CHAPTER 6: BOOSTING THE KNOWLEDGE ECONOMY FOR HIGHER PRODUCTIVITY

OVERVIEW

With the onset of globalization the international environment is becoming more competitive and demanding. Greater globalization, combined with more liberalization of markets and products means greater global competition. Since capital markets mobilize capital to economies where highest risk adjusted returns are expected, this implies a relocation of international capital to markets showing potential, which includes a dissemination of knowledge economy.

The New Competitive Context

The nature of competitiveness has been changing. Depending on the economic and business environment, traditionally it was based on lower capital or labor costs, or of other local inputs including infrastructure services. Although these fundamentals continue to play a key role, given the very rapid rate of development and dissemination of new knowledge globally and the pressure to restructure, there are important new elements, including the ability to

- Rapidly re-deploy resources in order to capture new opportunities

- Ensure the quality, skills and flexibility of labor force (and management)

- Keep up with rapidly changing technological and organizational advances

- Move to higher value parts of value chain (research/design; and marketing, branding, managing of customer information)

- Make effective use of information technologies to reduce transactions costs and improve capacity to respond quickly to changing opportunities and threats

As new knowledge and innovation is coming up, the advancements in information processing and communication technology is making international dissemination of such knowledge quicker and more diffused such that those who are not keeping pace with these changes end up falling behind. The increase in information technologies, along with decreases in transport and communication costs due to technological progress are leading to increases in international trading of goods and services.

The transition to a knowledge economy depends upon the readiness of a country to use such knowledge for its development. To help countries understand their strengths and weaknesses in making this transition to the knowledge economy, a useful benchmarking tool namely

Knowledge Assessment Methodology (KAM) has been developed by the World Bank Institute. The KAM provides global ranking of countries in terms of their readiness to use knowledge for their development in the context of four pillars namely,

(i) a regime that provides incentives for efficient use of existing knowledge;

(ii) An educated and skilled population that can create and share such knowledge;

(iii) A dynamic information structure for facilitating effective communication and dissemination of information; and

(iv) An efficient system of innovation of research centers, universities and other organizations that can tap into the growing stock of global knowledge.

A reduced index of KAM called knowledge economy index (KEI) to give a quick summary of a country's overall position is presented in the table below. Figures 1-2 show a comparison of KEI component of Bangladesh with countries of South Asian and other world regions[14].

Figure 6.1: Overall KEI 1995 Vs Most Recent
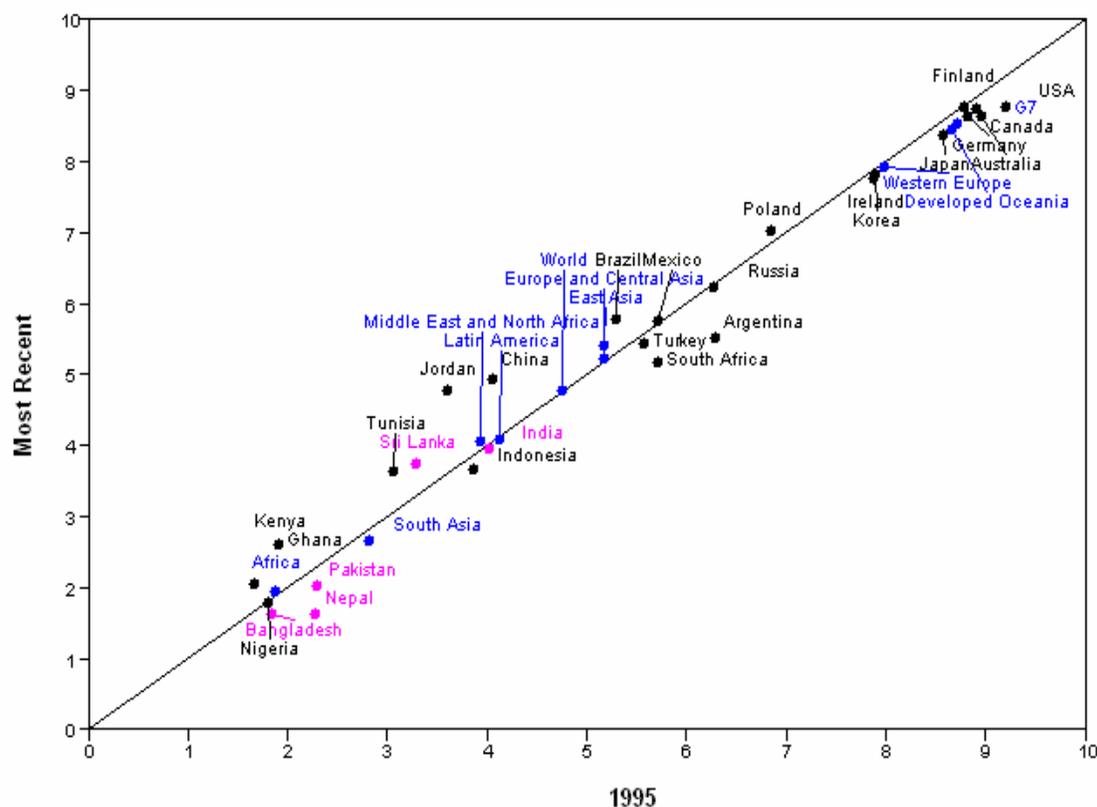
[14]The horizontal axis represents the relative position of the country or region in 1995. The vertical axis represents the position in the most recent year (generally 2000-2003). The graph is split by a 45 degree line. The most advanced countries are on the northeastern section of the diagonal. But the position relevant to the diagonal is also critical. Those countries or regions that are plotted below the line indicate a regression in their performance between the two time periods. Countries or regions that are marked above the line signify improvement between the two time periods, while those countries that are plotted on the line indicate stagnation. Source: World Bank, KAM 2005.

Figure 6.2: Comparison of KEI component parts for World Regions with South Asian Countries (most recent in top line, compared to 1995 bottom line for each group)[15]
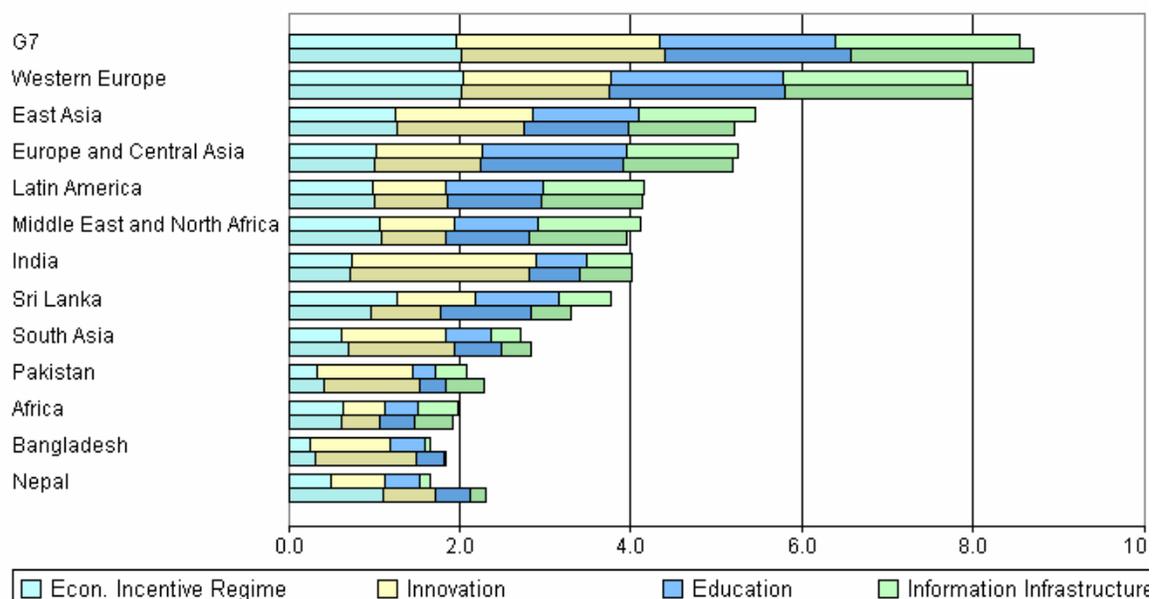
It is observed that among the developing countries South Asia does worse than the others except Africa. Within South Asia, India does the best, although it does not show any improvement over time. Its higher knowledge economy index is largely due to its high index on innovation given the large absolute size of scientists and engineers in R&D as well as the absolute volume of scientific and technical publications. Pakistan, Bangladesh, and Nepal all lose ground in the aggregate KEI. Bangladesh slips most in the innovation index and also slips in the economic incentive regime, but makes some gains in the ICT and smaller gain in the education index. The challenge for Bangladesh to catch up on the knowledge economy front is immense.

A Framework for Knowledge-based Development for Bangladesh

The need for higher levels of scientific manpower and new skills: With the on setting of the knowledge revolution, higher levels of education are imperative to keep up with and make effective use of rapidly changing knowledge. It also necessitates high levels of scientific and technical manpower to create new knowledge. However, since sharing the newly created knowledge entails learning of new skills, there is a need for a system of continuous training in order to constantly upgrade skills or re-skill people who have already passed through the formal educational system. This is reflected in the very high percentage of adults who are taking additional courses at work, in specialized institutions, or even going

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[15]The top bar chart represents the most recent aggregate KEI score for a selected region or country, split into the four KE pillars. The bottom represents the index in 1995. Each color band represents the relative weight of a particular pillar to the overall country's or region's knowledge readiness, measured by the KEI. The first line for each country is its position in the most recent year for which data is available (generally 2002-2003). The second line is for 1995. Source: World Bank, KAM 2005.

back to tertiary institutions for formal education (in Finland, this is true for over 50% of adults). This is also reflected in the number of students at universities who are older than the typical university age cohort of 18 to 24 years old. In the U.S., over 40% of undergrads are over 25 years of age. In Australia, New Zealand, Denmark, Norway and Sweden, over 20% of first time entering students were over the age of 27 in 2000.

The need to keep up with the new skills—in computer literacy, communication skills and the ability to work in groups—has led to the adoption of education and skill-oriented policies across countries to improve their overall business environment and enabling greater flexibility of their economies to respond to the rapidly changing circumstances. Countries are now improving their education and skill systems as part of their development and competitiveness strategy. Between 1990-91 and 2002-03, for instance in high income countries enrollment rates at the secondary level increased from 94% to 107% and from 47% to 66% at the tertiary level. In Korea, an economy that has placed a very high value on education and is now well known as a knowledge economy, tertiary enrollment rates increased from 39% to 85%, which put her second only to Finland (with 86%), the other well known knowledge-based economy[16]. At the same time, an increasing number of private educational institutions have arisen to fill in the needs not adequately addressed by public education system. Firms are undertaking increasing amounts of in-house training to give their workers the skills they need to compete. In addition, some of the larger firms are even setting up their own in-house universities to provide the most advanced specialized skills needed to be competitive. Firms are also more proactive in approaching universities and specialized training centers to get them to develop specific training programs to meet their needs.

Equally noteworthy is the increasing use of information-based technologies, which has been gathering speed as the technology has improved and more experience acquired on its use. In the U.S., 16% of tertiary level students are taking at least one course on line, and 40% of those are full time on line. E-learning is expanding very rapidly and much is being provided by non-traditional universities (new entrants, including publishers and mass media). E-education, by crossing boundaries, has also facilitated the internationalization of education.

It is also being increasingly felt that to be globally competitive and to be able to make innovation countries need high level human resources. There is thus also increasing competition for high level human capital across countries. For example, even the US, where there is no free trade in labor, except for highly trained persons has had more liberal immigration policies and developed a program for the temporary immigration of specialized manpower in the ICT sector.

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[16] World Development Indicators 2005, World Bank: Washington DC

Education is a key to the establishment of a knowledge economy: A part of the reason for low knowledge base in South Asia is low education attainment in these countries. Taken as a group their low enrollment ratios at the secondary and tertiary levels, low average educational attainment among the adult population, extremely low percentage of professional and technical workers among the labor force combined with emigration of the highly skilled workers and low quality of mathematics and science education, pose serious obstacles to their transition to knowledge economy.

The concept of a national innovation system: The innovation system plays an important role in acquiring, creating, adapting and disseminating knowledge, which is crucial for success in the knowledge economy. It consists of the network of institutions, rules, and procedures that affect how the country acquires, creates, disseminates, and uses existing global knowledge. It also concerns the application and use of existing knowledge to the local context.

The concept of a national innovation system rests on the premise that understanding the linkages among the various actors involved in innovation are key to improving a country's technology performance. These actors include private enterprises, universities, research institutes, think tanks, consulting firms, and others. The innovative performance of a country depends to a large extent on how these actors relate to each other as elements of a broader system.

These suggest that a comprehensive knowledge economy strategy will need to emphasize education, science and technology (to promote research and innovation), and information communications technology (ICT) to harness the knowledge effectively.

DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

National science and technology policy: The vision of the National Science and Technology Policy of 2010 was to meet the basic needs of human beings by harnessing the potential of science and technology. Two significant milestones were the emergence of Information and Communication Technology and the potential of Biotechnology. Dramatic changes in the global scenario as well as in the field of science and technology during the last two decades were reviewed and the existing policy has been accommodated these changes in meeting the challenges of the 21st century.

The new Policy focused on scientific research and production using indigenous resources as much as possible. It also focused on finding solutions to the emerging problems in agriculture, health, environment and climate change. In view of the frequent onslaughts of pandemic diseases like bird flu, malaria, etc., the policy supported research in areas such as prevention and treatment of diseases having pandemic impact. The new Policy suggested access to quality educational materials for studying science, mathematics, engineering and other subjects requiring instruments. At the same time, provision may be made for attracting Bangladeshi researchers living abroad. To encourage innovation and production of new technology, a

proper institutional system of copyright and patent should be established. In view of the expanded agenda for research in science and technology, allocation for R&D may be enhanced to 1-2% of GDP.

National biotechnology policy: In Bangladesh, biotechnology received much attention of policy makers since the first decade of the 21st century. The biotechnology policy focused on the tools and techniques of biotechnology for poverty alleviation, health, nutrition and livelihood improvement, environment protection, and ensuring sustainable development.

This policy may be examined further and the following issues should be considered:

- The policy should have clear resolutions on research misconduct;

- The policy should have clear direction on setting up laboratories and their roles i.e. whether they will be hierarchically organized or geographically distributed independent entities;

- The import policy should include special provisions for importing chemical reagents needed for biotechnology research. The policy may provide incentive for producing them locally.

- The policy should include guideline on projects to preserve genetic profiles of endangered species;

- The policy should provide clear stand on animal cloning, stem cell cloning and human cloning;

- The policy should give clear indication on genetically modified organism (GMO);

- A permanent committee should be available for regular revision of the policy.

Institutions involved in Development of Science and Technology

Ministry of Science and Information and Communication Technology: The Ministry of Science and Information and Communication Technology (MoSICT) is the umbrella government agency for science and technology development. Since 1984, the S&T division under Ministry of Education had been functioning as an independent division. One of the key roles of the division was to provide secretarial assistance to the National Council for Science and Technology (NCST). In 1993, the division was upgraded to an independent Ministry (MoST). In April 2002, the ministry was renamed as Ministry of Science and Information and Communication Technology (MoSICT). Govt. has recently reconstituted the MoSICT in to two separate Divisions namely Science and Technology Division and Information and Communication Technology Division.

The ministry has seven agencies under its umbrella – Bangladesh Atomic Energy Commission (BAEC), Bangladesh Council for Scientific and Industrial Research (BCSIR), Bangladesh Computer Council (BCC), National Museum of Science and Technology (NMST), Bangladesh National Scientific and Technical Documentation Centre (BANSDOC), Bangabandhu Sheikh Mujibur Rahman Novo Theatre and National Institute of Biotechnology (NIB). Among these, BCC deals with ICT and all other agencies are related to S&T.

Others institutions working like BARC, BAS, BMDC are also contributing for the development of the science and technology.

Bangladesh Atomic Energy Commission (BAEC) and Bangladesh Council for Scientific and Industrial Research (BCSIR): These are the two principal organizations dealing with scientific and industrial research in the country. BAEC deals with research and development in peaceful application of atomic energy, generation of electricity and promotion of international relations congenial to implementation of its programs and projects.

Since its inception, BCSIR has been pursuing research and development activities in various fields of scientific and industrial interests of the country and has contributed noteworthy services to national causes.

Bangladesh Academy of Science (BAS): This was established in 1973 with the objectives to promote research in pure applied sciences and their practical applications to problems of national welfare in Bangladesh; to disseminate scientific knowledge among people. BAS regularly publishes proceedings, journals, memoirs, transactions and other publications on scientific subjects, holds conferences, symposia seminars, workshops, lectures etc on scientific topics of national and international importance either alone or in collaboration with local and international organizations and institutions. BAS awards scholarships and fellowships for approved scientific research and award prizes and medals for outstanding scientific work.

The Bangladesh Agricultural Research Council (BARC): The BARC under the Ministry of Agriculture is at the apex body of the national agricultural research system (NARS). The institutions under the NARS are: Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Jute Research Institute (BJRI), Bangladesh Institute of Nuclear Agriculture (BINA), Soil Resources Development Institute (SRDI), Bangladesh Sugarcane Research Institute (BSRI), Bangladesh Live stock Research Institute (BLRI), Bangladesh Fisheries Research Institute (BFRI), Bangladesh Tea Research Institute (BTRI), Bangladesh Forest Research Institute(BFRI). It has the responsibility to strengthen the national agricultural research capability through planning and integration of resources. It is the umbrella under which the entire Bangladesh agricultural research is coordinated. This involves cooperative activities in several ministries of the government: Agriculture, Forest and Environment, Fisheries and Livestock, Rural Development, Education, Industries, Commerce, and Science and Technology. National Oceanographic and Maritime

Institute of Bangladesh was established, which is yet to play the expected role in guiding relevant agencies in managing marine resources.

Bangladesh Medical Development Council (BMDC): This was established to coordinate the research in the field of medicine. However, there is no such coordinating body for the field engineering. The National science and technology policy recommended a similar council for engineering research.

BANSDOC: Bangladesh National Scientific and Technical Documentation Centre (BANSDOC) is the national apex body in the field of scientific and technological library, information and documentation services in Bangladesh. It has already passed 47 glorious years for the benefit of scientific and technological research and experimental development and upholds the socio-economic development of Bangladesh. According to mandatory role and responsibility BANSDOC is dealing with library, documentation and information services, products and systems in the field of science and technology & information and communication technology.

BANSDOC houses the National Science Library (BANSDOC Library) that acts as a major information resource centre in the country in the field of Science and ICT. It has the finest collections in Information Science and Information and Communication Technology and a strong reference collection in general S&T aspects. It holds over about 17000 books, about 300 periodical titles and receives over about 90 periodicals both Local and Foreign in the field of S and ICT.

 To support its ICT services, BANSDOC has set up an ICT based Cyber Service Centre which is well equipped with the computer and online broadband connected networking facilities to ensure all out high quality cyber services to the users. It is also associated with the activities of International Federation for Information and Documentation (FID), international Federation of library Associations (IFLA), Commonwealth Library Associations (COMLA), SAARC Documentation Centre (SDC), European Patent Organization (EPO), European Commission (EC).

Public and private universities teaching involved in science and technology: Of the 31 public and 54 private universities in Bangladesh, 5 public universities are dedicated for engineering education, 1 for medical science and the rest cover both general and science education. Dhaka University and Bangladesh University of Engineering and Technology (BUET) have few specific institutes dedicated to scientific and engineering research, respectively. The Institute of Appropriate Technology (IAT) of BUET is playing an important role in identifying appropriate and sustainable technology for the country. The research activities in this type of institutions are conducted by professional scientists and their projects are funded both internally and externally. Only few universities have graduate research programs in science and technology. Of these, Dhaka University, Rajshahi University,

Chittagong University, Jahangirnagar University, Bangladesh University of Engineering and Technology offer graduate level courses on science and technology. The engineering colleges in the country were upgraded to engineering universities. As a result, number of engineering graduates has gone up.

Non-government initiatives in science and technology: There have been a number of initiatives from non-government and voluntary sector in Bangladesh for promoting science and technology. Bangladesh Mathematical Olympiad is a good example of non-formal activities related to promotion of mathematics education among the school and college students. It has been running successfully since 2001. From 2005, every year, the best performers of the National Olympiad participated in the International Mathematical Olympiad one of the most prestigious knowledge based competitions for high school students around the world. In 2009, two of Bangladeshi students have achieved Bronze medals. The Bangladesh Mathematical Olympiad is organized and run by the Bangladesh Mathematical Olympiad Committee, a not-for-profit voluntary organization. A similar event in the field of informatics was also organized. However, the arrangement of Physics, Chemistry and Biology Olympiads are yet to attract popular attention of the students because of lack of enough organizers.

Constraints and Challenges in Progress of Science and Technology

Bangladesh needs to come out of the "basic needs" agenda for research and come up with ambitious research programs in the field of science and technology which are closely related to its aspirations of becoming a middle income country with rapid poverty reduction. For example, Bangladesh may aspire to have its own satellite, which would serve the purpose of economic growth through accurate and timely forecasting of natural disaster including flood and cyclone. However, constraints remain in the way of progress of science and technology. These are as follows:

Need for autonomy: The dynamic life cycle of scientific research requires quick decision making system. The current process is slow and inefficient, which hinders undertaking progressive research agenda. To allow quick decision making the research institutions need autonomy within the framework of national policy for science and technology.

Lack of proper incentives: In Bangladesh, an incentive mechanism for creating intellectual property of high financial value has not yet developed fully. As a result, many scientists prefer to work for institutions abroad or for private institutions. The pay structure for research institutions should be determined autonomously so that adequate financial incentive can be provided to the capable scientists.

Poor initiative for talent hunt: Today's scientific research demands talented students. To attract them to science and technology popularization activities are essential. Such activities were launched in early 1980s by the National Museum of Science and Technology. A good number of science clubs had also emerged then. But the number of science clubs and their activities has been reduced drastically due to lack of patronization. The National Science Fair,

a competitive process of selecting young scientists is now dormant. There is need for reviving such activities.

Human resource problems: Capacity building of scientific personnel tailored to the theme of projects as well as adapting new and state of the art technology is not taking place as desired. This is mainly because firstly, the in-house and overseas training facilities for the scientists working in the field of cutting edge technology are not adequate, and secondly, very often the scientific personnel sent abroad for short-term training do not return home after the expiry of the training period, thus contributing to partial failure of a project. Other human resources constraints are as follows:

1. *Lack of training:* There is lack of training for teachers of colleges under National University as well as the new Science and Technology Universities in terms of upgrading and modernizing syllabuses and teaching quality. There is small coordination between the MOSICT and UGC. Establishment of private universities without complete regulatory preparation creates problems.

2. *Inadequate fellowships:* The government introduced the national science and technology fellowship (Now National Science and ICT fellowship) in the year 1977-78 to encourage young scientists and researchers in different universities and research institutions. Selected students studying in Masters or pursuing their M. Phil and PhD degree receive this fellowship. Students studying in the field of inorganic science, organic science and agricultural science are eligible for the fellowship. In the year 2009-10, Tk. 20.2 million was distributed among 409 students. Besides the NSICT fellowship, a few corporate agencies including a multinational bank also provide financial support to some researchers. However, the amount of money of the fellowships needs review in the context of pursuing scientific research.

3. *Lack of professionalism:* There is a severe lack of professionalism in conducting research. Only those who choose to be serious researchers in the long run take research-based courses. The absence of proper and rich graduate research programs in universities results in poor intake of scientists and technologists in national research organizations. On the other hand, lack of adequate financial incentives inhibits talented students to join science and research courses.

4. *Inadequate facilities:* Opening of new science departments as well as universities of science and technology without ensuring appropriate space, teachers, equipment and ICT environment is a reason behind degradation of standard of science and engineering education.

5. *Lack of patronage for popularizing science:* Today's scientific research demands talented students. To attract them to science and technology popularization activities were launched in early 1980s by the National Museum of Science and Technology. The National Science

Fair, a competitive process of selecting the best young scientists and awarding them with suitable prizes was also introduced. Such competition is not organized any more. Informal scientific activities carried out by Science Clubs and Societies such as outer space observation, science fair, science quiz competitions, debates, essay writing, lectures etc. has been reduced drastically due to lack of patronization. Only a few educational institutes arrange science fair regularly. The Bangladesh Academy of Sciences has a role to play in encouraging such young talents through arrangement of such periodically arranged lectures.

6. *Lack of research funding:* There is a severe dearth of financial resources for undertaking research and development in various fields under a long term vision and plan. Allocations for science and technology in previous Plans as a proportion to total allocation have been inadequate. There is a severe lack of efficient mechanism for dialogue between relevant ministries dealing with research and ministry of finance. There is lack of freedom and mechanism for scientific institutes to mobilize financial and technical resources from various sources, including private sector.

7. *Inadequate research and laboratory facilities:* While lack of adequate research and laboratory facilities is a problem, in some cases existing facilities are not fully utilized because of the absence of the skilled human resources.

8. *Lack of promoting success in R&D:* Most of the institutions do not have appropriate communication plan and system in place. The success of research institutions does not reach general people, particularly new generation. As a result, young talents do not have any role model among the scientists and researchers. While scientific publications are generally in English, the need for local language scientific literature is ignored. For example the catalogue, website, or various publications of BANSDOC all are in English. So it is out of reach for most of the people.

9. *Inadequate collaboration:* International and regional collaboration are essential to bring in new ideas and skills. However, existing act/rules sometimes prohibit the collaboration with international organizations and/or even with local private organizations. Inadequate collaborative projects between the universities and the research organizations widen the gaps between research institutions and the academia.

Objectives, Targets, Strategies and Policies for Science and Technology in the SFYP

Sixth Plan Objectives

The major objectives of the Sixth Five Year Plan in the field of science and technology are as follows:

1. Development of new sustainable technologies and industrial processes for production and preservation of products for poverty alleviation and income generation by environmentally sound and appropriate biotechnology.

2. Development of nuclear service related infrastructure such as development of nuclear facility, improvement of health services, transfer of nuclear technology as well as service delivery to various end users including environment and human resource development.

3. Strengthening of the institutional and human resources development activities in the country for introducing nuclear power technology.

4. Development of technologies specially required for the capital goods sector and large industrial enterprises and improvement of appropriate traditional and indigenous technologies for small enterprises in both rural and urban areas.

5. Upgradation of research organizations involved in the field of science and technology and attempt to make Bangladesh into a knowledge-based modern state through use of indigenous technology and innovations.

6. Strengthening R&D programs of existing organizations of the Ministry of Science and ICT through dissemination of modern scientific and technical know-how.

7. Strengthening of the institutional and human development activities in the country through development of improved science and technological knowledge.

8. Development of new and renewable sources of energy and their dissemination for the end users.

9. Providing education, research and training in marine science and utilization of the knowledge for invention and exploration of marine resources and protection of marine environment.

Sixth Plan Strategies

The Sixth Plan will have two dimensions: one is to create opportunities for investment by private sector, NGOs and development partners through creating enabling environment (both infrastructure and policy), which will need massive reform; second, the government will invest to ensure constitutional obligations for offering public good. It is important to identify target areas for science and technology development with a twenty year vision. In this line, it is important to identify thrust areas.

Basic research: Considering national priority and need for food security and health security of the nation, Biology and Medicine Research is becoming very important in the context of new intellectual property rights regime, where life saving drugs are going to be expensive and detrimental to national agenda of poverty reduction. It is true that it is not possible within short time to come to a stage when new drugs are possible to generate by our own scientists. However, a structured start may produce result in 20 years time. Research in the area of biodiversity and conservation will be very important for the country.

Specific areas of focus may be: Immunology and vaccine research; basic biology, biochemistry and drug design; genetics and genomics, ecology, biodiversity and conservation;

plant molecular biology and basic research in agriculture; biotechnology; bioinformatics; bioengineering.

Physical science: Energy security has become more important for Bangladesh with global volatility in energy prices, depletion of fossil fuel resources globally, and need for renewable energy development for protecting planet earth from adverse impact of climate change. Thus, Bangladesh can focus, again with long term plan, research related to "fusion". Fusion is the ultimate source of energy with minimal environmental degradation. The atomic energy research needs to push to the fusion program in the direction of commercial fusion reactors.

Chemical science: Chemistry of energy conversion processes and harvesting of different forms of natural energies can be one priority in the area of Chemical Science. Other possible areas may be: Chemical Biology with emphasis on biometric synthesis, molecular mechanism of drug action; Chemical ecology/ natural products.

Engineering: Engineering is one area, where Bangladesh may target to export technologies and know-how within coming decade. Robotics, Parallel computing; cyber security; bioinformatics; signal processing and communication networks; wireless communication; Structural mechanics; earthquake engineering; prediction of natural disasters including earthquakes, cyclones, tsunamis, etc.; early warning systems, structural engineering for resistance of natural disasters and loss mitigation technologies; energy engineering, including energy generation (renewable/ non-renewable), energy storage, efficient utilization and pollution control technologies.

New emerging research areas: There is a constant need to review developments at the cutting edge of basic research. A task force should be deployed to monitor global development in the R&D and bring in information for scientific communities on new area of development in science and technology.

Science and technology for micro and small enterprises (SMEs): As Bangladesh's economy is based on SMEs, effective methods and plans of promotion of innovations in the SME sector need to be devised in SFYP. The Plan may include a program for providing special technical and financial support to innovators to set up enterprises. More specifically, there may be three specific components of the plan for **(SMEs)**:

1. **Technology/ knowledge-based new start-ups** (which need S&T inputs for incubation)**:** There are no technology business incubators (TBIs) for providing technology supports for **(SMEs)** in Bangladesh. By comparison, in India there are 20 incubators, over 1000 in USA, 300 in Korea and 100 in Finland. Universities, Engineering colleges, business schools should be preferred institutions for TBIs. There is a difference in TBI and TIC (Technology Innovation Centre). TBIs are located in educational institutions and aim at converting results of R&D to industries. TICs are located in SME clusters and provide them

technical supports in technology up gradation and new product development. During the Sixth Five Year Plan 10 TBIs may be set up.

Other specific programs for (SMEs):

- Ministry responsible for Science & Technology should launch Science & Technology Entrepreneurship Park, Technology Business Incubator, Small Business Innovation Research Initiative.

- Ministry of Industries (MoI) should set up food parks for promoting technology for food production.

- MoI may prepare sectoral technology profile. These technology profiles will help critically examining and addressing technology needs in line with the business requirements of respective sectors. Involving CII, UNIDO.

- Ministry of Education/UGC should include Entrepreneurship/ Incubation into the engineering curriculum. Technical and vocational institutes need to be revamped for brining in school-dropouts and supply quality human resource for SMEs.

- Appropriate mix of man-machine is important for avoiding complete automation which is contrary to policy of labor intensive economy.

- It is desirable to encourage patenting by offering financial support/subsidies. Quality assurance, eco-labeling and bar coding of products also needs to be encouraged in a big way.

- Continuing education program for upgradation of skills at levels of technicians, supervisors, engineers and entrepreneurs is also necessary.

2. **Manufacturers of consumer products/ancillaries, driven by market demand** (which needs S&T interventions for innovation in process/product/packaging): Specific programs/ initiatives for this component may include:

- MoI should launch Small Industries Services Institutes, Tool Rooms, Central Footwear Training Institutes, Product-cum-Process Development Centers, Regional Testing Centers & Field Testing Centers, CAD & CAM Centers, Product Development, Design Intervention & Packaging Scheme;

- Ministry responsible for Science & Technology should undertake program for technology development & demonstration and program for 'TechnoPreneur' promotion.

3. **Rural technology:** Science and technology intervention is useful in all areas of rural economy such as agriculture, physical and social infrastructure. However, most effective

results would be obtained through rural technologies for non-farm rural enterprises, particularly for sustainable job creation in rural non-farm sector. Because, task of development and application of appropriate technologies for non-farm rural enterprises lacks a definitive institutional framework in the government set-up and therefore, significant value would be added to existing developmental goals by establishment of new institution responsible for transferring technology to rural non-farm sector. Such an agency can be linked up with the employment schemes for rural unemployed people. Furthermore, non-farm rural employment is of increasing importance due to low employment elasticity in the farm sector and the phenomenon of "job-less growth" in industrial sector. Currently, development of rural technology is promoted by BCSIR and by S&T non-governmental organizations and Institute of Appropriate Technology (IAT). All agricultural research institutions are major suppliers of technology to rural areas.

A dedicated agency for rural technology identification, development and promotion needs to be introduced. This agency can search out and link up thousands of disparate, small but sincere groups, working in far-flung corners of the country and provide them necessary support to implement technology transfer program. R&D institutions, universities, can supply technology to the new agency, which may be disseminated through grassroots partners including telecentres. There should also be a mechanism of field support for those grassroots partners. This institution can partner with telecentres for building their capacity to make them technology hubs for farmers, rural artisans and small producers. Specific programs for rural technology development will include:

- Training programs on Packaging for Exports;
- Scheme of Fund for Regeneration of Traditional Industries;
- Food Processing & Training Centers;
- Support to Training and Employment Program for Women (STEP);
- Intensive Dairy Development Program (IDDP); and
- Fisheries Training and Extension.

Biotechnology: Induction of biotechnology is necessary for Bangladesh to maintain our agriculture remunerative and globally competitive in the face of major challenges such as declining per capita availability of arable land; low productivity levels of crops, livestock and fisheries; heavy production losses due to biotic (insects and other pests, weeds etc.) and abiotic (salinity, drought, alkalinity etc.) stresses; heavy post-harvest crop damage during storage and transportation; and declining availability of water as an agricultural input. Investment in agriculture-related biotechnology has resulted in significantly enhanced R&D capability and institution building over the years, but progress has been rather slow in converting the research leads into usable products. Uncertainties regarding IPR management and regulatory requirements, poor risk assessment, and effective management and commercialization strategies have been the significant problems.

For ensuring food and nutrition security, value addition to primary agricultural produce through application of new technologies, employment generation, economic development and improved health and nutrition of all sectors of society biotechnology is very important. In an emerging era of preventive health care, it is envisaged that improved food products can be developed which promote well being and prevent diseases.

The mission mode projects in the areas of biotechnology can bring about significant value addition, cost effectiveness and competitiveness in product and process diversity. Biotech product/process development involves an elaborate pathway of innovation value chain over a period of years (7-10 years) with defined elements of basic research, translational research, development, verification and validation, prototype development, field trials, production/manufacturing and marketing.

In biotechnology research, problem arises concerning the protection of intellectual property for innovations in this field beyond legal and ethical questions. In view of the special quality of living organisms the scope of patents has to be clearly defined to find balance between innovation and public interest.

The mission mode project may include following components:

- Bio-fortification of agricultural crops with better nutritional traits for iron, zinc, vitamin A etc.
- Nutritional improvement of vegetable crops with special impetus on underutilized (neglected vegetable crop) species from different regions of the country
- Development of nutraceuticals/ health food supplements/ functional foods with proven evidence of efficacy and safety.

Bioinformatics: Sixth Five Year Plan proposes an initiative to establish a Centre for Bioinformatics under the National Institute of Biotechnology. For creating excellence in bioinformatics, following components may be included in the plan:

- Preparation of a pool of experts on bioinformatics through collaboration with biotechnology research institutions in the region, particularly with India and China, which obtains a very strong network of bioinformatics research institutions.
- Setting up supercomputing facilities for developing databases.
- Initiation of courses on bioinformatics in universities by inviting Bangladeshi scholars from abroad.
- Supporting Bioinformatics incubator facilities.
- Developing a resource pool of at least 10 PhDs in the field of bioinformatics within the period of Sixth Five Year Plan.
- Making online courses on bioinformatics available through globally reputed institutions.
- Institutional mechanism may be put in place for testing public domain databases and software and making them available to the users from the academia and the industry. After

such testing, these databases and algorithms may be graded so that scientists can use them with higher confidence.

- Commercial databases and software may be tested before the industry invests in the products. Such service will help the industry to reduce their costs and use only certified products.
- Giving priority to bioinformatics companies in High Tech Park.
- Facilitating collaboration between bioinformatics, agricultural scientists and plant molecular biologists. Special emphasis may be laid on adaptation to environmental stress.
- Another sector which merits attention is the documentation of the microbial wealth of the country and its possible utilization. Here again extensive collaboration with microbiologists is important.

Bioengineering: Bioengineering covers a wide range of areas such as tissue engineering, biomaterials for therapeutics, biomedical sensors, biomedical devices and implants, etc. Bioengineering offers opportunities for indigenous development of critical implants and devices, advanced biomaterials for therapeutic applications, tissue engineered products, etc. in coming decades.

The mission mode programs in the area of bioengineering may include:

- Charting of a national program on bio-design providing an incubator for generation of new ideas to develop novel biomaterials for therapeutic applications, design of indigenous devices and implants, tissue engineered products, etc.
- Establishment of a stable network amongst engineers, clinicians, basic scientists and the industry.
- Creation of partnership with universities, medical colleges, public research institutions having expertise in various disciplines such as chemistry, life sciences, molecular biology, medicine, engineering etc.
- Initiation of programs to facilitate indigenous production and evaluation of implants and devices which are currently available internationally but not available in the country at affordable cost.
- Establishment of a regulatory mechanism for testing and validation of bioengineered products and devices.
- Creation of new as well as improved Vaccines to create effective single-dose vaccines; prepare vaccines that do not require refrigeration; and develop needle-free delivery systems for vaccines.
- Solve how to design antigens for effective, protective immunity; and learn which immunological responses provide immunity. Priority diseases are: Dengue, Influenza, Tuberculosis, Malaria and emerging Indian pathogens.
- Participation in formation of regional biotechnology foundation in the region.

Marine resources: Research on marine resources is an underserved area, which can be a major source of economic development and employment for the country. The Sixth Five Year

Plan will undertake specific programs in the area of marine resource management which will include:

- Research on protection of coastal breeding & nursery areas:
- Research program on Integrated Coastal Resource Management by Integrated Coastal Zone Management (ICZM)
- Long term project on conservation of marine biological resources
- Program on protection of IUU (illegal, unreported and unregulated) fishing in Bangladesh waters
- Program on prohibition of pollutants discharge from ship breaking and other sources and their impacts
- Deep-sea resource survey every five years.

Strategies for Meeting Science and Technology Targets in the Sixth Plan

Science and Technology Agenda will consist of four components:

1. Appropriate R&D agenda in line with national development aspirations;

2. Appropriate institutional system for managing R&D;

3. Appropriate HRD for Science and Technology;

4. Appropriate resource allocation for accomplishment of the agenda.

Programs and projects to be undertaken in Sixth Five year Plan will be of two types:

  i. Regular programs and projects; and

  ii. Mission mode projects: This is more like special milestone or flagship initiative to promote science and technology in new areas. "Manhattan project" during Second World War for developing nuclear bomb is an example of mission mode projects.

The following strategies will be followed for development of science and technology in the Sixth Five Year Plan:

  i. Increasing public sector allocation for advancement of science and technology in Bangladesh.

  ii. Expanding education in science and technology to cover at least 80 percent of enrolment at secondary and higher secondary and 60 percent at graduate levels during the Plan period.

  iii. Training of scientists, technologists and ICT personnel in selected fields at post-graduate levels in centers of excellence at home and abroad on a massive scale.

  iv. Integrating policies for development of science and technology with macro-economic, industrial, agricultural, commercial and educational policies.

v. Effectively linking the entrepreneurs within the country with the supply of technology originating both at home and abroad through a national network.

vi. Remodeling the legal framework for protection of intellectual property, providing incentives for local entrepreneurs and development and transfer and absorption of technology.

vii. Linking the remuneration package for scientists, technologists and ICT experts to their individual productivity and potentiality.

viii. Providing institutional support and financing for commercializing technology, setting up venture capital fund to this end will be a step in the desired direction.

ix. Encouraging and enabling expatriate Bangladeshi experts to generally forge linkups with scientific and technological development of the country inclusive of wooing back home recognized experts in selected fields.

x. Entering the nuclear age through setting up of a nuclear power plant at Roopur for productive and peaceful use of nuclear technology.

xi. Modernizing science education syllabi at all levels of education as per present and future national needs.

xii. Providing strong support for theoretical R&D in sciences like computer science and engineering, physics, chemistry, mathematics and medical science; appropriate balance is to be evolved between theoretical and applied research.

xiii. Establishment of Hi-tech Park, IT and Bio-technology incubator, IT Village and Software Park, Community e-Centre in suitable locations of the country.

xiv. Establish unique educational/recreational facilities at different suitable locations of the country such as tilted dome Planetarium/Digital Pavilion for making people science and ICT conscious.

xv. Compiling of all laws, rules, statutes relating to science and technology, identification of their necessary modifications for help in adaptation to the requirements of the day and also for harmonization with the international conventions, particularly relating to intellectual property, patent of indigenous products and processes as an incentive to the scientists and technologists and the local entrepreneurs.

xvi. Assessing the need for focusing research on perceived national problems; research in fields of biotechnology and genetic engineering; its application in agriculture, aquaculture, animal husbandry, food processing, health and environment , promotional of technologies for enhanced use of renewable energy (e.g. bio-mass, wind, solar) and new materials.

xvii. Strengthening regional and sub-regional cooperation with SAARC countries and with other science and ICT organizations for better cooperation and bilateral relations.

xviii. Research for proper exploitation and exploration of resources of the Bay of Bengal for socio-economic development of the country and encouraging for inclusion of ocean science related subjects in the curriculum of the educational system.

xix. Providing budget allocation for women involved in science and technology related R&D, higher education and entrepreneurship.

Policy Framework

Formulation of a new National Science and Technology Policy (NSTP) will top the agenda for five year planning. Besides updating of NSTP, there is need for enactment of appropriate laws and acts and modification of existing ones. The issue of knowledge transfer as well as adherence to the Intellectual Property Rights will be given proper attention.

Role of PPP in Development of Science and Technology

For the balanced development of science and technology, steps will be taken to involve the private sector. The role of the public and private would assume new dimensions through the explicit adoption of Public-Private Partnership (PPP) in SFYP. Under the initiatives the public sector would join hands with the local and international private sector to ensure investment for science and technology infrastructure, particularly in power and energy, Public Key Infrastructure (PKI), Hi-tech Park, Software Technology Park, ICT etc. The PPP would be aimed at promoting efficiency of overall investment in science and technology sector incorporating with managerial skills, technical know-how and experts from local and international sectors. Similarly, the local bodies will also be involved in promoting and disseminating technical knowledge for setting up of projects relating to solar energy, bio-fertilizer and IT enabled services.

Institutional Reform

With renewed emphasis on science and technology for national development both in the short to medium term and long term, setting up a system of appropriate institutional mechanism is important to reflect in Sixth Five Year Plan. A task force will be formed for developing appropriate institutional system by first two years of the SFYP. Such institutional system will be led by an apex institution, 'autonomous from but related to' the Ministry responsible for science and technology. This apex institution will replace existing National Council for Science and Technology. This institution will have responsibility to formulating and implementing the new schemes for enhancing research infrastructure and for attracting new generation of students and faculty into research institutions and universities. Appropriate allocation during Sixth Five Year Plan period would be necessary to inject fresh vigor into research system of the country. Institutional reform program will include the following:

- **Appropriate human resource in Ministries dealing with R&D:** Competitive exams for awarding of research and Ph.D. fellowships under the umbrella of research institutes, universities and joint programs with sandwich Ph.D. programs with foreign research establishments will also be introduced.

- **Funding new infrastructure in the University System and in National Institutions**: Flexible mechanisms will be evolved where funding is effected rapidly and installation and operation of equipment follows quickly. The apex institutions will act as creator of facilities and as watch dog to ensure efficient operation.

- **Establishment of higher education commission:** A higher education commission with two components will be set up, consisting of eminent scientists covering all branches, e.g. biological, physical, and mathematical as well as social science disciplines. One component will be related to institutions up to the pre-university level and the other will be related to university level institutions. The Commission will submit its report and recommendations to the Government at an inter-ministerial level meeting chaired by the Prime Minister, to enable inter-ministerial cooperation for effective and rapid implementation of its recommendations. Both components of the commission will work independently, but will however coordinate between each other. This commission will work upon the following issues:

- To form a small group with invited scientists to monitor and report on the science and technology (including agricultural, health, industrial, engineering and social) development in different countries relevant to our needs;

- To develop a few priority research programs and projects, which could lead to tangible benefit for the country;

- To invite industry and research/university scientists to dialogue to assess the needs of industry in establishing linkages, which would reduce industry's dependence on expensive imports of know-how and raw materials;

- To consider funding of relevant research work undertaken by industry;

- To work with public university authorities on ways to reduce their dependence on government funds. For example, increasing fees, but providing scholarships to needy students, seeking R&D resources from institutions aboard and private sector as well;

- To upgrade selected departments in carefully chosen areas of science;

- To establish University of Engineering and Technology (UET): the UGC will establish 10 UETs of international standards;

- To make the research internationally competitive, quantum of grant support to selected departments will be increased;

- To support to scientific associations.

Human Resource Development for Science and Technology

The following strategies will be adopted in the field of human resources development under Sixth Five Year Plan.

a.   **Initiative for recruitment of faculty/ scientists:** Most pressing problem in research institutions is shortage of newly recruited faculty members, as a result, having decline of research profiles. For attracting quality human resources, including those from foreign research institutions following actions will be taken:

- A new attractive recruitment policy will be introduced, which would stipulate ground rules different from those in force for recruitment for administrative positions. The apex science and technology institution with autonomy should be free to develop new schemes in which new recruits to the academic S&T system can be centrally funded and placed in institutions.

- Flexibility in salary support will be built in for attracting appropriate human resources.

- The initial invitation for joining the research institutions will accompany a start-up research grant in order to attract the best scientists to work in Bangladesh.

- Scheme for creating a prestigious Chair in different departments of the university will be adopted, where foreign eminent scientists will be invited to serve for 2-3 years in order to modernize teaching and research.

b.   **Plan for bringing Bangladeshi scientists working aboard to lead specific Agenda item:** A database of scientists and technologists of all disciplines will be created with the help of the Bangladesh Embassies and Offices of the High Commission abroad. The Global Network of Bangladeshi biotechnologists is such a website, but limited to scientists of that discipline only. Such a database will be of tremendous benefit to any Ministry in need to prepare a comprehensive plan for attaining certain specific objective.

c.   **Incentive mechanism for R&D:** Promotion of university teachers will be only on considerations of combined merit of research and teaching. There should not be any departure from the principle from the selection criteria followed throughout the world over if we want to keep abreast with them in academia. A system of awarding and giving special incentives for the working scientist and technologist will be developed. Government may think of a separate pay-scale and facilities for researcher and scientist like the judiciaries. In this regard linking

the remuneration package for the scientists and technologists to their individual productivity and potentiality may be considered.

d.   **Increased fellowship and grants:** A scheme will be taken up to convert a large number of public universities in the country into graduate research institutions. This will require allocation of adequate funding, with consequential increase in the number of teaching and mentor staff and physical facilities of the universities. It will also require increase in the amount and number of S&T fellowship/internship/scholarship. Sufficient research funding sources will have to be made available so that the research work is not) hindered for lack of equipment.

e.   **Improve effectiveness of research grants:** For improving effectiveness of research grants existing grant money for research, result based system of monitoring will be introduced.

f.   **Development of research talents:** There will be an arrangement for 4-year prestigious Ph.D. fellowships under sandwich programs and tying these to research themes identified previously and also to the international laboratory links mentioned below. The system of administrative file movement for higher research in universities will be streamlined for quick approval and allocation of funds. Research experience under local conditions must be mandatory for recruitment of the best students as teachers for the university.

g.   **Attracting young talents in R&D:** For attracting young talents to research in science and technology, the following programs will be included in the Sixth Five year Plan: (i) An attractive financial reward will be introduced for teachers of Science, Mathematics, English and other related subjects. (ii) Fresh graduates having excellent academic record will be tapped for research and development with adequate incentives. (iii) The apex institution will make online scientific resources free of cost for all members of academia and research institutions.

h.   **Inter-institutional linkage program:** Academic research institutions and national laboratories play a major role in scientific research outputs. The university system does not contribute much to scientific research output in a major way. This is largely because of the decline in research activities in the science departments of universities. To enhance scientific activity within university system, a new program to promote inter-institutional linkages will be introduced in Sixth Five Year Plan period.

i.   **Building system of awarding scientific invention and innovation:** A prestigious award system will be introduced during Sixth Five Year Plan for various categories of scientific research on annual basis so that scientists are encouraged for conducting quality research and contribute to achieving national agenda.

j.   **Policy for international and national collaboration:** Collaboration with the international scientific and technological institutions and organizations needs to be encouraged. The concerned ministry should make sufficient budgetary allocations for their membership and funds to attend their important meetings. A case in point is the membership fee of the International Centre for Genetic Engineering and Biotechnology, Trieste and funding to attend the meeting of the Board of Governors. Almost every year concerned scientists are to approach the Government for renewal of membership and funds to attend its meeting by the concerned representative of Bangladesh. Developing better relationship with the neighboring and developing countries by sharing scientific methods, ideas, inventions, discoveries and to take initiative to bring and adopt new technologies from the developed nations.

Financing science and technology: It is essential to increase public sector allocation for the advancement of Science and Technology. A target of allocating 2% of GDP will be made in the next five years. The allocation will be clearly marked as the R&D part of total allocation. As in ICDDRB all the senior teachers will be encouraged to apply for research grants from Institutions such as NIH, USDA, WHO, FAO, Ford Foundation, funding bodies from UK, Australia, European Commission etc. so as to supplement their salaries instead of allowing them to be hired by private universities and foreign institutions.

Implementing copyright law: To encourage R&D activities in private sector implementation of copyright law is very important. For proper implementation of this law surveillance should be increased.

Building effective linkage between basic research and technology: New technology is closely related to basic research. Ideas of new technologies are generated by researchers working in basic research and these can spawn new products and processes. For such linkage public-private partnership will be promoted. The Sixth Five Year Plan will include:

Program for technology business incubators: Technology-business incubators will be established, so that the results of basic research can be transformed in to new technology. The incubators will provide support to scientists to start businesses based on technology developed in the lab. This type of technology transfer can be very effective in terms of implementation, particularly for low initial capital start-ups.

Providing incentive for R&D in industries: The Ministry of Finance will provide fiscal incentives to industries for producing products and services through R&D undertaken in Bangladesh or in collaboration with partners abroad. These industries will be encouraged to invite research students working in basic science related to new technology by some incentives. New techniques and methods are most easily transferred in this way.

New infrastructure: Rapid advancement of science in all areas necessitates that research infrastructure be constantly upgraded and added. Creation of specialized laboratories and advanced instrument facilities is essential if Bangladesh's research is to play a role in achieving national aspirations. The proposed apex body will form a committee to identify needs for establishment of new infrastructure and allocate financial resources for their implementation.

Modernization of R&D facilities: The existing facilities in the R&D institutions will be modernized and a research network among the different national organizations will to be set up. The capacity of BANSDOC will be strengthened so that it could become the effective national S&T information centre.

Technology transfer: Under the Sixth Five Year Plan a national centre for technology transfer will be established, which will cater to the need for various industrial segments.

Programs/Projects during Sixth Five Year Plan

In accordance with the strategies mentioned, the indicative work-plan in terms of physical components has been prepared considering the situational context and the specific objectives of the Ministry of Science and ICT and its agencies like Bangladesh Atomic Energy Commission, BCSIR, Bangladesh Computer Council, National Museum of Science and Technology, BANSDOC and Bangabandhu Sheikh Mujibur Rahman Novo theatre, National Institute of Bio-technology (NIB). During the Plan period the thrust areas of the Ministry of Science and Technology (MoSICT) will include:

  i. Establishment of Information Highway

 ii. Establishment of an ICT University in the country on PPP model

iii. Offering overseas fellowship/scholarship programs for young scientists and technologists, computer programmers, system analysts annually for training at M.Sc./Ph. D level

 iv. Setting up a complete national institute of oceanography top achieve its targets

  v. Setting up an ICT cell within the Ministry to serve as a clearing outfit for acquisition, dissemination and adaption of ICT in Bangladesh

 vi. Establishment of computer labs at educational institutions, Community e-Centre (CeC) and Information Network Village (INVIL)

vii. Updating laws and statutes relating to science and technology as per global requirements

viii. Strengthening organizational support for the NCST, ICT and Bio-technology Taskforce

ix. Upgradation of Bangabandhu Sheikh Mujibur Rahman Novo theatre with large format film and digital exhibits for attracting the young generation towards science and technology

x. Encouraging science education through establishing the Science Museum and Digital Planetarium/Novo theatre at each Divisional headquarter

xi. Establishing of a Centre of Excellence for transfer of technology

BCSIR

The main thrust of BCSIR during the SFYP will centre on:

a. Training for the development of human resources

b. Modernization of laboratories and institutes

c. Promoting research on tissue culture, herbal medicine, bio-fuel, fruit-processing, etc.

d. R&D activities on new and renewable energy, tools and bio-metallic implant

e. Development of technology for preservation of food, fruits, vegetables and spices for local market as well as for export

f. Pilot plant study on liquid fuels, re-cycling of bio-wastes, bio-fuels, etc.

g. Development of molecular techniques

h. Establishment of food safety laboratory and analytical research institute

i. Development of energy standard and ISO-17025 accredited instrumentation and calibration laboratories

j. Setting up regional laboratories at Sylhet, Khulna and Barisal Divisional headquarters

k. Setting up three mobile laboratories for promoting and dissemination of science and education, and

l. Support to university research for the development of scientific education.

BAEC

The main areas of activity during SFYP will be (a) expansion of medical diagnostic and therapeutic services using nuclear and other state-of-the art techniques (b) strengthening of non-destructive techniques as a part of quality control (c) strengthening of elemental and analytical techniques (d) expansion of food preservation and sterilization and tissue banking using radiation techniques (e) continuing environmental monitoring (f) development of radiation processing (g) acquisition of capability in electronic instrumentation and maintenance (h) acquisition of nuclear minerals (i) upgradation of Nuclear Safety and Radiation Control Act, 1993 (j) development of human resources for nuclear technology and (k) considering the paucity of indigenous primary energy resources, environmental dimension

of fossil fuels, energy security and the need for maintaining a long-term energy-mix, the Rooppur nuclear power project will be implemented in SFYP.

BANSDOC

During the Plan period BANSDOC will concentrate on (a) transforming its library into digital library with the ultimate goal for establishing a virtual inter-library (b) launching inter-library cooperation and sharing at national and international level (c) establishment of new branch of BANSDOC at Divisional level.

The infrastructural facilities of National Museum of Science and Technology (NMST) will be expanded during this period for popularization of science and technology. During the SFYP period NMST will concentrate on (a) digitalizing of NMST (b) introducing museobus (c) modernization of library (d) collection of 500 new exhibits (d) assist the science club in the country and (e) establishing new science museum at Divisional headquarters.

NIB

National Institute of Bio-technology (NIB) will play a very significant role in the promotion and advancement of bio-technology research in different areas. These include:

(a) animal bio-technology (b) plant bio-technology (c) fisheries bio-technology (d) environmental bio-technology (e) microbial bio-technology (f) molecular bio-technology (g) medicinal bio-technology (h) food bio-technology (i) bio-informatics;

Specifically following actions will be undertaken:

1. Establishment of bio-technology incubator;
2. Human resources development in bio-technology;
3. Strengthening of NIB. The NIB has the potential to become the coordinating centre for technology transfer and human resource development in new and emerging areas of bio-technology. During the SFYP period NIB will emphasize on increased productivity, augment farm income, and reduce poverty through innovative application of genetic engineering and bio-technology in Bangladesh.

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

The Vision 2021 adopted by the Government envisages Bangladesh to become a digital nation by 2021. For realizing vision 2021 designing of a comprehensive master plan has been taken up with adequate elaboration of individual components of that master plan. The master plan is being developed on the basis of a framework. The framework is built based on a few important documents: Vision 2021, ICT Policy 2009.

The ICT Policy 2009 identified the objectives of ICT in development. They are: (1) Social equity (2) Productivity (3) Integrity (4) Education and research (5) Employment (6)

Strengthening exports (7) Healthcare (8) Universal access (9) Environment, climate and disaster management (10) Support to ICTs. The proposed framework captures the objectives of ICT in development.

At the centre of the proposed framework will be a National Information and Knowledge System (NIKS), which will be designed to provide the platform for developing and delivering services to all citizens in rural and urban areas, particularly emphasizing service delivery to poor and backward communities. In the model for ICT based economic development the role of information has been considered as mission critical and the completion of process of creation of a "universal' national information and knowledge system (NIKS) is the core of all development activities. There are five components of the ICT based economic development framework which stem from the development of the NIKS. They are:

1.   **Connecting citizens:** Under this component all citizens of the country irrespective of their residence, age, economic condition, race, sex, ethnicity, will have access to ICTs for accessing information and knowledge required to perform their day-today activities. Such access to information and knowledge will make the 'digital citizens' able to take informed choice in exercising their rights and entitlements, increase their economic opportunities and protect themselves from exploitation. The "connecting citizens" component will be built around (i) An inclusive information and knowledge system by way of allowing access to an information and knowledge system for all citizens through the various channels of ICTs and access to locally relevant content in Bangla language; (ii) Deployment of specific programs and projects through ICT for employment generation, promotion of agriculture, access to quality health care particularly maternity health care and digital empowerment of women; and (iii) Establishment of two-way channels for promote participation of grassroots in policy discourse and effective feedbacks to the policy makers on particular policy adjustments.

2.   **Human resource development:** The education system will be restructured so that it ensures a higher quality of education which will produce skilled human resources for meeting the demand of domestic knowledge-based economy as well as global demand for quality human resources. The role of ICT in boosting the quality of education will be emphasized and steps will be taken for narrowing the ICT skills between urban and rural people. The human resource development component will have four parts:

- *Building E-learning Infrastructure:* One school one computer lab, smart class room with e-learning facilities

- *ICT in elementary education:* Creating facilities for ICT education for accessing information and knowledge for school children;

- *ICT based higher education:* Mainstreaming ICT in education process for collaborative learning of core courses;

- *Vocational ICT training:* Creation of facilities for youth to learn ICTs for jobs at home and abroad and self-employment.

3.   **Digital government:** Work flow in government and semi-government offices will be fully integrated with ICTs through re-engineering of government's business process. This will bring efficiency in the decision making process as the government can now take informed and timely decisions on various policy matters due to data generation system from grassroots to the national level. Digital government also will also increase transparency government through implementation of "Right to Information" legislation, which also ensures participation of citizens in decision making process using ICT tools. There will be three specific sub-components of "Digital Government":

- *Building sound legal and policy infrastructure of the NIKS:* Creating appropriate dynamic legal and policy system to unleash potential for participation of citizens, private sector, development agencies and government for creating new services;

- *E-Administration:* business process re-engineering for the government agencies for efficient and transparent decision making and accessing, for improvement of transparency of the government

- *E-Citizen Services:* Converting traditional service delivery mechanism into e-service delivery system to bring "service at the door step of citizens".

4.   **E-Parliament:** Digital Parliament is one of the important components of vision of 'Digital Bangladesh'. All documents and records of Constituent Assembly of Bangladesh (1972) and the documents since the 1st Bangladesh Parliament will be digitized. With that view a data base can be developed and published in the web site. Ultimate target is to build an e- Parliament – a paperless Parliament where the Members of Parliament can submit their notices electronically and get every response from the Parliament electronically.

5.   **E-business:** The general economic and business activities will be carried out through the use of ICT which would enable business to utilize maximum potential with appropriate human capital created through digital education. Businesses irrespective of their size can avail ICT for production and access to market domestically and internationally. Businesses also can transact and make payment off line and online internally and globally.

6. **Institutional and financial framework for Digital Bangladesh agenda:** There are two sub-components of this component:

- Intuitional framework for implementation of digital Bangladesh agenda.

- Resource Allocation and Fiscal measures.

Review of Past Progress

The National Telecommunications Policy (NTP), 1998 was a first step taken by Government towards developing a clear policy stance in telecom. As a first effort it was largely open-ended and there was inconsistency between some aspects of the policy. There was negligible focus on technological convergence and in many ways the policy statement did not address the key challenges facing the industry, which are reform of BTTB, privatization, and measures to encourage significant amounts of new investment. These changes happened outside of the purview of the policy. The NTP 1998 created confidence among the market players and actual progress exceeded expectations of the stakeholders.

The government decided in June, 1998 to withdraw all import duties and VAT from all computer hardware and software, which fortunately coincided with global reduction of prices of computer hardware. This has brought the prices of computers down to a level affordable by middle income households.

The National ICT Policy was adopted in 2002. The policy was updated in the year 2009. Ministry of Science and Information & Communication Technology (MoSICT) undertook several Programs from Revenue Budget and Projects from Development Budget to foster a sustainable e-Readiness in Bangladesh. These are: (1) TIER 3 Certified National Data Center; (2) Government wide Network Infrastructure under Korean and China Exim Bank Credit; (3) Human Resource Development through establishment of Computer Training Labs at secondary and higher secondary schools and colleges; and (4) Promotion of IT/ITES Industry in the country.

Current Trends in ICT Development

The ICT Policy of Bangladesh aims at building an ICT-driven knowledge-based society. In the light of this policy Bangladesh's ICT sector is growing at a rapid pace, with increased involvement from local and foreign investors. Submarine cable has connected Bangladesh to the global information superhighway. The Bangladesh Association of Software and Information Services (BASIS) estimate the value of ICT industry in Bangladesh at US$ 150 million, and growing at an estimated 20 percent per year. According to the Bangladesh Computer Samity the number of sector-wise companies has been growing as shown in Table 6.1

Table 6.1: Growth of ICT Sector-wise companies in Bangladesh

Sector/year	2000	2001	2002	2003	2004	2005	2006
Hardware	1200	1600	1900	1950	2000	2200	2500
Software	100	190	240	275	300	320	350
Internet service provider(ISP)	30	40	80	100	130	140	150
Training and other	100	150	150	140	130	140	150

Source: Industry Profile and Statistics Bangladesh, Bangladesh Computer Samity

Computers are now widely used in offices, businesses, educational institutions, at home and in the field. Besides, a number of cyber cafes are also providing e-mail and browsing facilities in all the major cities of the country. The annual market size for IT including computer hardware, peripherals and software was estimated to be worth approximately US$ 25 million (Figure 6.3). The market is fast growing at an annual rate of over 25% and is forecast to rise to US$ 43 million in 2009 (BOI). Software export has seen significant growth over recent years, rising from US$ 12.6million in 2005 to over US$ 27 million by 2006.

Figure 6.3: Value of Bangladesh Software Exports (US$ m)
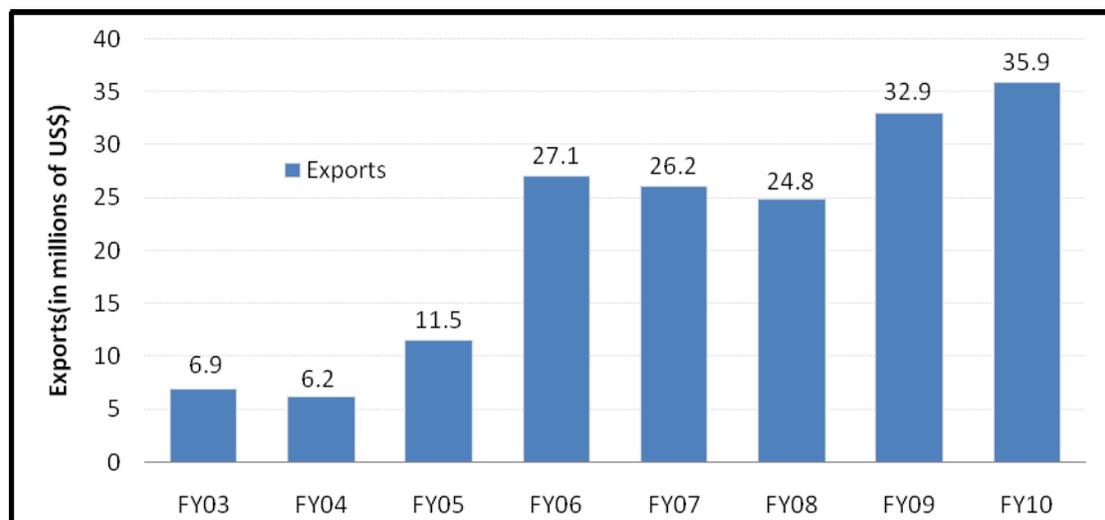
Source: Export Promotion Bureau of Bangladesh

Computer hardware accounts for around 65% of the IT market in Bangladesh while software and IT services account for the rest 35%. The local packaged software market is dominated by multinational companies, with Bangladeshi software companies accounting for 25-30% of the local packaged software market. Software applications comprise more than half the packaged software while systems infrastructure make up 30% and applications development and deployment makes up the balance. Hardware and software support and installation are the largest segment of the IT market, accounting for 40% of revenues. IT education and training account for 8% of the market.

Figure 6.4: Composition of the IT Sector in Bangladesh

270
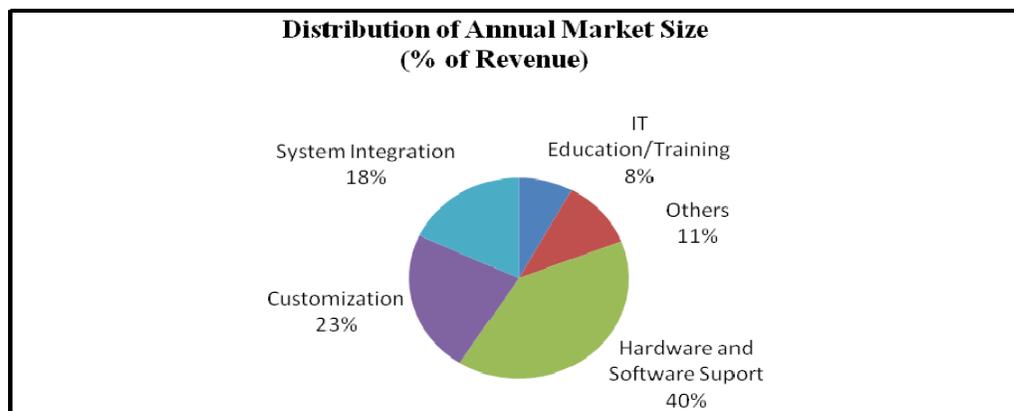
Telecommunications sector in Bangladesh experienced robust growth during the last one decade. While mobile teledensity had been predicted to reach 10 percent by 2010, actual teledensity by end of 2008 stood at 31.21 percent, more than thrice the target. There were 52 million mobile phone subscriptions by the end of 2009. Competition policy and deregulation account for this phenomenal growth in the mobile sector. In contrast, the fixed/PSTN market observed modest growth, with only 1.19 million—PSTN subscribers (17.82 percent) at the end of 2008 slightly up from 1.01 million in June 2006.

A probable reason for the sluggish growth in PSTN may be issuance of too many licenses and uneven competition with mobile telecom industry. All PSTN operators are choking now competing with the mobile phone operators. The fierce competition among the mobile telecom operators led to a nosedive in call rates within the domestic market. Bangladesh offers the lowest mobile phone call rates among South Asian countries.

In contrast to mobile service uptake, Internet adoption was slow, mainly due to the high price of Internet connectivity. However, after Bangladesh got connected to the information super highway via the SEA-ME-WE4 submarine cable, the quality of Internet connectivity improved. Data transfer capacity went up to 14.78 gigabytes per second, 64 times higher than total capacity at the time of installation in May 2006. The bandwidth price was also subsequently reduced by the state-owned Bangladesh Telecommunications Company Limited (former BTTB. However, the reduced rate is still much higher than the price for the same bandwidth in India.

So far, the only submarine cable network is operated by BSCL. In May 2008 the government decided to allow the private sector to install and operate a submarine cable. Following this decision, the government gave license to a private company in 2009 to create a fiber optic network around the country. ISPs have been given telephone licenses to make telecommunication services more affordable.

To increase countrywide internet services via submarine cable, internet bandwidth price has been reduced by 33%. As of 2010, the number of mobile internet users was estimated to be around 5 million. Of this, around 4.5 million access the internet using mobile phone. The government implemented the International Long Distance Telecommunication Services Policy (ILDTSP) in the second half of 2008. However, illegal Voice over Internet Protocol (VOIP) services continued due to inappropriate pricing policy of internal and local call termination.

E-governance and Digital Content Initiatives

Initiatives to migrate to e-governance: To migrate to e-Governance by 2014, implementation of an IT road map, designed and adopted by the government, initiatives are well underway. The Office of the Controller of Certifying Authority (CCA) began functioning

to launch digital signature with an aim to introduce e-commerce by 2012. As a first step to digitalizing the manual file management system, a Digital-based Filing System has been introduced in the establishment ministry and its subordinate offices. The government has established Community E-centers in 133 Upazilas to ensure easy access of rural population to information technology and thus minimize the digital divide. Measures are being taken to bring 4,409 Union Parishad Bhabans under the optical fiber network. Steps have also been taken to establish one crore land phone connections and convert 8,000 rural post offices in phases into Community Information Centers (CIC) within a short span of time.

As part of the program to introduce compulsory computer and technical education at secondary and primary levels by 2013 and 2021 respectively, steps have been taken to establish computer laboratories in 1,200 educational institutions at Upazila level in seven divisions and in 200 educational institutions in six metropolitan cities. Tax rebates are proposed on any assistance made to schools and colleges under MPO (monthly payment order) for improving computer education. This has been proposed with a view to encouraging Corporate Social Responsibility (CSR) activities in this sector.

Besides, the South Asian Sub-regional Economic Cooperation (SASEC) Information Highway project has been undertaken, to strengthen regional cooperation and establish connectivity between India, Nepal, Bhutan and Bangladesh.

Digital content initiatives: Enhancing relevant digital content has become a major issue as PC penetration and Internet access have increased across the country. Without locally relevant content, ICTs are of no use to people. Content development is now a priority not only of the private sector and civil society organizations but also of government. The content issue has been highlighted in the draft Broadband Policy. Government has recently established *infokosh* (Web Portal) that provides key information on the activities of different ministries/divisions/agencies.

The most noteworthy government initiative is with content both in English and Bangla languages. The website of the Bangladesh Government Press or BG Press is facilitating access to government information. In the mean time 64 district portals have been made operational and construction of 5,000 government websites is under way. BG Press is the single point of publication of all gazettes and documents related to the functioning of the government and state. An earlier digital content initiative by government made government forms more accessible to citizens via the website www.forms.gov.bd. People access the forms through telecentres which charge a minimal fee for downloading and printing the forms.

The downloadable forms include passport application, visa application, citizenship form, pension form, Internet connection (BTCL), birth registration, income tax return, and driving license. The availability of these forms online helps citizen's access government services in less time and costs. The website is bilingual. Those who cannot read can get the forms from telecentres, which are now becoming popular in rural Bangladesh

Use of digital technology: Use of digital technology in educational institutions has been increasing rapidly. SSC and HSC results are now available via mobile and internet and are also e-mailed to the educational institutions. Using data obtained from the Education Boards, Shahjalal University of Science and Technology, Sylhet, completed its administration registration process via mobile-phone-based applications. In 2009, for the first time, results of medical college exams were available through mobile SMS system.

To make high speed internet more affordable for students of Shahjalal University and Dhaka University, special free Wi-Fi zones have been created. To ensure timely availability of textbooks to students, they have been published online. The science and ICT ministry has not only set up computer labs in 128 schools in 64 districts, but has also appointed IT professionals there.

The country's 800 health centers have been given internet and mobile connectivity. Several telemedicine centers have been built. Along with mobile health services by the private sector, upazila health complexes have started offering similar services. To ensure equal access to technology for all, the government is setting up community e-centers/tele-centers all across the country — there are more than 2,300 of them now. The Registrar of Joint Stock Companies and Firms has digitalized its registration process. Bangladesh Bank started an automated clearing-house on a trial basis since November 2009.

Initiatives from the Non-government Sector

Apart from government initiative, a number of initiatives have been taken in the non-government sector. D.Net was the pioneer in development of digital content in Bangla language. In 2003 D.Net started research on content development targeting the rural poor. Since then, a huge content base in Bangla has been developed. D.Net initially focused on the CD-ROM version of the content since Internet connectivity was not available in the rural areas at that time. But with the availability of access to the Internet through EDGE or GPRS from almost anywhere in Bangladesh, the Web version is available. The second largest Bangla website is dedicated to human rights issues and provides legal practitioners with access to the full text of laws, explanation of laws, addresses of legal redress institutions and the like. Local digital livelihood content generation by NGOs gained further momentum in 2007. Bangla Wikipedia (bn.wikipedia.com) is also getting richer with participation of large number of volunteers.

Besides, "Digital festivals" and "IT festivals" have been held in various parts of the country to familiarize the people with ICT use. Even a remote place like Bagerhat organized a knowledge festival. BCS, BASIS and Bangladesh Open Source Network took active part in these festivals, which have increased people's interest towards computers.

Role of ICT in Creating Equitable Job Opportunities

Access to ICTs is just a first step towards creating equitable opportunities for citizens. It has two distinct elements: communication infrastructure including high speed broadband, and, physical access points. In a country where 38% of the population lives below the poverty line, personalized access to ICTs for all citizens is a remote possibility in the near future. Community-based public access to ICTs is can be an interim solution for providing access to ICTs for all. However, as the proportion of population with mobile handset is increasing, services should be designed also for accessing ICT through mobile phones.

In Bangladesh, private sector and non-government agencies have been leading in enabling public access to ICTs through telecentres of various varieties and brands. The number of such telecentres is above 2,500. The government has also started establishment of telecentres in local government offices and other relevant institutions.

Services through ICT channels are very helpful in gaining employment opportunities. The private sector is offering ample services in this regard. An example is bdjobs.com, which was established in 2001 and which now has a monthly page view volume of 8,00,000 and 14,000 daily visitors. According to their records, over 2,500 employers in Bangladesh have recruited more than 35,000 professionals at different levels through the bdjobs.com service.

ICT in Access to Health Care Facilities

A number of help lines are now offering consultation and counseling on various issues. Grameen Phone's 789 and Bangla Link's 789 for health and Bangla Link's 7676 for agriculture offer consultation with experts. D.Net's *Teletathya* is the oldest helpline in the country leveraging mobile phone penetration since 2004. This helpline offers counseling on agriculture, health, education, human rights and information government services. It also offers directory services. BIID offers networking among farmers through its *'e-krishok'* initiative. The most significant e-health initiative till date is the Amader *Gram* Breast Cancer Initiative, which offers free of cost diagnosis and treatment of breast cancer for women.

Role of ICT in Education—E-learning—and Human Resource Development

ICT has the potential to improve the quality of learning, expand access to learning opportunities and increase the efficiency of the administrative process. Through use of computer, the learning process shifts from learning-by-telling to learning-by-doing. However, for this to happen, extensive teacher training in the new technology is also necessary. Teachers may be equipped with learning aids for enhancing their skills and using them in the class room for enhancing learning experience of the students.

In Bangladesh, lack of local educational content is a barrier to increased use of ICT in schools. To address this gap, the Institute of Education and Development at BRAC University, in collaboration with Foundation of Education Research and Education (FERI) and D.Net, a

Bangladeshi research institution promoting ICT 4 development, developed interactive digital content for Grades 6-10 students of Science and Mathematics.

Training in ICT vs. job availability: ICT education in Bangladesh is generally concentrated at the tertiary level. Although there is an optional course on computers in the secondary schools, the course curriculum is outdated and there is little opportunity for hands-on practice. Skilled human resources are currently in high demand but short in supply.

It has been observed that graduating ICT students are unable to find employment. There is a great gap between the academic and professional sectors. The ICT topics taught widely do not always match the needs and priorities of the private sector. Students learn the requisite theoretical and technical skills but do not know where to apply them: career counseling and formal contact with the private sector is non-existent or too general to be of any benefit to ICT students. Education in the ICT field is seen as formal and theoretical and as a result it does not convey the real picture of the private sector.

Constraints to ICT-related activity

Lack of capacity building: There is a great lack of capacity building. The teachers of colleges under National University as well as the new universities of science and technology are not sufficiently trained to adopt current changes in science and technology. The in-house and overseas training facilities are not adequate for the scientists working in the field of cutting edge technology.

Limited access to scientific sources: Research institutions and universities in general do not have access to high speed internet connectivity. Thus access to scientific resources is limited. Most often there is no budgetary provision for subscription of scientific online resources.

Electricity and power instability: Availability of continuous power is the biggest logjam in physical infrastructure. Power generation capacity in Bangladesh is still among the lowest in the world. Frequent power failure and low voltage stand as a big hurdle for software companies in Bangladesh. Domestic and international companies are working to find solutions such as low-power ICT equipment.

Lack of coordination among ministries: Implementation of National ICT Policy 2009 is being carried out by a number of Government entities but there is low level of coordination amongst them. This acts as impediment towards timely completion of these activities.

Currently as per the rules of business of the government, the responsibilities for ICT activities are fragmented across three ministries: Ministry of Post and Telecommunications (MoPT), Ministry of Science and Information & Communication Technology (MoSICT) and Ministry of Information (MoI). MoPT is responsible for telecommunication infrastructure; MoSICT through its ICT Division (ICTD) is responsible for e-Government and IT/ITES business promotion while MoI is responsible for Broadcasting. ICTD conducts its activities through its

3 organizations: Bangladesh Computer Council (BCC), Office of the Controller of the Certifying Authority and High Tech Park Authority. The country's lone ICT Incubator is operating at Karwan Bazar and the 12 storied building Janata Tower is now being renovated to establish the IT/ITES Technology Park in Karwan Bazar. The ICT Division through High Tech Park Authority is in the process of appointing Park Operator for the Kaliakoir High Tech Park and has also initiated the process of acquiring lands outside Dhaka for the establishment of IT/ITES Technology Parks.

Various e-governance implementations are now being implemented by Access to Information Program (A2I) under Prime Minister's Office and Bangladesh Computer Council (BCC) under ICT Division.

Though lack of coordination among various agencies in implementation of ICT project is one of the challenges but the situation is improving. Ministry of Local Government and Rural Development, Bangladesh Computer Council and A2I Program have successfully implemented 4501 Union Information Service Centers and more collaboration at various levels is taking place.

Vision, Objectives, targets and Strategies for ICT in the Sixth Plan

The vision of the government is to make Bangladesh the most preferred destination for ICT and ICT- enabled services through the combined efforts of all stakeholders in both the public and private sectors.

The objective during the Sixth Five Year Plan will be to make an effective and maximum utilization of ICT to improve the quality of life of the citizens and promote inclusive growth through human resource development, so that Bangladesh can find its proper place in the community of nations.

Targets

The major Targets of the ICT sector in the Sixth Five Year Plan will be broadly as follows:

1. Expansion of infrastructure facilities for development of ICT sector for transforming the country into Digital Bangladesh.

2. Development of ICT skills in public and private sectors for ensuring productivity and efficiency of the economy and using ICT for good governance.

3. Ensure women participation in all professional trainings.

4. Development of national network for establishing connectivity in all government offices and public key infrastructure for electronic transactions.

5. Encouragement of IT enabled services and establishment of ICT incubator, Software Technology Park and IT Village in suitable locations of the country.

Main Elements of ICT Strategy

The main strategic elements for the development of the ICT sector in the Sixth Plan are presented below.

Development of a comprehensive master plan: The Sixth Five Year Plan will be designed as a part of a Master Plan developed for an 11 years period (FY 2010 - FY 2021). The Master Plan will be developed on the basis of existing works done by the ICT stakeholders in the country. The ICT Policy 2009 will be taken as a starting point for the development of the Master Plan. Huge energy was given in developing the revised ICT policy by stakeholders from all four segments of Digital Bangladesh concept. It captures works and recommendations from people of all walks of life during last 20 years. The Master Plan will be designed in a way so that the plan is incorporated in five-year planning process and annual national budget preparation process. The National ICT Task Force will be involved in the process of development of the Master Plan.

Framing of a universal access policy: The country does not have universal access policy. Public access to ICTs created fully on commercial basis denies access to citizens who are unable to pay for services. A hybrid model proved to be better for creating balance between crucial information services, which are less attractive in terms of income generation, and services which may generate income by serving better off part of a community. Income earning potential varies, and there is high correlation between income potential and severity of poverty in a particular location. High speed Internet connectivity can change the whole scenario of access to education, health care and government services. Thus, one of the priority agenda for the government will be creation of Internet infrastructure and make the bandwidth free for rural population at least for the whole period Sixth Five Year Plan. The free bandwidth may be for maximum 512 kbps, which is adequate for accessing rich content.

Developing legal and regulatory environment for ICT development: There is a need for formulation of universal access policy and broadband policy for ensuring equity in ICT-based growth and development. To implement this policy, details of the relevant rules such as the Patent Law, Secrecy Act, Consumer Protection Act, Trade Mark Act, Foreign Exchange Regulation Act and Income Tax Act should be taken into consideration so that there is no infringement of rights or violation of existing rules in implementation of the ICT Policy.

Ensuring access to Government information: Information is the currency of democracy. Government agencies are among the most prolific collectors and generators of information that is useful and valuable to citizens and business. Improvement of the nation's information infrastructure provides an opportunity for the citizens to be updated about the measures taken by the government in different sectors of the economy as well as government policy stance on important issues. It also alerts them about their duties as responsible citizens of the country. Thus improvement in the collection, compilation and easy dissemination of government information will be a target of the Plan

Promotion of e-commerce and automation of financial sector: The financial sector in Bangladesh has made rapid progress in adopting new technology for better and prompts service. Various ICT-based services like ATM, POS internet banking, etc. are in use. Absence of system of e-payment in Bangladesh is holding back the potential of e-business and e-commerce. However, unmonitored use of such a system can give rise to corruption. Therefore, identifying ways and means of promoting e-commerce, while protecting the national interest, will be a focus during the SFYP.

Establishing E-citizen services: Both government and non-government institutions offer online services, which range from information services to e-commerce. The government's SICT program initiated and in some cases completed over 40 e-governance projects of varying sizes across many government agencies. Expansion of e-citizen service with facility for women and disabled and increase its accessibility to rural and under-served areas of the country will be a target of the Plan.

Enabling E-participation in decision making: ICT creates opportunity for improving transparency as well as for participation of people in decision making process. Web 2.0 tools in local language have become a powerful tool for inclusive policy making by creating a two-way channel. Bangladeshi citizens are very active in various global online platforms and exchange ideas and promoting democratic practices. On national level, the government can obtain public opinion on vital issues through public opinion polls which are prevalent in developing countries. Encouraging E-participation in matters of public interest will be a target for ICT in the Sixth Five Year Plan.

Developing curriculum-based computer labs for educational institutions: The government has established 1800 state-of-the-art computer labs in 128 educational institutions. The Ministry of Science and ICT is planning to establish more 1200 computer labs in various educational institutions. However, for sustainability of ICT education curriculum-based computer labs will be established during the sixth Five Year Plan. The opportunity of teaching mainstream subjects will also be explored. Steps will be taken to introduce multimedia teaching system. Teachers will be trained for developing course contents for multimedia presentation.

Expanding digital content in Government websites: As part of the government's overall policy of increasing transparency, expanding digital content will be a target of the government in the Plan. The launching of the Bangladesh Government (BG) Press in February 2008 was an important event in the history of facilitating access to government information. BG Press is the single point of publication of all gazettes and documents related to the functioning of the government and the state. Initially, the website will publish gazettes released in 2008 and 2007. An earlier digital content initiative made government forms more accessible to citizens via the Web service. Many people access and download the forms through telecentres for a minimal fee. It may be mentioned here that some private and foreign as well as donor

organizations are involved in developing digital content. The opportunities for expansion of their activities will be explored.

Attracting local investment and FDI in ICT sector through PPP initiative: The vast scope for expansion of ICT sector in Bangladesh is evident from its international ranking in terms of teledensity and outreach. Existing incentives including fiscal and financial incentives will be advertised more vigorously for attracting local investment and FDI in ICT through the PPP initiative.

Specific Policies and Actions during the Sixth Plan

The main policies and actions to be taken for achieving the ICT targets in SFYP will be as follows:

i.   Increasing public sector allocation for the advancement of ICT in Bangladesh.

ii. Developing ICT infrastructure facilities and expansion of connectivity even to the remote places of Bangladesh.

iii. Transforming traditional file-based administrative work in the public sector into e-government/digital government for better and efficient services to the people.

iv. Expanding education in ICT to cover at least 80 percent of enrolment at secondary and higher secondary levels and 60 percent at graduate levels.

v.   Training would be women friendly and less expensive.

vi. Training of ICT personnel in selected fields at post graduate levels on a massive scale.

vii. Effectively linking entrepreneurs within the country with the available ICT both at home and abroad through a national network.

viii. Exposing the country as a whole to the process of change and progress at the frontiers of production, development, knowledge and the market through ICT.

ix. Establishment of IT incubator, software park, IT village and community e-centre at suitable locations of the country.

x.   Assessing the need for focusing research in computer software development in the public and private sectors.

Institutional Reforms for Facilitating the Expansion of ICT

Creation of a "Digital Bangladesh Secretariat" under the Prime Minister's Office:

During the tenure of Awami League Government (1996-2001) a National ICT Taskforce was formed to accelerate development in the ICT area. Although task force was not abolished during the tenure of subsequent governments, the Taskforce remained under utilized. The government has reconstituted the ICT Taskforce as Digital Bangladesh Taskforce. To facilitate the activities of the Digital Bangladesh e-governance cell at PMO may be upgraded to Digital

Bangladesh Secretariat (DBS) to minimize inter agency/organizational conflict. The DBS will ensure regular and timely meetings of the Taskforce and the executive committee of the meeting and conflict resolution between various entities implementing e-government. The Bangladesh Computer Council may be strengthened and empowered with skilled and trained manpower to support the establishment of digital Bangladesh.

Single Point for ICT Infrastructure

A strong Ministry of ICT will be the first step towards institutional reform. This Ministry will be the key entity for supporting the master plan through ensuring robust ICT infrastructure. The formation of a strong ICT Ministry may take place in the following manner:

a) Since information and Communication Technology encompasses the activities of MoPT, ICT Division under MoSICT and part of MoI. These activities which are part of ICT may be put together under Ministry of ICT. Since this convergence may take time the activities of MoPT and ICT Division can be strengthen to promote ICT in the society.

b) S&T Division under MoSICT may be encouraged to promote Science & Technology in the society to nurture entrepreneurship in the society. The S&T Division should be strengthened to expedite implementation of nuclear power plant and promote development of local technologies.

c) Reconstitution of Ministry of Information after transferring Broadcasting to Ministry of ICT to manage the information content in the media to portray positive image of Bangladesh. This may lead to increased foreign investments.

d) Placing BTRC, BCC, High Tech Park Authority and Office of the Controller of Certifying Authority under reconstituted Ministry of ICT.

Coordination of e-Government activities

The e-Governance cell on upgrade to Digital Bangladesh Secretariat will provide secretarial service to the Digital Bangladesh Task Force. It will liaise with the MoPT, ICT Division under MoSICT and MoI to compile e-government and ICT related national indicators. The ICT focal points in each ministries/Divisions will coordinate the activities of Digital Bangladesh. The automation of all ministries/divisions/agencies will be focused on improved service delivery.

e-Citizen centric activities under DBS: DBS will promote e-Citizen centric activities by all ministries/divisions/agencies. The ICT Focal points may be utilized to disseminate the idea of e-Citizen to provide service to all. The reduction of digital divide will also be tackled under this activity.

Promotion of ICT based education: DBS will promote ICT based education in all public and private educational institution. To achieve the targets set in MDG the DBS will assist in institutional capacity building to mainstream ICT in the education.

Single window for ICT business coordination: High Tech Park Authority will provide single window service to all investors in the ICT sector. The service through single window will be comparable to other countries in the region to promote ICT based industry in the country.

Introducing financial rewards for promoting S&T and ICT: To promote young talents in Science & Technology and ICT the government may explore avenues for granting financial awards to students for exemplary achievements.

Promoting R&D in ICT: Scientific institutes are often unable to mobilize sufficient long-term resources for R&D. In many cases there is hardly any R&D agenda. To overcome this hurdle, the SFYP will ensure that the approved R&D strategy is adequately funded.

Establishment of technology-business Incubators: Technology-business incubators will be established so that the results of basic research can be transformed into new technology. These industries will be encouraged to invite research students working in basic science in the related field with the objective of promoting technology transfer.

The University Resources Centre (URC) and Bangladesh Education and Research Network (BdREN) were established for better coordination and cooperation between the Universities and the University Grants Commission of Bangladesh. This has paved the way for our students, teachers, officers and researchers to enter into the world-wide information technology network. University Grants Commission (UGC) can play a very important role in building up an online library or a portal to have access to the world class journals for research purposes. These journals usually are very expensive for subscription and sometimes it is not possible for a single university to become its member. As Bangladesh is lagging behind in the field of research and the universities generally do not share their research topics or outcomes with others, lack of knowledge sharing is a common problem.

BERNET can act as a centrally controlling body for the knowledge sharing activities of the universities. It can negotiate with the universities for information sharing so that other researchers can take advantage of available information rather than starting from scratch. In the private sector, the Bangladesh Computer Society (BCS) and Bangladesh Association for Software and Information Services (BASIS) play important roles in promoting the ICT industry. The ISP Association, Bangladesh, also facilitates the growth of ICT in the country. Both BCS and BASIS organize annual exposition of software and applications and hardware.

STRENGTHENING THE SUPPLY SIDE OF ICT

Ministry of Post and Telecommunications (MoPT)

The Ministry of Post and Telecommunications (MOPT) is responsible for facilitating the growth of telecommunication needs and introduction of new technologies. The MoPT plays an important role in the development of ICT services in Bangladesh through enhanced

accessibility to telecom and postal services. It gives special focus to extend telecom and internet services to rural areas of Bangladesh with the aim of fulfilling the "Vision 2021" of the Government of extending telecommunications up to the village level and also bring all Upazilas under internet connection. The departments and agencies of the MOPT are:

1. Bangladesh Telecommunications Company Ltd. (Former BTTB has been divided into BTCL and BSCCL)
2. Bangladesh Submarine Cable Company Ltd. (BSCCL)
3. Bangladesh Post Office (BPO)
4. Teletalk Bangladesh Ltd.
5. Telephone Shilpa Sangstha (TSS)
6. Bangladesh Cable Shilpa Limited (BCSL)
7. Bangladesh Telecommunication Regulatory Commission (BTRC).

The Ministry of Posts & Telecommunications is trying to facilitate the ICT sector during last few years. But the adoption of ICT is very limited in all the sectors. The adoption of ICT policy (2009) and some success in the ICT sector are the success in this sector. Lack of awareness of the benefit of ICT use insufficient telecommunication infrastructure, low density of internet connectivity, expensive internet access, absence of adequate legal and regulatory frameworks and lack of know-how about ICT among public officials are the reasons of the slow flourishing of ICT use.

Objectives and Targets of Tele-Communication during SFYP: One of the prerequisites for accelerated economic growth of Bangladesh in a competitive environment is the availability of adequate telecommunication services for quick acquisition and dissemination of information, both inside and outside the country. The government, in its election manifesto, has set year 2021 within which a Digital Bangladesh will be built. The sixth FYP will also target to fulfil the millennium development goals in the field of ICTs.

The major objectives of the Sixth Plan for the telecommunication will be to:

- Ensure universal access opportunity to the mass people through harmonious development of networks and exchanges throughout the country.
- Build a well-developed, strong and reliable telecommunication infrastructure for effective implementation of ICT Policy, Broadband Policy and ultimately for complementing Vision 2021.
- Ensure optimum utilization of resources specially expert, trained and untrained manpower.
- Reduce digital divide between 'have' and 'have not', urban and rural areas etc.
- Ensure optimum output from investments by coordinating all services provided by the systems and networks.
- Provide cost-effective telecom services to the people.

- Produce low cost Laptops to popularize e-learning particularly for the students.

Targets and Milestones

- Bring all Upazilas and important growth centres under optical fibre network to provide modern telecom facilities.
- Extend High Speed Internet services up to rural areas through Next Generation Network (NGN)/ WiMax Technology.
- Construction of modern Data Centres at the important cities to support IT enabled service providers.
- Provide Triple Play (Voice, Video & Data) service through a single converged network.
- Establish a modern Billing Centre for improving quality of revenue management service.

Strategies

- Coordinating among old systems and new latest systems to be built/ installed for effective utilization of the investments.
- Develop business by commercializing, re-building and focusing on customer needs throughout the country.
- Reduce operational expenditure (OPEX) through adoption of appropriate and cost-effective technology.
- Upgrading professional training in ICT and modern technology.

Constraints

- Subsidized operation in rural areas

- Lack of capital investment

- Lack of skilled manpower oriented in the latest technology.

- Non-availability of uninterrupted commercial power

- Unexpected Delay in project implementation

- Absence of Universal Service Obligation (USO) fund.

- Rapid technological development in telecom sector and problem of matching with these changes.

- Low level of salary in comparison with private sector.

- Lack of marketing approach

The submarine cable network is to be the main infrastructure for "Digital Bangladesh" as planned to be achieved by the year 2021. Bangladesh Submarine Cable Company (BSCCL) is providing submarine cable Bandwidth through SEA-ME-WE-4 cable system and contributing to the revenue earning of the Government of Bangladesh.

Bangladesh Post Office

Development Targets for SFYP: The development targets of BPO for the SFYP are shown below:

- Procure and distribute at least one vehicle per mail line in order to expedite the mail collection, transmission and delivery system throughout the country by 2013.

- Render all the departmental post office buildings secure for complete protection of government properties by 2013.

- Give training to all officers and staff of Bangladesh Post Office in order to render them capable of performing their duties in an IT-enabled work environment along with imparting them other essential skill building training and implementing other Human Resources Development Techniques by 2013.

- Bring 461 post offices under automation by 2013.

- Bring 304 post offices under automation by 2015.

- Convert 2220 rural post offices into Post e-center by 2013.

- Convert 1480 rural post offices into Post e-center by 2015.

- Completion of construction of 1776 rural post offices by 2013.

- Completion of construction of 1200 rural post offices by 2015.

- Completion of construction/reconstruction/extension of 420 Head Post Offices/ Sub Post Offices / Upazila Post Offices/Mail & Sorting Offices by 2013.

- Completion of construction/reconstruction/extension of 280 Head Post Offices/ Sub Post Offices / Upazila Post Offices/Mail & Sorting Offices by 2013.

- Expansion, Remodeling & Renovation of Dhaka GPO for Maximum Customer Satisfaction by 2012.

- Construction of Postal Directorate (Dak Bhaban) at Sher-e- Bangla Nagar, Dhaka by 2015.

Development Strategies for Meeting Targets: To meet the targets, BPO has spelled out a number of strategies, the main ones being: providing institutional autonomy and financial flexibility to operate a business; harmonize the domestic and international postal networks; incorporate modern technologies to provide customer responsive products and services and improve and expand postal services to under-served areas and help alleviate poverty and rural isolation. Additionally, the post offices throughout the country will be converted into development and outreach centers to serve the special needs of the poor for information technology and banking services (Box 6.1).

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Box 6.1. Converting Post Offices into Development Centers

About 1500 Post offices in Bangladesh has been modernized as 'call-centers and information centers' to provide Information-Communication-Technology and financial services in addition to their traditional services.

During the SFYP the special programs will be undertaken to transform country's post offices into 'call-centers and information centers' to provide following services: (i) quasi-banking services which may include deposit, and remittance of foreign funds; (ii) distribution of funds under the various 'social safety net' programs operated by the government; and (iii) access to information and technology using the internet and web facilities.

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STRATEGY FOR KNOWLEDGE DISSEMINATION

Knowledge generation is useful only to the extent that this knowledge is made available to the citizens in a low-cost and timely manner. Telecommunications is critical for this. At the same the print and digit media have very important roles. Steady progress has been made in deregulating the television activities, although the Bangladesh Betar is still a public monopoly. Similarly, progress has been made in promoting a very active print media. Today, the media (print and digital) has become a major player in promoting good governance and economic development through timely processing of good knowledge and information and making it widely available.

This strategy will continue and strengthened in the Sixth Plan.The Government through the Ministry of Information will facilitate the growth of knowledge dissemination activities and ensure the freedom of information consistent with protection of public interest. Bangladesh Television and Bangladesh Betar will be encouraged and strengthened to provide best possible knowledge and objective information through technical upgrading, better management and better staff quality.

RESOURCE ALLOCATION FOR KNOWLEDGE MANAGEMENT IN THE SIXTH PLAN

The Government puts high priority to strengthening knowledge management activities in Bangladesh. The resource requirements are large. Given the overall resource constraints, a significant part of the financing will come from private sector in terms of investment in technology and related service facilities. However, the Government will take the lead role in areas relating to scientific education, research and development as well as in key support services including knowledge planning, prudential regulations, core technology related infrastructure and support institutions. The Sixth Plan knowledge strategy is built around this strategic partnership between public and private sector institutions. A part of the funding will also come from the resources mobilized by service agencies including BTCL and the Postal Authority.

Based on these strategic considerations, the planned development allocations for the Sixth Plan period in current and constant prices are shown in Tables 6.2 and 6.3.

Table 6.2: Development Resource Allocations for Knowledge Economy in the Sixth Plan

(crore taka; current price)

Ministry	FY2011	FY2012	FY2013	FY2014	FY2015
Science and ICT	170	212	243	289	330
Ministry of Posts and Telecommunications	105	115	132	157	182
Ministry of Information	160	192	220	259	295
Total	**434**	**519**	**595**	**705**	**807**

Table 6.3: Development Resource Allocations for Knowledge Economy in the Sixth Plan

(crore taka; FY 2011 price)

Ministry	FY2011	FY2012	FY2013	FY2014	FY2015
Science and ICT	170	197	211	236	254
Ministry of Posts and Telecommunications	105	107	115	128	140
Ministry of Information	160	178	191	211	227
Total	**434**	**483**	**517**	**575**	**621**

ANNEX
Annex 6.1: Targets and Strategies: Connecting Citizens

Item #	Description	Timeline	Accountable Agency/(ies)
1.Building an inclusive information and knowledge system: To ensure that by 2011, all Bangladeshis have access within their community to ICT			
1.1.	Building a national partnership to establish an inclusive system of information and knowledge for all citizens through telecentres and other forms of public access, with special emphasis on marginalized groups and disability, which will be delivered using a rich combination of different business models, including - Entrepreneur / Value adding sector - Voluntary sector - Schools computer labs opened up to the community out of school hours - Government infrastructure (e.g., many post offices having been enhanced as e-post/ Cyber Post/e-service hub for government/public service (e.g. direct foreign remittance, money transfer, bill payment), local government institutions have big establishments, public libraries are underutilized) - Through creation of information access through mobile telephone and community radio All the venues will be accessible to all citizens		
1.2	Deployment of low cost broadband Internet connectivity across the country for offering e-learning, e-health and e-government services to the citizens.	2nd year	Pub-private Partnership
1.3	Launch Citizens Helpdesk in public organizations. The host is not mandated to be physically located at the relevant public organization. Telecom operators will have to provide low-toll/toll-free numbers for these call centers.	2nd year	Relevant government agencies
1.4	Expand the voter ID to National ID platform to be used for all citizens' services such as birth registration, passport, bank account, school enrollment, healthcare, vaccination, VGF/VGD and other social safety net programs.	3rd year	Cabinet
1.5	Deployment of Electronic Public Grants (safety net benefits) Delivery System	2nd year	Multiple agencies

Item #	Description	Timeline	Accountable Agency/(ies)
1.6	Launching of a development TV Channel	3rd year	Public-private partnership
2. ICT for Equity			
2.1.	Launching of multi-year localization program which includes research on Bangla language computing and Bangla content development	1st year	Public-private partnership
2.2.	Launching of a program and system of protection of children from harmful content	1st year	Ministry of Home Affairs
2.3.	Deployment of public key custodian for ensuring network security. This is related to encryption standard and security related laws.	1st year	MoSICT, BTRC
2.4.	Deployment of system for protection of information, data and program from hacking, fraud and damage and introducing/spreading computer viruses	2nd year	Ministry of Home Affairs

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2.5.	Deployment of a robust, country-wide system of market information with daily price update of all markets in the country	Gradually over the five years	Ministry of Food and Disaster Management, MOA
2.6	Program of digitization of land record	Gradually over the five years	Ministry of Land
2.7	Launching of Employment generation scheme for rural youth: info-lady, telecentre workers, BPO	Gradually over the five years	Public-private Partnership
3. E-Participation			
3.1.	Deployment of a system of public grievances and reprisal and publication of results of those grievances through electronic means	2nd year	Public-private partnership

Human Resource Development

Item #	Description	Timeline	Accountable Agency (ies)
4. Building E-learning Infrastructure: One school one computer lab, smart class room with e-learning facilities			
4.1.	Launching of program for ICT education in each secondary school which includes establishment of multimedia classroom, computer lab, teachers, training, technical support system, up-to-date curriculum, Community access for income generation	Over five Years	MOE, MOSICT, Public-private Partnership
	Launching of program of e-learning which includes providing free broadband access to each school	2nd year	MOE
	Installation of computers, LAN, reliable high-speed Internet connectivity for tertiary educational institutions	1st year	UGC
5. ICT Education			
	Redesigning of the ICT literacy curriculum for secondary and higher secondary syllabus at regular intervals based on the needs of an inclusive and cost-effective knowledge society.	1st year	NCTB
	Initiate ICT Professional Skill Assessment and Enhancement Program (IPSAEP)	1st year	MOE, UGC
	Develop labor market information system to assess domestic and global labor demands for education planning m	1st year	MoP, MoE
	Periodic ranking of IT programs of private and public universities by a competent body (including academia and industry) approved by UGC	1st year	UGC
	Introduce and allocate fund for industry-ready applied research projects with mandatory industry & academia collaboration using government grant facilities	1st year	MoE
	Ensuring ICT literacy evaluation as part of Public Service entrance exams	1st year	PSC
	Launching program to convert all libraries into digital library	3rd year	MOC
	Organizing regular national, regional, and International conferences.	2nd year	MOE, MoSICT
6. ICT-based Education			
	Introducing ECDP for all poor rural children in regular and community schools for at least six months using multimedia Tools	2nd year	MOE

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	Launching program of ICT-based learning: Install computers, LAN, reliable Internet connectivity with reasonable speed and multimedia teacher training content for all Secondary Teachers' Training Colleges; with a special focus on Mathematics, Science and English	1st year	MoE
	Launching program of ICT-based learning: Install computers, LAN, reliable Internet connectivity with reasonable speed and multimedia teacher training content for all Primary Teachers' Training Institutes, like PTIs, URCs and NAPE	3rd year	MoPE
	Launching program of ICT-based learning: Establish smart class room with flat screen large television and laptop for supplementing learning in the class room with appropriate multimedia content	Over five years	MoE
	Organizing regular national (including at grassroots level), regional, and international competitions on ICT related topics and support participation of national teams in international events.	2nd year	MoE
	Creating central repository for e- Learning content for teacher training and for all students. Provide Incentives for e-Learning content development.	2nd year	MoE
7. Vocational ICT Training			
	Install computers, LAN, reliable Internet connectivity with reasonable speed and multimedia educational content for TVET institutions	2nd year	MTVEB
	Introduction of national certification examinations for different levels of ICT personnel/ professionals	2nd year	Multiple Agencies
	Establishment of a central body for streamlining syllabus, evaluating eligibility of training instructors and for ranking of ICT training institutions	2nd year	MoE
	Introduction of loan facilities for procurement of ICT equipment for government officials, students, teachers and working people	1st year	MOF

Digital Government

Item #	Description	Timeline	Accountable Agency (ies)
8. e-Administration			
8.1.	Digitally publish all govt. publications in Bangla using a standard encoding to guarantee document portability	1st year	All government agencies
8.2.	Mandate all public information to be made accessible through appropriate electronic means including SMS and other channels.	From 1st year over 5 years	All government agencies
8.3.	Launching of online-data sharing and decision making system	3rd year	All government agencies
8.4.	Creating a national network for the government to connect the public organizations.	2nd year	All government agencies
8.5.	Establishing necessary policy framework and introduce IP telephony and video conferencing services in critical government offices.	1st year	All government agencies
8.6.	Establishing National Data Resource Centre to control and manage the public network and act as a system of national databases to store and supply national data	4th year	All government agencies, BBS, PPP

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8.7.	Adding a 50-mark examination (to the current 300- mark examination) for applied computer and Internet literacy for senior scale promotion examinations for cadre services.	2nd year	MoEst
8.8.	Stopping new steno typist recruitment in the Government offices. Converting all existing steno typists into data entry operators through proper training.	1st year	All government agencies
8.9.	Redesigning ICT and e-Governance curriculum of government training academies with a distinct focus on change management and process re-engineering.	2nd year	MoEst, Cabinet, BPATC, PSC
8.10.	Deployment of computer-based project planning and resource allocation system	2nd year	MoP, MoF
8.11.	Launch ICT Technical Clusters to cover all public sector organizations to be run by ICT professionals. Create ICT posts for this Cell. All ICT posts in the public sector should be declared technical posts. Create an ICT cadre in the long term	2nd year	MoEst, Cabinet
9. e-Citizen Services			
9.1	Develop national web portal as a "one-stop shop" for delivering e-citizen services	From 1st year over 5 years	All government agencies
9.2.	Enable payment of utility bills through mobile phones, banks, ATMs or other service centers from any location and at any time of the day	From 1st year over two years	All relevant government agencies, PPP
9.3.	Enable online status check of court cases	2nd year	MOL&PA, PPP
9.4.	Enable electronic filing of GD and FIR	2nd year	MoHA, PPP
9.5	Introduce service to access public transport schedules, fares and ticket purchasing through the Internet and mobile phone.	1st year	MOC, PPP
9.6.	Allow online registration and work permit for foreign investors	2nd year	BOI
9.7.	Introduce online tax filing for all citizens	1st year	NBR
9.8.	Introduce online application for licenses in business, vehicle registration etc.	From 1st year over 5 years	Multiple agencies
9.9.	Introduction automation of all customs check points	By 3rd year	NBR, Port Authorities, PPP
9.10.	Automation of land record and registration system	By 3rd year	MOLPA, PPP
9.11.	Introduction of online payment both for transaction within country and international	By 2nd year	BB, PPP
9.12	Introduce online procurement system (in phases)	By 3rd year	All government agencies, PPP

E-Business

Item #	Description	Timeline	Accountable Agency (ies)
10. Online Transaction and Payment Infrastructure			
10.1	Establish Certifying Authority (CA).	1st year	MoF, BB
10.2	Develop capacity development programs for the judiciary & the law enforcement agencies	From 1st year over 5 years	MoLPA
10.3	Launch legal reform to protect interest of stakeholders in e-commerce	1st year	MoLPA

11. Promotion of e-business and commerce			
11.1	Establish an Authority/Body on ICT Industry Development	1st year	MOC
11.2	Establishment of ICT Industry Development Fund	1st year	MoF
11.3	Establishment of TP	1st year	MoSICT
11.4	Conduct research on global Human Resource needs vis-à-vis local capability to identify national focus	Every two years	MOE, MOC
11.5	Introduce free facilities for ICT industry/ ICT for Development Agencies in TP for five years	3rd year	
11.6	Conduct regular study on ICT economy	Every two years	MOC
11.7	Introduction of Venture capital Fund for ITES Industry	1st year	MOF
11.8	Arrange fairs, exhibitions & targeted workshops for local enterprises. Road shows and other interactive programs.	Every year	MOC
11.9	Implement ICT based model SMME (one for each category) at Dhaka and other divisional HQs	1st year	SME Foundation, MOC, PPP
11.10	Create special promotional program (by EPB	1st year	
	BMET, Probashi Ministry, and Foreign Labor wings, and Bangladesh Missions abroad) for high end overseas employment in IT		MOFA
11.11	Create strategic roadmap for Human Resources Development for the ICT industry (both home & abroad)	1st year	MOE, MOC
11.12	Enhancing competitiveness of business through business process re-engineering		
11.13	Develop Agriculture, Food and SMME related content in Bangla	1st year	
11.14	Develop network within communities to share indigenous knowledge and innovations related to pest management, crop preservation, etc	1st year	MoI, MOA, PPP
11.15	Establish SME resource centre focused on agricultural needs spanning relevant supply chain in the local context.	1st year	MoI, MOA, PPP
11.16	Support the agricultural supply chain management system through business portals accessible through various electronic channels.	1st year	MOA, PPP
11.17	Provide training of extension workers and farmers on updated technologies, credit schemes, etc. using ICTs.	1st year	MOA, PPP
11.18	Utilize GIS based soil mapping system to analyze detailed data to provide information relating to crop suitability, land zoning, nutrient status and fertilizer dosage.	2nd year	MOA, SRDI, PPP
11.19	Provide access to m-banking for farmers and agribusinesses	1st year	MOF, BB, Telcos
11.20	Develop Internet and mobile-based trading platforms for agriculture produce for extended supply chain	2nd year	MOC, MOA
11.21	Initiate a pilot project to promote sector based customized ERP	1st year	MOC, PPP
11.22	Create and disseminate e-Learning resources on Energy Efficiency, ISO competencies, Lean Six Sigma, advanced Production System, etc	1st year	MOC, Industry Associations
11.23	Implement ICT based automation and MIS model at Division level.	2nd year	MOC, Industry associations, PPP