**Country Paper**

**Science and Technology Status of Bangladesh**

**Md. Humayun Kabir Lasker**

**Joint-Secretary**

**Ministry of Science and Technology**

**Government of the People’s Republic of Bangladesh**

**October, 2013**

**Abstract**

*In a resource scarce and highly densely populated country like Bangladesh, the role of science and technology is very crucial for attaining economic growth, eradicating the vicious poverty circle and to enhance the quality of life. Technology transfer is one of the tools for technological attainment. In Bangladesh Science and Technology Policy, 2011, there has been made clear provisions for establishment of national capacity for development of indigenous technology and attainment of a national capacity for the assessment, selection, acquisition, adoption and adaptation of foreign technology. Accesses to the frontiers of international technological shelf and its adoption and adaptation of new technology have been emphasized in outlining the objectives and strategies of the Sixth Five-Year Plan (2011-2015) of the country. And, the national Science and Technology Action Plan, 2011 also has been formulated as to how the objectives and strategies will be implemented practically for development of science and technological innovation .High emphasis has been placed on the advancement of science and technological research and innovations by adopting improved technology as well as through development of indigenous technology. Technological innovation has contributing the country in alleviating the poverty, developing the Small and Medium Enterprise, and upholding the quality of living standard of the people.*

1. **Introduction**

It has been recognized that economic growth draws its vital nourishment from technology without which no matter how favorable all other factors might have been. It is also well perceived that effective policies of economic growth without taking into account the underlying technological thrusts are not practically viable. We are in the threshold of twenty first century, which has been recognized as century of knowledge based economy, where science and technology will be the prime mover of society and new setting of techno-economy has been emerged worldwide. The developing countries are in need of reorient their whole technology policy instrument and other allied factors for gaining technological competence in a competitive free market economy. Technology transfer will be all the more crucial and challenging in the coming days.

Bangladesh now recognizes that given the limitations of her factor endowments, the mounting problems of providing for the basic needs of the people, ensuring a reasonable standard of living and accelerating the pace of economic development cannot be achieved without the help of science and technological innovation. It is, therefore, for attaining socio-economic development of the country, technological innovation and research has been given high emphasis in the Sixth Five Year Plan (2011-2015) and National Science and Technology Policy, 2011 to achieve the specific goals and strategic objectives.

1. **Strategies and Policies for Science and Technology to the National Development Plan**

In the Sixth Five Year Plan (SFYP) of Bangladesh, and also in the earlier such plans, the cardinal goal was to attain self-reliance within shortest possible time. The SFYP plan recognized the role of science and technology in attaining this goal. 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. Up gradation 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.

The following strategies are being followed for the development of science and technological innovation and transfer of technology in the Sixth Five Year Plan:

1. Effectively linking the entrepreneurs within the country with the supply of technology originating both at home and abroad through a national network.
2. Remodeling the legal framework for protection of intellectual property, providing incentives for local entrepreneurs and development and transfer and absorption of technology.
3. Providing institutional support and financing for commercializing technology, setting up venture capital fund to this end will be a step in the desired direction.
4. Establishment of Hi-tech Park, IT and Bio-technology incubator, IT Village and Software Park, Community e-Centre in suitable locations of the country.
5. 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.
6. Strengthening regional and sub-regional cooperation with SAARC countries and with other science and ICT organizations for better cooperation and bilateral relations.

**3. Science and Technology Policy-2011 and Action Plan**

The National Science and Technology Policy of Bangladesh was first introduced in 1986. With advancement of science and technology, The new National Science and Technology Policy-2011 has been declared by the government where the vision is to meet the basic needs of human beings by harnessing the potential of science and technology. The 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. To encourage innovation and production of new technology, establishment of a proper institutional system of copyright and patent has been given importance and initiatives has been taken to expanded allocation for R&D to 1-2% of GDP. New and emerging science and technology including those related to biotechnology, nanotechnology and material science also have been given emphasis as one of vital enabling instrument for poverty reduction and national development. It is mentioned in this pocliy that national capability for development of indigenous technology and attainment of national capacity for adoption of foreign technology will be established in the country. In order to achieve the specific objectives and goals of this policy, a National Science and Technology Action Plan-2012 has been approved by the Cabinet. Total 246 actions have been identified for achieving the 15 objectives within the short term, Medium term and long term period.

#### 4. Organizational Structure for the Development of Science and Technology

The Ministry of Science and Technology (MOST) is the umbrella government agency for science and technology development. The ministry has six agencies under its umbrella who work for the research and development of Science and Technology – Bangladesh Atomic Energy Commission (BAEC), Bangladesh Council for Scientific and Industrial Research (BCSIR), 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). Others institutions working for the development of the science and technology- **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).**

The Bangladesh Agricultural Research Council (BARC) is the apex body of the NARS. The Council serves as the national coordinating organization for planning, integration, and implementation of various programs. It has been possible for NARS to attain a high level of capacity in research in agriculture as well as the dissemination of the results. The effort level and success would be evident from the fact that at present about 40% of the rice produced in the country is based on the variety evolved at the Bangladesh Rice Research Institute. The high yielding variety of wheat developed at the BARI is also widely used in the country. Other R&D efforts on cash crops like jute and tea, pulses, spice, fruits, oil seed, medicinal plants are also showing encouraging results. The R&D efforts have substantially reduced dependence on food import.

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.

### **5. Technology Policy and SMEs Development in Bangladesh**

In a labor surplus country like Bangladesh small and medium enterprises can play a substantial role in providing the impetus to the development of a modern manufacturing sector and in job creation outside of agriculture and informal services. The Government constituted a National Taskforce on small enterprise development to draw up a realistic strategy for promoting rapid growth and vigorous competitiveness among these enterprises. Considering the importance of small enterprise financing, a Small and Medium Enterprise (SME) cell was created in 2003 in the Ministry of Industries (MoI). Products of SMEs related to electrical, light engineering and agro processing are mostly targeted for the domestic

markets and the revenue from domestic sales is higher in those industries. Table: Percentage of Revenue from Domestic Sales

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Firm  Size | Agro & food processing | Leather & Footwear | Electrical& electronics | Light engineering | Designer goods | Plastic |
| Micro | 100 | 15.38 | 100 | 100 | 16.67 | 100 |
| Small | 94.76 | 50.22 | 100 | 100 | 40.31 | 58 |
| Medium | 86.18 | 54.48 | 100 | 100 | 53.14 | 62 |
| Large | 86 | 90 | 100 | 100 | 39.25 | 37 |

***Source: SMEF survey of six sectors, 2006/07***

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# Table : Percentage of Revenue from Export

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Firm  Size | Agro & food processing | Leather & Footwear | Electrical& electronics | Light engineering | Designer goods | Plastic |
| Micro | 0 | 84.61 | 0 | 0 | 83.33 | 0 |
| Small | 5.24 | 49.77 | 0 | 0 | 59.69 | 39 |
| Medium | 13.82 | 45.51 | 0 | 0 | 46.86 | 38 |
| Large | 14 | 10 | 0 | 0 | 60.75 | 57 |

***Source: SMEF survey of six sectors, 2006/07***

Limited access to modern technology is a major challenge facing the Bangladesh SME sector. Agro and food processing industry uses the smallest number of machines designed using the local technological knowhow. Leather and leather goods industry uses the largest number of machines followed by designer goods industry and this is true for small and micro enterprises too.

A large part of small and micro enterprises belong to the informal economy of Bangladesh. These enterprises do not have any legal identity and therefore do not pay any tax even if their income is taxable. Cost of being legal (registration fees, tax, harassment, etc) can be much higher than being in the shadow economy. Therefore, in order to target the small and micro enterprises effectively, to bring them in the formal sector, government has offered tax incentives .Now in Bangladesh Income derived from any Small and Medium Enterprise (SME) engaged in production of any goods and having an annual turnover of not more than BDT 2400000 is exempt from tax and Income from Information Technology Enabled Services (ITES) business is tax exempted up to 30th June, 2013.

In order to put SME on the forefront of national policy domain and to implement the policies, institutional capacity of the relevant ministries, Bangladesh Small and Cottage Industries Corporation (BSCIC)/Small and Cottage Industries Training Institute (SCITI), Bangladesh Institute of Management (BIM), Bangladesh Industrial Technical Assistance Center (BITAC) and National Productivity Organization (NPO), SME Foundation, etc. are being up upgraded by government.

As Bangladesh's economy is based on SMEs, effective methods and plans of promotion of innovations in the SME has been given importance by the government. 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. Ministry of Industry may is planning for launching 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. On the other hand, Ministry responsible for Science & Technology has taken initiatives for undertaking program for technology development & demonstration and program for 'TechnoPreneur' promotion through BCSIR.

**F**oreign direct investment has been encouraged in high-tech, innovative industrieshaving potential for skill and technology transfer in the Industrial Policy 2010. In the SME Policy 2005 of Bangladesh, theTechnology-exchange programs between countries in similar stages of development, and with a similar maturity of the infrastructural development for SME development has been placed high importance in the interest of rapid technology transfer.

**6. Government Policy for Diversification of Energy Sources**

The use of renewable energy has risen considerably in recent times in developed and developing countries. In Asia, India and China have achieved considerable success in innovating and using the technology of renewable energy. Although the initial installation cost of renewable energy is high, it will gradually decline and will come down within the purchasing capacity of the people. As the global reserve of fossil fuel is gradually decreasing, the Government has taken steps to extend and develop the use of renewable energy to ensure the future energy security. Under this plan, targets have been set to produce electricity from renewable sources as 5 percent of total production by the year 2015. Renewable Energy Policy has also been adopted to attract and encourage the private sector. The vision of the government is to provide access to affordable and reliable electricity to all by 2021. Presently 53% of the population has now direct access to electricity which was 47% when the government took office

In Bangladesh renewable energy such as biomass, solar power and wind power are being used. Especially in areas which do not have gas supply, household use of biomass for cooking and solar power and wind for drying of different grains as well as clothes are known to all. However, Bangladesh is lagging far behind in the scientific use of such energy. The use of renewable energy has become popular worldwide in view of depleting reserve of non-renewable fossil fuel. The use of solar panel in all large public buildings has been made mandatory within and Solar panel imports made duty-free for which SMEs sector for solar energy business has been developed significantly. However, it is compulsory to install solar panel in the new building in the city area for covering the 10 % of the lighting and fan electricity load capacity of that building for which SMEs in the solar products have been developed in the last few years in Bangladesh.

**7. Role of PPP in Development of Science and Technology**

For the balanced development of science and technology, the involvement of the private sector has been encouraged in Bangladesh. The public sector may 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 is 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 may also involve in promoting and disseminating technical knowledge for setting up of projects relating to solar energy, bio-fertilizer and IT enabled services.

**8. Institutional Infrastructure for Nanotechnology**

Bangladesh is one of the Asian countries that have not yet established nanotechnology programs or initiatives due to the limited R&D in nanotechnology and the lack of international collaboration, tools and equipment. The Ministry of Science and Technology of the Government of Bangladesh is giving emphasis on the innovation of new strategies and appropriate technologies for the poverty alleviation and socio-economic development of the country. The scope for research in nanotechnology in Bangladesh is limited because of the unavailability of appropriate tools and equipments, fewer numbers of resource personnel as well as lack of proper training, less interaction and collaboration in this emerging technology. The Materials Science Division of Bangladesh Atomic Energy Commission is carrying out some research work in the field of nanotechnology covering the synthesis of nanoparticle by chemical methods and Magnetic iron oxide nanoparticle.

**9. Technological Innovation in the ICT Sector**

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 below:

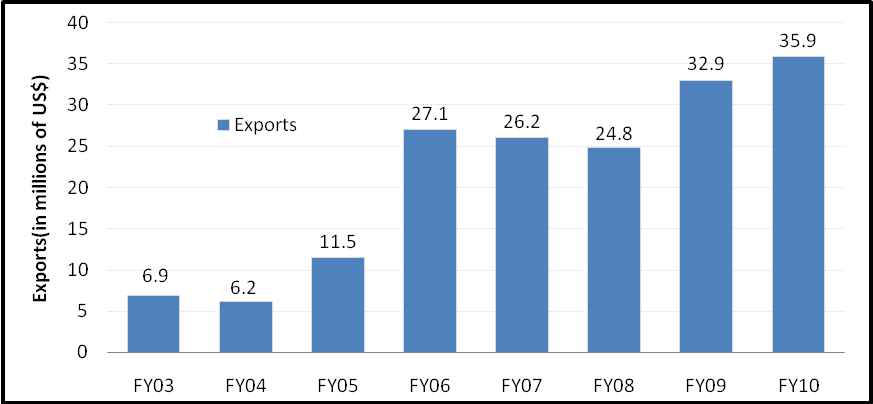
# Table Growth of ICT Sector-wise companies in Bangladesh

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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. 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.

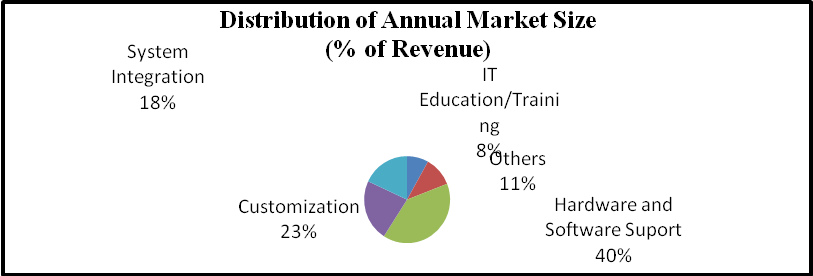
##### Figure : Value of Bangladesh Software Exports (US$ m)



***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 : Composition of the IT Sector in Bangladesh**



***Source: Board of Investment***

The use of digital technology in educational institutions has been increasing rapidly. Public examination results are now available via mobile and internet and are also e-mailed to the educational institutions. Using data obtained from the Education Boards, Universities have started administration registration process via mobile-phone-based applications. 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.

**10. National initiatives for Technology Transfer and Innovation**

The Ministry of Science and Technology disseminate indigenous technology to improve living stand of the people through ‘Appropriate Technology Transfer seminar’ throughout the country. Every year 14 Upazilla of Bangladesh has been under covered through this seminar. High Emphasis has been given on National Science and Technology Polciy-2011 and Sixth Five Year Plan for technology transfer and innovation management capacity enhancement for attaining the sustainable development of science and technology. The Ministry of Science and Technology is formulating all necessary policies and taking all necessary initiates for promoting technological innovation with its agencies. The Ministry arranged 40 national seminars and workshops in different region of the country during the last two years for disseminating the indigenous and locally developed technology to the people. ‘Bangabandhu Fellowship Program on Science and Technology’ has been taken for the higher education in abroad for the professional in the area of science and technology.

Bangladesh Atomic Energy Commission (BAEC) and Bangladesh Council for Scientific and Industrial Research (BCSIR) 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. During the last two years BCSIR has developed total 36 new technological processes and 24 processes have got patent. Total 89 SMEs have been given lease permission to commercialize these developed products in the market. Recently, BCSIR has developed ‘Arsenic Kit’ and ‘Duel-Fuel Irrigation Pump’ for the first time in Bangladesh.

***Carbon Emission and Energy Security***

Bangladesh has started to transfer of technology to the rural areas for ensuring energy security and mitigation of carbon emission. A project ***‘Mitigation of Carbon Emission and Extension of Alternative Energy usage Through Dissemination of BIO Gas Plant and Improved Cook Strove Technology’*** are being implemented through BCSIR in order to set up total 2800 BIO Gas Plant and 28000 improved cook strove technology to the rural areas within 2013 for ensuring the energy security of the poor people and mitigating the carbon emission. The scientist of BCSIR arranges training in the rural areas for transferring the technology to the rural people.

IDCOL, a Government owned Investment Company fixed a target to set up 37,669 biogas plants in Bangladesh by 2012, under its National Domestic Biogas and Manure programmers (NDBMP). It has also set a target of 25 per cent of the total target of biogas plants in the northern region which is yet to be brought under the national gas grid. Since May 2011, IDCOL along with its partner organizations; has installed 18,713 biogas plants in different parts of Bangladesh

Using the solar energy is costly in Bangladesh. For introducing low cost solar energy technology, a project has been approved by the government for conducting necessary research in this area as to how low cost solar panel could be making possible to the people of the country.

***Processing of human amniotic membrane***

Amniotic membrane has been used by Bangladesh Atomic Energy Commission (BAEC) as an effective dressing material for treating burn patients. Drying is one of the major steps in amnion processing. Bangladeshi scientists at BAEC have developed more effective drying but simple methods using electric oven at 400C. This technique is now widely used in tissue banks of many countries

***Disclosure of Jute genome sequencing***

Bangladeshi scientists have successfully disclosed genome sequencing of jute (mystery of origin of jute) after long research opening up a new vista in the development of variety of the world's most biodegradable natural fiber. This gene sequencing would help improve the fiber length and quality, including colors and strength; and develop high yielding, saline soil- and pest-tolerant jute varieties through genetic engineering.

***Decoding the genome of Macrophomina phaseolina***

Bangladeshi scientists have decoded the genome of a crop-killer fungus *Macrophomina phaseolina*. Scientists are confident that the breakthrough will help tackle the fungus that blights valuable crop plants such as jute, rice, cotton, maize and soybean. This genome sequencing will help designing rational strategies for plant disease control and develop fungus-resistant crops.

***Technology and innovation in Agriculture***

Since inception, Bangladesh Rice Research Institute Varietal development (BARI) has been successfully contributing to national agricultural production by evolving technologies that are suitable for the country's climate and appropriate for the farmer's condition. BARI has so far developed a total of 777 technologies of which 355 are improved crop varieties (commodity) and 422 technologies on different non-commodity areas. BARI has also developed a self-contained gene bank where more than 10000 germplasm accessions of pulses, oilseeds, and vegetables have been preserved.The major achievements of BRRI have been in developing high-yielding modern varieties MVs) of rice. BRRI has so far released 60 MVs (56 inbred and 4 hybrids). Some important technology developed in the agricultural sector is as follows:

1. Hybrid Seed Production and Hybrid Variety development (Rice-BRRI Hybrid1-4, BADC Hybrid 1-2).
2. Stress tolerant rice variety has been developed in the recent year. Saline tolerant rice variety is BRRI Dhan-47, BINA Dhan-7.
3. BRRI has developed rice transplanter for using transplanting rice plant.
4. Alternative Wetting and Dying (AWD) technology is developed for ensuring the effective use of irrigation water. This technology is helpful for adaptation to drought.
5. Irrigation technology has been developed in order to ensure effective and efficient use of irrigation water and fertilizer simultaneously.
6. Integrated Pest Management (IPM) technology is developed and used for environment friendly and judicious use of pesticide.
7. Organic Pesticide i.e- Neembicide
8. Floating agriculture technology (Baira Hydroponics) is used in the wetland area of Bangladesh for adapting to flood.
9. Power Tiller Operated Seeder ( POTS) technology has been developed as rural technology and is used for shadow tilling, fertilizing , seeding in line and seed covering in a single pass. This technology is used for wheat, maize, lentil, chickpea production in Bangladesh.
10. ‘Strip till drill’ and ‘Zero till drill’ Technology has been developed for the farmers to place seed and fertilizer in side by side.

**11. Constrains for Transfer of Technology**

* Lack of a rational, coherent and comprehensive national science and technology policy (NSTP) to guide decision-making on distribution of resources
* Lack of a clear perception of the very special nature of R & D institutions and their management
* Limitation of resources, dependence on foreign technology
* Shortage of skilled manpower in many areas, brain drain and emigration of trained manpower
* inadequate research facilities and skill development programs
* Lack of coordination among scientific organizations,
* Obsolete science curricula in the educational institutions,, and
* Poor social consciousness of the role of science and technology in national development

**12. Suggested Programme of Action**

* **Establishment of Technology transfer Centre**

In the Sixth Five Year Plan of Bangladesh it is mentioned that a national centre for technology transfer will be established, which will cater to the need for various industrial segments.

* **Program for technology business incubator**

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.

* **Development of 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. 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 may 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.
* **Training Program**

Offering overseas training programs for young scientists and technologists among the countries for sharing of knowledge and skills

* **Establishment of Information Network Village**

Establishment of Information Network Village (INVIL) and liking regional connectivity may be executed skills and to promote the SMEs in the agricultural sector.

* **Renewable energy development**

BIO Gas and Improved Cook Strove Technology would be helpful for ensuring energy security in rural areas and mitigating carbon emission.

* **Development of Nanotechnology**

Joint initiative may be taken to have close cooperation to share the knowledge base and infrastructure for better understanding of the nanoscience and technology for future development of this region.

**13. Conclusion and Recommendation**

Impediments to the efforts on sustainable development in Bangladesh find their origin in frequent natural disasters, constraints of financial and physical resources, inadequacy of trained human resources and inadequate infrastructure. The state of the scientific and technological research, as stated earlier, cannot be considered sufficient in view of the complexity and diversity of the problems. The task ahead being enormous, solutions of the problems would require international and bilateral collaboration and inputs. It is to be recognized that developed as well as the developing world has a common stake in the future of the planet, especially as the vast majority of the consumers live in the developing world and if they are denied access to science and technology, then over-dependence on the other half of the world for survival could create chaos and disharmony. The need for symmetrical relationship and equal opportunities for nations at the different levels of scientific and technological development is thus overwhelming. The following recommendations are made with the above in view.

* Sincere endeavors should be made to harness the benefits of science and technology for the improvement in the living condition of the multitude of impoverished down trodden population in the developing countries.
* Transfer of technology from the developed to the developing world as well as within the developing world should be augmented.

Scale of technology development and transfer will depend on future reduction commitment target and participation of different parties.

Many technologies for adaption can be built on existing experiences in developing countries, some of these technologies will required to be scaled up. Bangladesh is committed to ensure the development of science and technology innovation and sharing the knowledge and skills for enhancement of technology transfer in this era. Therefore, strengthening of the linkage between the political and scientific/technological systems with the Science and Technology Policy is inevitable. The entire population must be imbued with self-confidence and pride in the national capability. Science and Technology must be duly harnessed to unleash the creative potential of the people for transforming Bangladesh into a prosperous nation making collaboration and regional relation for technology transfer.

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