-based diagnostic kits were developed for HBV, HCV, Tuberculosis and HCV Genotyping. • Electrified 4800 houses, through installation of 19 Microhydel power plants and 95 houses/ mosques/ schools, through installation of Solar PV systems (total capacity 33KW). • Developed, fabricated and installed 11 community size (net load capacity of 5100kg) solar dryers for drying of dates. • Technology Incubation Centers have been completed at KLC, LLC and PLC. • About 9400 efficient cook stoves have been distributed in the rural areas.

Program for 2007-08

Financial

In the next financial year (2007-08) an amount of Rs 4829 million has been allocated for Science & Technology sector, out of which Rs 3600 million for Ministry of Science and Technology, Rs 580 million for Pakistan Atomic Energy Commission Rs 627 million for SUPARCO and Pakistan Metrology Department Rs 21 million.

Physical

Science and Technology has enormous significance for economic growth at the macro level and for building business competitiveness at the micro level. In an increasingly competitive world, Pakistani industry needs the support of indigenous S&T in a big way. At the macro level, S&T management should focus on meeting the needs of the nation and encompass a wide spectrum of activities, namely basic

research, applied research, technology transfer, design, fabrication, tests and trials, manufacturing and product support during the life cycle.

Major initiatives have been launched to re-furbish and re-build the infrastructure facilities and scientific manpower at all the centers of PCSIR. This modernization and upgradation is also being carried out at other organizations such as PCRET, NPSL, NIO & PSQCA. Major targets of science & technology sector for the year 2007-08 are presented in Box: 17.3.2.

Box 17.3.2**Major Targets Science and Technology 2007-08**

- Construction of 18 Water Quality Labs will be undertaken. 24 water filtration plants will be installed during 2007-08.
- Water Quality Monitoring of 1000 water supply schemes will be completed.
- Maintain and expand the current Labs and Certification Bodies, for which accreditation of '31' labs and '2' certification Bodies will be achieved.
- Large Scale development of color electronic display board for outdoor use is to be completed.
- Secure communication equipment to be developed including miniaturization of surveillance devices using Surface Mount Technology (SMT).
- New building at NIE will be constructed to accommodate new labs (Automotive Electronics Lab, Embedded System Lab, Quality Testing Lab, High Performance Computing Lab, etc.).
- Initial studies on transformation of cotton with drought tolerant genes, will be conducted.
- Another Human Gene, namely G-CSF will be cloned for therapeutic use.
- Diagnostic facility to hormones and various other biochemicals would be extended.
- 50 Microhydel power plants (net capacity 1.2 MW) will be installed.
- 1200 (Family Size) biogas plants will be installed.
- A 20 KW of Solar Cells and PV modules will be fabricated.
- 500 houses/ mosques/ schools will be electrified using solar energy.

PCSIR will provide analytical services to 4000, calibration services for the equipment/instrument to 5000 clients from various Government/Public and Private Sector in all the available fields. For the purpose of accreditation/certification, the advisory services will be provided to 20 different organizations/industries and other departments. 06 PSDP projects will be completed, 25 PSDP projects will be carried out, 10 new projects will be submitted and to appropriate forum for approval, in different fields. 10 patent/processes will be developed and launched in market after testing on Pilot Plant level. For the expansion of scope of accreditation, various activities in NPSL, PLC, KLC, LLC and FRC will be included. For the purpose of trained manpower, classes for the training course in various technical disciplines will be started in PSTC Peshawar, Dimension Stone Evaluation Centre, PLC Peshawar (newly established centers) and continued in PSTC Lahore, IIEE Karachi and PSTC Quetta (established previously) during 2007-08.

PCRWR would be mainly focusing on (i) water quality management (e.g water quality monitoring, establishment of water quality labs and installation of experimental filtration plants to support provision of safe drinking water to the community), (ii) water quantity management (e.g rainwater harvesting in deserts, groundwater assessment and recharge, research and promotion of efficient water management techniques in irrigated and rainfed areas, watershed management activities, glaciers monitoring and mass awareness for water conservation and development).

NIE undertakes to upgrade and expand extensively its physical infrastructure and strengthen its human resources with a view to provide leadership role in the field of electronics at the national level. This would also include setting up of a small-scale production-line to develop electronic boards and assemblies for industrial, commercial and common-utility items.

NPSL will undertake the procurement of the primary standards to achieve its foremost objective, that is, to maintain and disseminate primary standards of measurements and materials at the national level. The physical infrastructure and human resources of NPSL will be upgraded to transform NPSL from international category-C to category-B National Meteorology Institution (NMI) and obtain Mutual Recognition Agreements (MRAs) for facilitating trade and commerce activities of the country in terms of WTO's requirements of Technical Barriers to Trade (TBT).

PCRET undertakes research, development, promotion, and dissemination activities to provide energy services to the people living in the remote areas including the earthquake effected areas, to uplift their socio-economic conditions. The Council is expanding its activities to provide R&D infrastructure of international standard in all thrust areas of the Council, to provide indigenous technological support and sustainability to the local industry, and to develop and promote renewable energy products of international quality. PCRET will provide quality testing services to the local industry and commercial community in the emerging field of solar energy to ensure the high quality commercial products in the field of solar energy. PCRET will also establish new facilities for the design and small scale production of solar and other renewable energy products.

CAMB will expand DNA testing service for crime investigation and training workshops for police, medico-legal doctors and attorney. Initial studies of transformation of cotton with drought tolerant genes, field trial of fungus resistant gladiolus, siRNA screening for virus resistance in potato will be done. One human gene, G-CSF will be cloned for therapeutic use. Stem cell therapy will be studied in mouse model for liver fibrosis and renal ischemia. Diagnostic services will be extended to determine the hormones and other biochemicals.

PNAC has undertaken accreditation of 30 laboratories and two CBs. Furthermore PNAC has also planned to accredit medical labs as well as to launch accreditation services for inspection agencies.