An Alternative Eye

Computer for Persons with Visually Impairment: A Door to Education, Information and Employment

A Study on the Situation and Prospect of the use of Computer for persons with visual impairment

October, 2003

A study
Conducted By

Centre for Services and Information on Disability
In Association with Peace corps-Fredskorpset

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Study Team

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Executive Summary

As many as 1.3 million people with visual impairment currently live in Bangladesh. The national development framework has neglected to include the needs and desires of these people, putting them in a dire predicament characterized by a lack of education and widespread unemployment.

Aside from their physical handicap, there are many socio-economic barriers impeding their progress on the road to development. There is a general social stigma attached to blindness, which is virtually inescapable. Generally, the average citizen does not have confidence in the abilities and capacities of a person with visual impairment. This stereotype affects education and employment opportunities for the visually impaired. As such, employers tend to rely more on sighted employees than visually impaired ones. Contrary to popular belief, it is found that a visually impaired person can perform just as well as a sighted person in the classroom and in the workplace. Simply, they have not been afforded the opportunity to prove so.

One way to remedy this nationwide problem is through the utilization of Information Communication Technology (ICT). Using specific computer software, hardware, accessories, and other tools, visually impaired people can advance in both education and employment. Access to such computer technology is essential in promoting positive growth for visually impaired people.

The benefits of ICT training and skills acquisition are numerous and varied, applying to visually impaired people of all ages, educational backgrounds, and employment histories. With these tools, the scope and opportunity for visually impaired people will be improved dramatically. Through demonstrated success in such an endeavor, social stereotypes will recede, and the visually impaired people will acquire a greater sense of motivation, confidence, and independence.

This study by the Center for Services and Information on Disability (CSID) sponsored by Peace corps-Ferdskorpset proposes that a Center of Excellence be established in order to facilitate ICT training, resource management, and information distribution. There is immense interest and demand for such training among the visually impaired; however, supply for this need is scarce. This study and the birth of the Center will set a precedent for similar future action to be taken by policymakers and activists in Governmental Organizations, Nongovernmental Organizations, and Private Institutions.

This study has collected a wealth of information and data on the situation and prospects of visually impaired people in Bangladesh. Interviews, discussion forums, questionnaires, and other research techniques have provided comprehensive, useable knowledge on the subject that was thoroughly analyzed and processed. The demands and needs of people with visual impairment were considered as well as the sentiments of software providers, employers, and other interested parties. Both the potential costs and benefits of ICT use have been contemplated as well.

This study is an indispensable resource with respect to visual impairment in Bangladesh, and can contribute to a nationwide policy on ICT development for the visually impaired. It is the suggestion of the study team that action be taken to improve the lives of the visually impaired through the utilization of computers. Development must be just and equal. It must include all citizens, even those with disability.

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Introduction to the Study

Background

Over the past few years, many nations in the region have made remarkable achievements in socio-economic development through integrating Information Communication Technology (ICT) in their respective national development policies. Bangladesh is no exception, and is committed to ensuring countrywide ICT and Internet accessibility to all citizens, including those with disabilities.

Bangladesh is transforming into an information-based society, where value is based on the ability to create, distribute, and utilize information. Obviously, the success in such a society requires education and computer literacy. It is nearly impossible to complete an education, let alone find and maintain employment without Information Technology (IT) and computer skills. Accordingly, Information Technology availability and competency are vital and necessary to everyone. The disabled, primarily the visually impaired (VI), cannot be left behind in the transition to such an information society. In fact, Information Technology can have a more significant impact on the visually impaired with respect to employment and other aspects of daily life. A visually impaired person is merely one who cannot see properly- he or she must be afforded the same right to Information Technology as one who has sight. ICT development must not discriminate based upon the physical capacities of the citizens.

A team from Norwegian association of the Blind and Partially sighted headed by Mr. Halgeir Holthe visited Bangladesh to find out the possibilities of establishing a Centre of Excellence to train up the visually impaired persons of Bangladesh in computer technology with the financial assistance of Peace Corps-Fredskorpset. The team visited different people from educational institution, government agencies, community development organization, organization working for the people with disabilities in Bangladesh and the visually impaired persons.

As a follow-up, the study has been carried out by the Center for Services and Information on Disability (CSID), whose expertise helped identify the current situation and condition of visually impaired persons, while assessing particular problems and constraints with respect to Information Technology access. More importantly, the study intends to explore further possibilities and alternatives to empower the visually impaired and integrate them into mainstream job sectors vis-à-vis computer skills training and education.

Finally, the findings of the study will lead to the establishment of a Center of Excellence to provide technical assistance to visually impaired persons in Bangladesh. This will help create access to low-cost computer technology. This report will also provide Government Organizations (GO), Nongovernmental Organizations (NGO), and other interested parties with a comprehensive description of the relationship between computer technologies and the visually impaired. The overarching goal of this study is to look at providing access to Information Technology to visually impaired persons, so as to eliminate social and economic inequities that cause widespread unemployment. In the foreseeable future, with Information Technology, the employment rate of visually impaired people could meet the same standard as that of the sighted population. Such a feat would be a monumental success. This is not an expectation, but instead it is a target to be fervently pursued.

Rationale

In Bangladesh, there are approximately 700,000 adults who report some form of visual impairment. Among the working-age visually impaired, unemployment is rampant. Services that provide specific employment-focused skill development have made great strides in enhancing visually impaired peoples' ability to be competitive in the domestic job market. Furthermore,

such programs have pursued a progressive path, which goes beyond employment stability to promote advancement in the workplace.

During the past fifteen years, technology has broadened the job possibilities for people worldwide. Computers have brought about innumerable opportunities for both totally blind and low vision people. In an increasingly interdependent world, information Technology is an essential tool to create, distribute, and exchange knowledge. That said, Bangladesh is not alone in its purpose. In order to be effective in information accumulation, the country must participate in domestic and international information technology exchange. It is vital to sustain open, organized, and cohesive information flows at home and abroad to help facilitate the advancement and empowerment of visually impaired people. Communication and adaptation are crucial in this process.

The barriers for visually impaired people in Bangladesh include lack of computer knowledge, inadequate access to information and insufficient physical access. Throughout the country, provision and support for visually impaired people are not available. Unfortunately, people with visual impairment face many inequities in many aspects of daily living. Most important among them are employment preparation and job acquisition. In fact, the visually impaired people are able to work and contribute in nearly every sector of the Bangladesh economy. They are as likely as any other to use computers and the Internet. This is an indispensable human right.

Generally, visually impaired persons have limited difficulty using a computer keyboard. They require accommodation and orientation to the computer's output systems. Individuals who have low vision often use screen magnification programs to enlarge text and images. Speech synthesizer or a refreshable Braille display are often utilized as well. Current versions of the software that accompany a speech synthesizer or Braille display intercept information as it is being sent to the screen. It is then stored in a memory construct known as the off-screen model (OSM). Essentially, an OSM is a database that holds the contents of the screen including text, graphics and controls. The screen reading or Braille program then access the information in the OSM and translate it into speech or Braille.

Visually impaired persons require accommodation in the workplace to successfully perform their job duties. Computers can be used as an intelligent interface between them and the sighted. Information that would otherwise be inaccessible or require manual processing can be automatically transformed into formats better suited for the visually impaired.

Objectives

The primary objective of the study is to explore the feasibility of establishing a Center of Excellence to promote access to Information and Communication Technology (ICT) to the visual impaired people of Bangladesh. Empowerment through technology is the main focus. The study particularly addresses the situation, attitude, and understanding of the visually impaired person in reference to education and employment opportunities, and ways to optimize their development.

The specific objectives of the study are to investigate the following areas:

- The attitude, understanding and the level of confidence of the educated visually impaired person in the country.
- The attitude of the potential employers on employment of visual impaired persons.
- The employment scope for visual impaired person by job category.
- The special needs to create computer access of visual impaired persons.

The Methodology

Due to the current situation of the visually impaired in Bangladesh, the establishment of a Center of Excellence to offer human development resources and education is justified because of the positive potential effects that could be accrued. While initiating the study, the research team employed wide projections with a variety of methodologies to facilitate in-depth data and analysis that can contribute to the issue both at local and national level.

Information collection through a preset questionnaire:

A set questionnaire was developed by the study team in order to collect relevant information from direct respondents. The respondent selection criteria were visual impairment and minimum education of class eight. The respondents were stratified into four categories:

1. Persons with no knowledge on computer
2. Persons with computer experience
3. Employed persons with no computer access
4. Employed persons with computer access

The questionnaire was pre-tested, and information was collected by a team comprised of researchers and educated visually impaired persons. In total, eleven data collectors polled 190 respondents. The collected data was analyzed using SPSS software.

Information collection through organizing Focus Group Discussions:

Focus Group Discussions (FGD) were organized in different locations with a diverse panel of invitees, including persons with visual impairment. A total of nine FGD's were conducted with a sum total of 136 participants in attendance.

Interview with employers and managers of development organizations:

Several formal and informal interviews were held with a variety of sources. ICT development managers, organization heads, employers of visually impaired persons, government officials, and representatives of commercial computer agencies all gave constructive input relating to the overall present situation and future of ICT and the visually impaired.

Review of available documents:

Substantial research materials, including Internet resources and hard-copy documents have been collected, reviewed, and analyzed. Government documents such as ICT policy papers, disability legislation, and national policies on disability significantly contributed to the research as well. ICT-related technical documents, catalogues, and brochures from technology manufacturers and dealers can be found herein.

Practical orientation on computer technology both within and outside country:

During the study period, the Webel Mediatronics Ltd., a well known organization specialized in computer technology for visually impaired people based in West Bengal, India held a demonstration of computer technology for visually impaired persons in Bangladesh. This has allowed the study team to become more familiar with modern, innovative technology. Such technologies are more adaptable in nature in the context of Bangladesh. Furthermore, various

visits to agencies in India were instrumental, exploring different technologies and teaching methodologies. International exchange is especially helpful in terms of learning from both current successes and past shortcomings.

Study Team

A team comprised of the following persons conducted the study:

Mr. A.H.M. Noman Khan	Principal Investigator
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Situation of Visually Impaired Persons in ICT Sector

Over the past few years, the country has had significant success in the ICT sector, and it is still making progress in terms of growth and development. Bangladesh, alongside many other developing countries, is transforming into an information-based society. Obviously, its success is contingent upon computer access and computer literacy. Within such a society, visually impaired people should not be left behind on the road to technological development.

Policy issues and the national plans:

The national ICT policy of Bangladesh has been designed to develop a countrywide ICT infrastructure to ensure access to information by all citizens, including the Persons with Disabilities. The policy statement addresses a wide range of strategic actions and interventions in order to promote the ICT sector development. Unfortunately, disabled people, particularly the persons with visual impairment, have generally been neglected in these policy interventions.
A recent article by the Ministry of Social Welfare discusses a comprehensive strategy, addressing the needs of people with disabilities. This deserves more attention and elaboration for its inclusion in the nation policy on ICT.

Understanding on computer access for visually impaired persons:

A mere 10% of the respondents were aware of the availability and access of computer systems. Approximately 8% of the respondents had indicated that they had the choice to participate in computer-related training at their respective educational institutions. However, no one opted to participate in the computer classes due to lack of confidence and also uncertainty of the use of such training.

Out of the total employed respondents, one-quarter reported that their offices used computers. Only 12% of the respondents are currently using computers in their workplace. One responsible factor is that employers have limited confidence in visually impaired peoples' computer abilities. In addition, employers do not have the necessary equipment to accommodate visually impaired people.

Computer training scopes and opportunities:

12% of the respondents had previously participated in computer-training courses. But only a limited few had reported of having the scope and opportunity to apply their acquired computer knowledge and skills.

In 1985, the Norwegian Association of the Blind (NAB) developed computer software and training for visually impaired persons. A group of Bangladeshi computer software engineers had initiated a similar feat, but could not proceed due to some unavoidable circumstances.

12.6% respondents had received computer training from NGOs. Currently, very few NGOs are providing such training. The supply is inadequate to meet the demand.
Helen Keller International took initiatives to provide training to visually impaired person on JAWS windows, providing access to visually impaired people, most of which are HKI staff members.

Since 2001, the Vocational Training Center for the Blind (VTCB) has initiated training on JAWS windows with support from Christoffel BlindenMission (CBM). A non-residential 9-month course covers PABX and computer operation. Of the 36 participants, 21 persons studied computer operation. Using JAWS windows, the VTCB training introduced Braille-to-text as well as text-to-Braille formats.

The respondents mentioned that visually impaired people should receive training on the fundamentals of computer operation, word processing, spreadsheet operation, and Internet communication.

Computer Technology and devices Available in the Country:

JAWS for windows is still the most popular software. Helen Keller International, Baptist Shangha for Blind Girls, and the Vocational Training Center for the Blind have used this software, and have had extensive success. Although JAWS is prevalent, very few Braille printers are available. This can be attributed to limited economic resources or neglect in printer maintenance.

Education of Visually Impaired People:

There are no authenticated statistics available on the prevalence rate of disability in Bangladesh. An estimate states that the number of visually impaired people in the country is about one percent of the total population, totaling approximately 1.3 million people. Two thirds are of adult age, while the remaining third are of school age. A recent study on educating children in difficult circumstances found that only 4% of children with disabilities receive any form of education.

Sources indicate that a total of 95 visually impaired people have either completed or are in study in different universities around the country; 71 of them attend Dhaka University while the total number of students approximately are over 30,000.

Respondents of the study reported that they had participated in formal education (47%), in special education (17%), and in integrated education (36%). In most cases, the respondents begin their education in special or integrated education. If feasible, they then transfer to formal education.

Students with visual impairments do not have access to computer facilities that exist in schools where the Government runs integrated Education program. Sighted students, however, have free and open access. The computer set-up in these centers is not suitable for visually impaired people. In addition, the average citizen is not aware of the capacity of visually impaired people to use and operate a computer effectively.

Scope of computer training at educational institutes:

In some integrated schools and other educational institutes there are provisions for students for receiving training on computer applications, but this opportunity is not available to the students with visual impairment. The majority of the respondents identified several problems like unavailability of appropriate computer set-up, lack of trained teachers, and insufficient orientation and information exchange.

Findings and Analysis
Basic data of the respondents

Basic data of the respondents

The study has covered 190 respondents from 11 districts. [1] The age group of the respondents ranges from 13 to 47 years. 65.3% are male with 34.7% female. 94.7% of the respondents are with total loss of vision. 67.4% of the persons covered under the study had visual impairment during 0+ to 5 years. Typhoid (43.2%) is the single largest cause of visual impairment of the respondents.

Residence, education, and occupation

The majority (69.5%) of the respondents are residing in urban areas. There is a growing trend in the country among persons with visual impairment seeking education to migrate to urban areas like Dhaka. In fact, 64.2% of the respondents are residing in Dhaka. This is mainly because the educational and employment scopes and opportunities in Dhaka are much greater than any other locations. 71.6% of the respondents covered under the study are students at the Dhaka University. This particular group has the greatest potential to be trained in computer literacy. After completion of education the natural focus is on finding employment. The job-market is getting increasingly competitive with time. Among the respondents of the study 20% are employed. [2] However, almost all of the employed respondents are self-employed. They have to compete with sighted citizens for employment. Obviously, the sighted have the added advantage of acquiring additional skills, enhancing the scopes for employment. They also have to heavily rely on their sighted colleagues in the areas of information, communication and technology (ICT).

A certain section of the respondents have retired from their employment. This group along with all other respondents has shown intense interest in acquiring skills on the application of computers. They believe that this would not only prepare them better for the job market, but also give them the liberty to work independently.

Degree of disability

The respondents of the study can be divided into two broad groups according to their level of visual impairment- persons with low vision and persons with no vision. Although 94.7% respondents have no vision, there are a very large section of visually impaired who have low vision. Unfortunately, many of the persons with low vision are not properly identified, and are classified as person with no vision. Consequently those who are acquiring education are learning in Braille. Acquiring computer training by the persons with low vision is comparatively easier as they will be able to use different technologies to enhance their power of vision.

Use of Braille

81.1% of the respondents are proficient in Braille. This ability would make it much easier for them to learn and use computer applications. Some advantages of the software include the capacity to automatically convert Bengali and English text to Braille and the ability to allow a visually impaired person or a sighted Braille Transcriber to create a Braille document directly by typing in Braille codes with audio support.

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[1] There are 64 districts in the country in 6 divisions.
[2] It must be noted that most of the respondents are urban based and educated.

Educational Approaches

The respondents had acquired education under the approaches of formal (47.4%), special education (16.8%) and integrated education (35.8%). In most cases, however, the persons with visual impairment started their education in special or integrated education. If feasible, they would transfer to formal education in order to acquire a higher level of education.

Computer facilities exist in schools where the government runs integrated education programs. Although the sighted students had access to the facility, the students with visual impairments did not have such privilege. The computer set-up was not adapted to their use and the authorities were unaware of their computer capacities and potential.

If computer-training scopes were created within the institutes, it would allow them to be prepared with additional abilities for the job market. Besides, such an initiative would not only motivate visually impaired people, but would act as a model for other institutes to follow.

Scope of computer training at educational institutes

8.4% of the respondents indicated that they had scope during secondary education to take computer-related training. Regardless, none of them were given training at their respective educational institutions. The respondents on this matter identified different reasons. It was indicated by 84.2% that appropriate system were not available, 4.2% considered a lack of cooperation of authority as the main reason. A lack of trained teachers, appropriately modified systems and non-clarity of the total issue creates a discriminating situation, under which the students with visual impairments are being denied of the opportunity to receive computer training. If afforded the opportunity to participate in computer training, the respondents unanimously agreed that they would have participated.

Computer training scopes and requirements

12.6% of the respondents had previously received computer-training courses from NGOs. Those who did not receive training cited certain barriers like lack of information (23.2%), limited opportunities (38.9%), high cost (18.9%).

Currently, a few NGOs are providing training to persons with visual impairment. There is not a sufficient supply to feed the mounting demand for ICT. Training capacity of NGOs should be enhanced to address the growing demand in the country. They had also indicated that training opportunities should be created nationwide. The respondents called for adapting some computers of private computer training centers (26.3%). They requested adequate sensitization, motivation, and advocacy work on this matter with relevant sectors. The respondents also indicated a need to increase Government initiatives (11.6%) as well as NGO initiatives (13.7%). Adequate financial input (24.2%) is a major requirement in this sector. Braille keyboard, talking software, and Braille printer are required to adapt a computer for use by persons with visual impairment.

Areas of computer training, its appropriateness for employment and support required for self-employment.

The respondents informed that all should preferably receive training on fundamentals of computer operating, word processing and spreadsheet operations. In addition there are interest in acquiring additional skills on using Internet and email (37.9%), programming (33.7%) and other areas (9.5%). These training courses would for certain (100%) increase chances for not only job but also self-employment.

On a specific question regarding support required for self-employment, the respondents indicated financial (82.1%), technical (56.8%) and appropriate computer accessories and materials (82.1%) as main requirements. They opined that persons with visual impairment would be able to be involved with self-employment once trained but possessing skills is not the only requirement for them to be successful. They would also require favorable environment and the technical and material backup. They fear if their self-employment initiatives fail for some reasons it would be demoralizing for them at one end and on the other hand it will only strengthen the persistent negative attitude that is held by others.

Use of Computer at Workplace

The employed respondents were asked about their use of computers at work. Out of the total employed respondents 25% informed that their offices use computers in their work. 12.5% of the respondents are currently using computers in their work. The respondents remarked that if persons with visual impairment had necessary training many more could have been involved. Those persons with visual impairment who are employed but do not have necessary computer skills have pointed out that they find it extremely essential to acquire skills on computer applications. They feel with time they are only moving backwards in their career while their sighted colleagues move on due to their knowledge on computer literacy. This is not only frustrating for them but also very depressing.

Computer training acquired and scope of application

12.6% of the respondents had acquired some form of computer training. All of them received training on computer operating system and the basic fundamentals. Only 1.1% received training on programming while 2.2% on Internet application. The main source for computer training was NGOs (25%). The remaining had a variety of sources for receiving training like from family members, self-effort, etc. The duration of the training courses ranged from a minimum of seven days (1.1%) to a maximum of six-months (9.5%). There were no cost involvements for 98,9% of the respondents in receiving the training. Only one of the respondents paid Taka 15,000 to get computer training.

Although a certain percentage of the interviewed persons with visual impairment had acquired computer training, the majority (71.4%) was not able to use their skills. This was mainly because the work they were being involved were not computer related, their employing organizations did not have the necessary computer set-up that can be used by the persons with visual impairment besides there were the severe lack of information and awareness regarding the scope and opportunities of computer use by persons with visual impairment. As an effect the persons with visual impairment who had acquired training were gradually losing what they had learnt and were falling back with regard to the technological developments. They also did not have adequate scope to practice with computers after training. Only one of the respondents has his own computer where he can practice. Two others practice at the organization where they had received training. Lack of scope to practice what they have learned is a major barrier for the persons with visual impairment.

Case study 1:

"I see children today doing everything with computer, holding the entire world under their fingertips, but letters on a page and alphabet in front of a computer appeared a meaningless jumble - with no more logic to me," said Md. Sarwar Hossain Khan, a 31 years old visually impaired person studying for his Mphil in the department of political science at Dhaka University. He expressed his frustration, while discussing the possibility of using computers to help visually impaired in Bangladesh. He lost his sight in his childhood due to dysentery. To him, the computer and the Internet compose the doorway to a new life, one of limitless possibilities for visually impaired people. Standing in his way are the lack of equal opportunity to and availability of computer skills training, education, and employment. He feels as if he is being left behind in this information age, embarrassed of the fact that he does not have computer experience. This is due to no choice of his own, but rather to the surrounding socio-economic environment. Although he is studying at the most prestigious educational institution in the country, he does so without being afforded the knowledge of computers. In his mind, people with visual impairment need basic computer training. After the basic capacities have been developed, steps must be taken towards adaptive technology use. Most computer training programs and manuals fail to address the special needs of people with visual impaired, which acts as a major barrier to computer skills development. He holds that "great achievements in life are attained by a willingness to fail an attitude that failure is not what counts; that ten failures and one achievement is better than never having tried." Sarwar is not afraid of failure. Simply, he wants a chance- a chance to fail or succeed. He wants the chance to attain something great. How can he fulfill this desire if he is not even afforded an opportunity to do so? It is extremely desired for an educated man like Sarwar to accept this reality. He hopes that the doorway to a new life is at least accessible.

Expected impact of computer access

1. Promoting education at primary and secondary schools:

The limited enrollment for visually impaired children in school can be attributed to a large extent on lack of confidence in family members and community citizens. Simply put, the average system does not have faith in abilities of visually impaired persons to function at the same level as others. With the emergence of new IT and Braille equipment, visually impaired people will become more competent and independent, and thus more reliant in society's eye. This will create a positive impact on enhancing the rate of enrollment of visually impaired children in mainstream education.

2. Promoting education at higher secondary and university level:

The high dropout rate of visually impaired students from primary, secondary, integrated, and special education to higher education is a significant barrier to their respective advancement. Reasons for such barriers are limited access to educational materials and the unavailability of an appropriate learning environment in mainstream educational institutions.

Usually, the students in more advanced studies are dependent on a few subjects, of which they could access study materials in Braille. They even follow the same subjects studied by their senior visually impaired students as a means to access study materials. Such dependency limits enrollment in institutions like Dhaka University and such higher education institutions around Bangladesh. Computer access could widen the scope of the material available, while allowing visually impaired people the ability to take online courses. The Internet has a wealth of information, and visually impaired people deserve the right to educate themselves with this resource. The provisions of access to computer for visual impaired student will reduce the rate of dropout and create an impact to accelerate higher and diverse areas of education.

3. Promoting job opportunities for visually impaired person who completed education:

Although unemployment is perceived as a major problem, employment access for visually impaired people, regardless of education background, is still scarce. Only a negligible number of educated, visually impaired people have been employed. Most of the visually impaired employed hold jobs like being a telephone operator or a receptionist. Employers prefer to hire one who has vision and have little considerations to the qualities and potentials of visually impaired persons. Computer skills will establish the visual impaired person with focus on their capacity and ability to contribute more in a diverse job market.

4. Establishing visually impaired employees with more competencies in workplace:

The scope for employment for the persons with disabilities in the country is very limited. The employment situation is even worse for the persons with visual impairment. There are only a very few organizations that employ persons with visual impairment. But the type of jobs that persons with visual impairment are doing in these organizations are of low profile and of least importance. A majority of them are employed as telephone operators. A few are employed in NGOs that work for persons with disabilities, especially persons with visual impairment. But it is a proven fact that with appropriate skills and working environment it is possible for the persons with visual impairment to be employed in multi-sectored employments.

The access of the persons with visual impairment to acquire skills of ICT would build a pool of competent work force of persons with visual impairment. In the initial days it might take a little time for the employing organizations to experience the level of competence of the persons with visual impairment trained on ICT and be motivated, but with time the employment rate of persons with visual impairment will certainly increase at both the government and non-government sectors.

5. Changing the prevailing negative attitude of common masses on the potentialities of visually impaired persons:

Disability has often been associated with inactiveness. Persons with disabilities are still considered to be a burden of the family and the nation. The understanding of the common masses on persons with visual impairment is not different. This handicap is more a barrier for the development of the persons with visual impairment than the difficulties that they encounter due to their impairment. If this handicapping situation is not removed the condition of persons with disabilities including the persons with visual impairment will not significantly improve. But for this negative attitude to change it is essential to bring positive changes to the existing knowledge of the masses by providing appropriate information and experiences.

Persons with visual impairment trained on ICT and successfully employed or applying their acquired skills on appropriate sectors and field would provide a strong message to the general masses. This would be the best way to educate people and with more persons with visual impairment included into mainstream development would allow them to interact with people with no visual impairment; ultimately contributing in creating better understanding of the common mass of the abilities and capacities of persons with visual impairment.

6. Promoting Self-employment of educated visually impaired person:

The rate of self-employment among the employed persons with visual impairment interviewed in the study is large. Many of the persons with visual impairment are leading NGOs that are working on disability issues especially on visual impairments and low vision. But in all cases the persons with visual impairment have to be dependent on their sighted staff for matters related to ICT. Their current level of performance in their line of work is undoubtedly praiseworthy but this can be further enhanced if they can acquire skills on ICT and apply in their line of work. Their access to the 'worldwide information network' would allow further enrichment of their programs and activities. They would also be able to make better program plans for the future.

In addition to acquiring formal education if persons with visual impairment have the scope of gaining essential skills on computer applications they would be better prepared and feel confident in starting up self-initiated income generating activities. Their set examples could serve as motivating factors for other persons with visual impairment to follow in their footsteps. Families of persons with visual impairment could also be expected to provide required assistance to them for self-employment.

7. Upholding the access to recreational means for educated aged and retired visually impaired person:

Many of the educated and elderly persons with visual impairment are residing a retired life from employment at their homes. In addition there are many other educated and elderly persons with visual impairment at home who had never been employed. Most of them live a life of 'no-action' and boredom. And they are to a large portion dependent on other sighted members of the family for information and recreation. But this can very easily be changed if they can acquire skills on ICT and also have regular access to computers and the worldwide websites. It might also

encourage them to perhaps consider undertaking of different activities that would keep them involved and effectively busy. Such computer access could bring them into the information world, which would in turn lead to increase better quality of life for the visually impaired persons.

Case study 2:

"I could not get the chance to touch the keyboard even after I had received computer training." - Margina Ahmed

Margina Ahmed has no vision. She holds a Hons and Masters degree in philosophy from Dhaka University. Although currently she is unmarried, she hopes to marry someday soon. In order to do so, she feels as though she must establish herself as a self-confident, motivated, and independent woman. As such, she took part in a privately run computer training program to build her character. In anticipation, she hoped that she would be able to use a computer for her own needs, preparing her own curriculum vita and applications independently. However, in reality her expectations were met with stale dissatisfaction. She affirmed, "utilizing the training in real life became a distant dream to me, I could never touch the keyboard after the training." Though there is a computer in her home, it is not accessible for the blind. And, while other members of her family enjoy its use, sadly she cannot. She was educated using JAWS software. Presently, installing JAWS in a PC costs tk. 75,000, which is three times the amount of the computer itself. Due to the high cost of such software, most of visually impaired people, like Marzina, are unable to use PCs regardless of training. In Marzina's own words, "we cannot use mouse in the computer, we have to depend on keyboard and talking devices, we need to memorize hundreds of thousands of command, some of which are very complex. Since I could not use computer after the training, I have forgotten most of these commands. Someday, I may forget them all." This situation is typical for most visually impaired persons who obtained training on computer. Marzina may feel alone and helpless in her own world, but there are many Bengalis in the same situation. She is not alone. In fact, there are over one million visually impaired people that live day-to-day life just like Marzina. Computer training and education should not end upon the introduction to or graduation of a course. Instead, consistent access and use must be available in order to preserve and advance the computer knowledge received. Just as a seed grows in a garden, the seed of knowledge needs care and attention after planting. It is no use to simply plant a seed, if you cannot enjoy the benefits of the harvest. Marzina has the seed, but fears she may never get the chance to see it bloom.

Computer Technology

Software and Hardware System and Services

Computer access for a visually impaired person provides him or her opportunity to learn how to use essential tools in a working environment. With these tools the visually impaired can compete with the sighted in the job market. Information and Technology accelerate the learning process and broaden their outlook and perspective on education, leisure, and life in general. IT facilitates the continuum from lower education to higher education to employment and beyond.

Many varieties of simple and user-friendlier computer soft and hardware technologies have been innovated. In the modern world as well as in neighboring developing countries like India and Thailand, an increasing standard of technological equipment have been produced for use by visually impaired people. Several references of such technologies are reflected below:

Software Supported by Windows Operating System:

Jaws (Job Access with Speech) Talking Computer Software

JAWS, is a visually impaired user-friendly software that converts a normal PC into a talking computer so that the visually impaired people can learn to operate the computer independently. It simplifies the process of learning computers, provided with a help and support system, which guides the visually impaired person as to what to do next and even, which key to press to achieve any operation. It allows a visually impaired person to learn the keyboard as it speaks out the letters as well as its functions when pressed without affecting the computer. It has a talking installation feature that guides the visually impaired as to what to do next.

Connect Out loud - Internet And Email Software

Connect Out loud is like JAWS, the only difference is that JAWS helps use the computer as a whole with Windows and other applications while Connect Out loud is a low cost solution for those who want to use computers just for browsing the Internet and sending & receiving E-mail. Connect Out loud enables visually impaired person to surf the web, send and receive e-mail, create documents in the easy to use Freedom Scientific (FS) Editor word processor. It also allows visually impaired person to easily adjust speech rate, pitch and other settings without going through a complex menu system.

Jawbone

Jawbone is a specialized interface program that enables the coordinated use of Dragon Naturally Speaking Professional (ver. 6.0) and JAWS for Windows (ver. 4.0 and higher). The Jawbone interface (middleware) provides the necessary code for interoperability of these two dynamic technologies. It enables the visually impaired or users with learning disabilities to talk to the computer to give commands or generate text.

By enabling JAWS & Naturally Speaking to work together, the JAW Bone can provide a computer system that can be used by individuals with varying disabilities. Both programs can be configured to manipulate most text-based applications, which can improve both computing possibilities and user independence. It includes a lexicon of new commands that make operating the PC by voice easier. It also includes specific commands for Naturally Speaking, Microsoft Word, Notepad, WordPad, Outlook and Internet Explorer--along with documentation and support material (print, text to audio, and CD audio/video) to assist the user in developing basic capabilities with this technology.

MAGic Magnification Software

MAGic software magnifies the images on the monitor screen that enables low vision users to use the computer. It is available in 2 types: MAGic Standard Without Speech and MAGic With Speech. This has a talking installation feature that enables the user to independently install MAGic. It can magnify screen to 16 times. Its smoothing feature eliminates jagged edges caused by bitmapping when images or characters are magnified on the screen. Four configurable magnification views give the user the flexibility to display information in a way that fits his/ her magnification needs. It facilitates reviewing of documents quickly using simple, easy to remember keystrokes.

Interactive Tutorials on CD For Learning Computers

These are training kits for JAWS Users who are visually impaired for self-learning at their own pace. It combines theory & exercise through interactive practice in real environments. Uses descriptive narration combined with theory and exercise to explain the main concepts of using 'the particular application under study' with a screen reader. It is application based, and allows visually impaired persons to work within the application, pausing when necessary. The question and answer sessions at the end of each module allow you to test your comprehension. Exercises are presented in comprehensive steps, allowing the visually impaired user to practice executing keyboard commands.

Mobile Talking Computers & Note takers

Portable computers/ note takers enhance the independence of the visual impaired person. They play a key role in empowering and increasing the productivity of visually impaired persons in their jobs/ professions enabling them to work even when they are on the move.

Pac Mate

PAC is an acronym for Personal All-Purpose Computer. The PAC Mate converts objects and text to speech so users who are visually impaired can hear documents, images and Web content. PAC Mate is based on Windows CE and allows the visually impaired to work in Pocket PC versions of Word, Outlook, Excel and Internet Explorer which can then be transferred to a desktop at work or home. It enables the visually impaired to surf the Internet as well as send and receive emails using a modem card. It uses the popular JAWS Screen Reading Software and Pocket PC Technologies for Braille input and speech output. It facilitates the use of removable and reusable Compact Flash cards for extra storage space.

ARIA PALMTALK With Braille Keyboard

Aria is a small portable videocassette sized talking computer. It combines the facilities of a personal computer with a personal organizer. It has a Word Processor, Clock and Calendar, Calculator, Telephone Directory, Diary & File Manager with DOS operating system containing a wealth of in-built application software, created with an emphasis on power and user-friendliness. It has a 6 key 'Perkins-like' Braille Keyboard with 8 function keys as well as a choice of Braille languages i.e. Computer Braille, Grade I or Grade II.

Braille to Text Software (Direct Braille 1.0)

The Braille-to-Text Software developed in-house uses 6 Keys of QWERTY keyboard for data entry in Braille with audio support. The Software converts entered Braille into corresponding

Indian Languages automatically. The Software supports 12 Indian Languages as well as English and Bangla. The visually impaired persons can handle the PC with a portable case and can work in any environment. It has comprehensive editing facility with automatic Braille to corresponding Text Conversion.

Automatic Braille Printer (Bprt 10)

The Automatic Braille Printer is a PC based Braille embosser. The mechanical Perkins Brailler has been converted to Electronic Brailler with indigenously developed micro controller based Electronic Kit. Four such printers can be connected in a chain with a single work station for printing in quantity.

Text to Braille Software (Bharati Braille 1.0)

Windows based easy to use Text to Braille Software for Indian Languages. The Software follows Bharati Braille standard followed all over the India. The software converts text files entered through i-Leap software into corresponding Braille instantly. Braille rules are built in the Software. Software supports printing through Automatic Braille Printer Bprt 10. It supports 12 Indian languages e.g. Bengali, Oriya, Hindi, Assamese, Gurumukhi, Marathi, Gujarati, Tamil, Telugu, Kannada, Malayalam & Nepali and English.

Braille Writer System 1.0

Braille Writer 1.0 application software along with dedicated Braille keyboard BKB-10 provides friendly computerized environment for Braille file handling, Braille to Text conversion, Braille printing as well as ink printing option by visually challenged person. The System offers both single user and multiple user mode. Audio feedback enables visually impaired user to run the software independently. The Braille writer system is state of the art Windows based software which supports operation up to eight Braille Keyboard terminals simultaneously in parallel. It allows direct entry in Braille codes, with audio support.

Tact-Braille (Tactile Device) TR 10

Tact- Braille is a tactile device and an alternative to paper pints of Braille material. This PC based touch reading device can be used to read line by line, any Braille matters stored in a PC with a set of control switches like start, stop, next line, previous line etc. available on the device. Up to 10 units can be connected in parallel for fetching different Braille lines simultaneously from of a single PC, thus dispensing with costly and bulky paper books in many areas of Braille teaching and learning process such as class room or e-library. The tactile Device has been developed along with interface software for English and Indian languages including Bangla. Large, paperless storage of Braille matters accessed by multiple readers simultaneously offer a low cost & less cumbersome library facility, which can be networked globally.

Math Braille

Math Braille is useful software to create Mathematics & Scientific Texts, Books, Notes, Question Papers etc in Braille. The software provides a comprehensive editor to type in English, Indian and Bangla Languages, text as well al Mathematical symbols. For transcription the software uses Nemeth Braille standard. Braille print can be taken through modified Perkins Brailler & other compatible printers. The created document is editable in Braille mode as well as in text mode. For ease of typing on screen soft keyboard is provided for different languages and math-

symbols. It runs on Windows 98, Widows NT, and Widows 2000 and Supports Text entry as well as Braille entry from normal keyboard. It supports both English and Bengali along with other Indian languages.

Software Supported by Linux Operating System:

Microsoft provides almost all the software currently available in the market. Linux operation system provides similar facilities at low cost, particularly for software related to visually impaired people. Linux is not yet widely introduced in the context of Bangladesh, but there are positive feed back available from worldwide, Visually Impaired users of Linux. The Linux operating system could be gradually introduced in Bangladesh for use by the Visually impaired persons. Based on feedback from local users further popularization and facilitation for use of Linux operating system could be considered in the country.

Some examples of software's under the environment of Linux operating system are;

SuSE Linux has developed the screen reader SuSE Blinux--software that enables visually impaired users to comfortably work with Linux. SuSE Blinux is neither an independent distribution nor a kernel patch but rather a so-called daemon, i.e. a program that runs in the background. One advantage of this is that SuSE Blinux does not compromise system security in any way. Furthermore, blind users have unrestricted use of all applications of the new SuSE Linux version that runs on the text console. They can even compile their own kernel.

Emacspeak is a speech interface software that allows blind and visually impaired users to interact independently and efficiently with the computer. Available free of cost on the Internet, Emacspeak has dramatically changed how the author and hundreds of blind and visually impaired users around the world interact with the personal computer and the Internet.

All of Emacspeak is now voluntarily bundled with all major Linux distributions. Though designed to be modular, distributors have freely chosen to bundle the entire system without any undue pressure. The integrity of the Emacspeak code base is ensured by the reliable and secure Linux platform used to develop the software. Emacspeak is a fully functional audio desktop that provides complete eyes-free to all major 32 and 64 bit operating environments. By seamlessly blending all aspects of the Internet such as Web-surfing and electronic messaging into the audio desktop, Emacspeak enables speech access to local and remote information with a consistent and well-integrated user interface.

Case study 3:

Farzana Taleb Liza, 32, is serving as the Chief Executive of an NGO. She was born to a wealthy Muslim family in Kishoreganj, but spent her childhood in Khulna. A few years after her birth, she lost her eyesight due to small pox. In 1989, she graduated Higher Secondary Education with the help and support of her family. Then, she was admitted to BSS (honors) in the department of Social Welfare at Dhaka University, where she completed her studies. Thereafter, she obtained a four-year diploma in physiotherapy, and she completed a short course on leadership in the United States. She has successfully proved that the visually impaired are capable of utilizing computer to the highest extent.

She has completed a three-month course on computers from a private organization, using her training to optimize her computer efficiency. Accordingly, she purchased her own computer and installed JAWS talking software in her computer. Initially, she faced many problems, and had to rely on her program trainers for assistance. However, over time she has gradually become more and more efficient in computer use. Through consistent use and experiential learning, she has shown to be a cheered success story in the field of ICT and the visually impaired.

Recommendation

The issue of Information Communication Technology (ICT) for the visually impaired people in the country is new and not very much known to both the consumers and the agencies concerned with promotion of ICT issues in the country. This requires comprehensive planning and execution of interventions at different sectors and levels in the country. The advantage of the issue is the prevailing technology in the neighboring countries with user-friendly devices, which has been proved as an effective mean with options of necessary adaptation. Another notable strength of the issue is the number of NGOs working with the issues of disability who has keen interest to promote ICT for visually impaired persons in the country. The ministry of science and Technology had shown keen interest on taking the issue at policy level to expedite the endeavor. Ministry of Social Welfare who is the lead ministry for promotion and protection of the rights of persons with disabilities is also keen to promote the issue.

Capitalizing all these strengths and advantages, integrated and strategic interventions need to be initiated, focusing on the following broad areas of interventions at different levels:

1. Sensitization and Awareness rising at all levels
2. Systematic inclusion in national ICT policy
3. Permanent demonstration of technological devices
4. Introducing ICT in integrated and special schools
5. Introducing ICT in NGOs to decentralize access
6. Initiating human resource development initiatives
7. Ensure maintenance and follow-up of both soft and hardware
8. Research on development needs assessment

Suggested interventions:

1. Sensitization and Awareness rising at all levels

Sensitization on the potentialities of use of ICT for visually impaired persons needs to be made targeting the consumers with particular focus to the students and adult, resource teachers, school teachers, ICT programmers, NGOs working with disabilities, government authoritative bodies etc.

Interventions:
a) Organizing national level seminar addressing on possible use of ICT to empower visually impaired persons including appropriate technology.

b) Organizing division and district level seminar addressing on possible use of ICT to empower visually impaired persons including appropriate technology.

c) Information exchange through electronic and other network on feasible technological devices, features, prospects etc.

d) Sensitization through regular telecast of messages and print media like publication poster, leaflet etc.

2. Systematic inclusion in national ICT policy,

The ICT issues addressing the needs of disabled persons particularly the visually impaired persons has not been adequately included in the national ICT policy and the National action plan. This needs to be systematically included to facilitate intervention at different policy execution.

Interventions:

a) Facilitate formation of an action group to prepare statement of input to propose amendment in the policy document.

b) Organize round table with representative of authoritative bodies of the government ministries and departments and concerned agencies involved in promotion of ICT in the country.

c) Organize follow-up workshop on inclusion of issues at policy document and its execution.

d) Initiate coordination of services and supports to the interventions at different levels.

3. Permanent demonstration of technological devices.

As the concept and the technology are still to a big extent new to the country context, it needs information exchange and motivation to all concerned. Permanent demonstration of all required technological devices through establishing resource center at national and divisional level could play a vital role to promote such issues.

Interventions:

a) Establishment of a resource center (Centre of Excellence) in Dhaka city with demonstration of all available hardware and software related to ICT for visual impaired person.

b) Establishment of a resource center (Centre of Excellence) in collaboration with potential NGOs in five divisional cities with demonstration of minimum required hardware and software related to ICT for visual impaired persons.

c) Facilitate NGOs at district level to initiate resource center with possible technologies and training services.

4. Introducing ICT in integrated and special schools

Integrated and special schools are still the entry point for education of visually impaired students in the country. It could be the first step to initiate access of ICT for visually impaired learners. Many of the schools where the integrated education centers are established have the options for computer education but are not accessible for the visually impaired student.

Interventions:

a) Computer software accessible for the visually impaired person should gradually be introduced in the integrated schools with at least the computerized Parkinson Brailler.

b) The resource teachers could be developed as resource persons to provide computer skills to the student.

c) Braille to text and text to Braille along with print facilities should be introduced to minimize the needs for Braille copies.

5. Introducing ICT in NGOs to decentralize access

NGOs concerned with disability issues plays a vital role in facilitating services addressing specific needs. Selected NGOs could initiate development of computer services creating access of visually impaired person.

Interventions:

a) At least one NGO in one district could be facilitated to initiate computer services for the visually impaired persons.

b) Necessary soft and hardware should gradually be initiated to facilitate access to computer.

c) At least one computer trainer should be developed in each of the NGOs who will initiate such services.

d) Necessary technical assistant to the special and integrated schools could be provided through the NGOs.

e) Braille to text and text to Braille facilities should be provided to the visually impaired people of the areas.

f) Services could be offered on cost recovery basis or subsidized if possible.

6. Initiating human resource development initiatives

Currently other than a few in Dhaka city, there are no such services available in the country to develop skilled human resources to offer computer training for the visually impaired people. A systematic and strategic initiative is required to promote human resource development in the country.

Interventions:

a) The centre of excellence and the resource centre in Dhaka city along with other divisional resource centers should initiate trainers' development initiatives.

b) The resource centers should create facilities for training software user-friendly to the visually impaired learners.

c) The resource centers should have options for refreshers and follow-up training to meet the growing demand of such training.

d) The computer centers operating training should be motivated to initiate training computer support program for the visually impaired persons.

7. Ensure maintenance and follow-up of both soft and hardware

Maintenance of hardware and software is a vital factor for sustainable development of such initiative. Resource centers should be equipped with adequate back up and skills for appropriate and timely maintenance of devices.

Interventions:

a) Resource centers should have adequate skills and back up support for appropriate and timely maintenance of devices.

b) Necessary linkages should be established between the manufacturer of computer devices/technologies and the resource centers.

c) Services should be available for timely update of software and other devices to cope up with the advanced development of technologies.

8. Research on development needs assessment

Other countries have developed the technologies and devices that are currently available. Most of these are suggested to be adapted in the country context. There will be specific needs for further development and adaptation based on the prevailing situation.

Interventions:

a) Initiatives should be taken for systematic research and study on assessing the future needs and requirements for technological inclusion and adaptation. The national resource centre should have provision or establish proper linkages with appropriate agencies to carryout such researches and studies.

b) Necessary linkages should be established with the manufacturing agencies or developer to response to the growing needs and demands.

c) Hardware and software development agencies should be involved in the process of research and development of technologies.

d) System and assistive devices are required to be adapted using Bangla as the language.

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Case study 4:

Borhanuddin is a middle-aged man from a lower-middle class family. His father is the sole breadwinner, and the family relies on his limited income. Borhanuddin obtained a masters degree from the University of Dhaka with hopes to achieve success in the domestic job market. Unfortunately, an exemplary academic record and a quality computer training could not ensure him job security. "When you're disabled specially visually impaired, job won't hire you; so you have to create your own job."

While he completed his masters, he discovered an organization in Mirpur that provides computer training. Here, he completed a nine-month course. Despite his qualifications, he was unable to find a job. Employers were not confident in him because of his visual handicap. His morale is low, and he is on the verge of giving up. Regarding computer education and literacy, Mr. Hawlader holds that "if given training on computer to visually impaired people, would not come to any of its use, if it never serve the purposes and interests of any organization then why should waste money on learning computer. This sort of learning gives nothing in return except killing of time, money and energy". Demoralized by his experience, and frustrated at the blatant discrimination on the part of employers, he uncovers a pivotal barrier to ICT development for the visually impaired: employment. Employers must be aware of such technologies, and must appreciate the qualifications of a person, sighted or otherwise. Employers see the visually impaired as simply blind, neglecting to realize their inner potential and abilities. This needs to change in order for true progress to be made on the part of visually impaired people.

Case study 5:

Gopal Chndra Saha, 33, was a born blind. He grew up in Savar, close to Dhaka. Due to his tremendous self-confidence coupled with unwavering family support, he worked hard to obtain a Bachelor degree from Dhaka University. He knew very well that in the existing competitive job market, academic achievement alone was not enough. So, he decided to take computer training as a way to broaden his employment opportunities. Now, after finishing his computer training with JAWS, he serves in an NGO as a trainer. Not only is he employed, but he is also making great progress and advancements in his workplace. Gopal has made such great strides in working with computers that he needs additional software to continue his progress. In particular, he requires English-to-Bagla and Bangla-to-English software to assist him in communications.

A success story that keeps on developing, Gopal is a model for the use of ICT for visually impaired people. Employment should not be an end result or a destination for visually impaired people. Instead, employment should foster growth- a process, and not a product.

Overview of ICT Situation

With the application of information technology, the capacity to integrate and absorb human knowledge has grown immensely. The Internet and ICT facilitate information flows across national borders and have made it accessible to people at minimal cost. With the advancement of ICT, knowledge essentially becomes a factor of production. Data, information, knowledge and action are correlative- data becomes information through context and information become knowledge through networking. The transformation of implicit knowledge to explicit knowledge is critical for exploiting potentials of an organization. Knowledge resides in implicit and explicit form, and ICT plays a pivotal role in harnessing and disseminating knowledge for the development and empowerment of people.

Bangladesh has not had extensive experience with the Internet. It was initiated with UUCP e-mail in 1993, while the IP connectivity was achieved just three years later.

The Internet and Data Network are primarily responsible for the nationwide coverage and exchange of information. A variety of data networks are slowly emerging, Digital switches capable of services have been installed nationwide, various organizations have, or are in the process of installing local area network,

Recently, a demonstration of an ICT transcription device for visually impaired people performed by Webel Mediatronics Ltd. was made in Dhaka. This has created a good impact for both the government and non-government sector, initiating such devices to promote access to visually impaired people to ICT. The Ministry of Science and Technology has expressed interest to utilize the device. A good number of international and domestic non-government agencies have participated in the process of initiating such an ICT option for visual impaired persons.

A national non-government agency is providing limited-training services to a few visually impaired persons on JAWS for Windows. With its internal software speech synthesizer and the computer's sound card, information from the screen is read aloud, providing technology to access a wide variety of information, education, and job related applications.

National Development Plans on ICT

Policy Statements

The ICT policy of Bangladesh aims at building an ICT-driven nation comprising of knowledge-based society. With this end in view, it is envisaged to develop a country-wide ICT infrastructure to ensure access to information by all citizen, including the PWDs, for sustainable economic development using all sorts of on-line ICT enabled sources.

Goal/objective

In order to give a thrust to the ICT sector and expeditious development of Software industry and its export-required infrastructure facilities and legal framework will be created.

Provide effective incentives for development of ICT sector to both local and foreign entrepreneurs; Incentives may be given to the local and foreign entrepreneurs in the following form:

1. Tax-holidays for 5 to 10 years
2. Procurement of tele-communication infrastructure materials related to ICT from abroad/local with minimum/without taxes/custom duty for promotion of ICT.
3. Repatriation of income by the foreign investors etc.

Develop an efficient ICT infrastructure that provides open access to international and national network;

Promote and facilitate use of ICT in all sectors of the economy for transparency, good governance and efficiency improvement;

Establish legislative and regulatory framework for ICT issues like IPR, data security and protection, digital signature, e-Commerce, ICT education etc. as well as to ensure quality ICT education provided by different private organizations;

Set up national databases that is reliable and easily accessible to all the people of the country;
Promote use of ICT by providing special allocations for ICT project implementation in the public sector. Train the decision makers in ICT use and promote a ICT culture;

Develop a large pool of world class ICT professionals to meet the needs for local and global markets;

Set up a very high quality ICT institution to continuously promote and foster ICT Industry;
Enact Laws and Regulations for uninterrupted growth of ICT, in conformity with World Trade Organization (WTO) stipulations.

Strategy/action

Government of Bangladesh (GOB), has undertaken at number of steps for ICT infrastructure development which are as follows.

1. In order to establish direct connectivity with international and communication back bone, process of joining of Bangladesh with fiber-Optic Sub-marine cable net work is underway.

2. For better connectivity, importance of development of telecommunication infrastructure has been emphasized and deemed as industrial development to support the growing demands of the ICT sector, both in Public and Private sector. Initiatives are also underway to attract private sector investors in the telecommunication sector.

3. Steps to amend fiscal policy (Customs Duty and Tax etc.) towards procurement of telecommunication infrastructures as well as cellular telephone handset which are increasingly used as terminals for e-mail are also under consideration of the GOB.

4. Optimum utilization of MW/UHF towers, Radio Towers, Power Pylons, Cable Duct by the private sector for augmenting information infrastructure would be encouraged. Moreover, for promotion of ICT, co-operation between Bangladesh Telephone and Telegraph Board (BTTB,) Railways, power Development Board (PDB), Rural Electrification Board (REB), power Grid company, Oil and gas Companies etc. to build digital microwave and optical fiber based phonic information transport system for use by ICT service providers to be encouraged.

5. To construct countrywide National Information Infrastructure (NII) for the use of all Telecommunication and Internet Service Providers (ISP), co-operation between BTTB with private licensed ICT service providers ensuring the use of existing facilities to be established.

6. BTTB's role of providing services to different telecommunication service provider and ISPs of commercial basis being enhanced.

7. To provide dial-up Internet access from local telephone calls, ISP, will be provided with relevant technological facilities.

8. To ensure public access to information, cyber kiosks will be set-up in all post offices, union complex and upazilla (Sub-district) complexes. Private sector Participants will be encouraged to set-up these facilities.

9. To support the installation of ISPs in the country, national high speed communication back-bone for Internet will be developed and International high-speed gateway facilities for ISPs will be provided on commercial basis.

10. An integrated flexible and reliable nation-wide information communication network capable of transmission voice, audio, Video, data and graphic will be ensured. NII will be developed and it will be directly connected to Global Information Infrastructure through Information superhighway to create, collect and sell software and provide ICT enabled services to the world market through involvement of both Public and private Sectors.

11. To improve the quality of present telecommunication services, all existent analog telephone-switches and transmission link network will be replaced by digital switches and digital transmission link.

12. The bandwidth capacity and availability will be ensured all over the country at a reasonable cost to encourage the growth of Internet, ICT industries, e-commerce and e-governance etc.

13. A central depository for collection and dissemination of ICT information and research finding will be developed. These will he done under a network, connecting all university libraries and research organization to this central depository, which in turn will be connected to the Internet.

14. Hi-Tech Zones will be established through technology transfer with modern data communication facilities.

15. Use of Voice Over Internet Protocol (VOIP) and Wireless Local Loop (WLL) technologies will be used where necessary.

16. Basic telecommunication facilities will be extended to the rural and under-served areas to bring greater mass including PWDs into the stream of ICT activities both by the private and public sector.

17. Tele communication facilities will be made available to all segments of the society, particularly to the PWDs at an affordable/cost.

18. Teledensity will be increased to broaden the coverage, making special effort to provide facilities to the PWDs ensuring improvement of socio-economic condition of the people through ICT related activities in line with experience of developed conditions.

Annex 03

Quote from an article on "Information Communication Technology (ICT) and its Management for Sustainable Development".

In an article "Information Communication Technology (ICT) and its Management for Sustainable Development" presented by the Secretary, Ministry of Social Welfare of Government of the People's Republic of Bangladesh has pointed out significant indication of government ICT infrastructure, plans and consideration on ICT for persons with disabilities.

Regarding current ICT infrastructure in the country as stated in the article indicate that:

The basic telecommunication facilities will be extended to the rural and under-served areas to bring greater mass including PWDs into the stream of ICT activities both by the private and public sector. Tele communication facilities will be made available to all segments of the society, particularly to the PWDs at an affordable/cost. Tele-density will be increased to broaden the coverage, making special effort to provide facilities to the PWDs ensuring improvement of socio-economic condition of the people through ICT related activities in line with experience of developed conditions

The article suggested some specific elements of empowerment strategies that:

Facilities shall be built to promote ICT training and computer-aided training at all level of education to meet the demand for skilled manpower in ICT. Special type of training facilities enabling PWDs, to transform them efficient human resource in ICT, should be provided. All educational institutions related to the PWDs should be brought under the program of ICT. Ministry of Social Welfare, in collaboration with all the NGOs working with the PWDs, will play the key role in implementing this program.

Universities, Technical institutes and colleges, both in the public and private sectors, shall be strengthened to produce ICT graduates of International standard in computer science with the support of government. Preference for study will be given to the PWDs in those institutions.

To train teachers in ICT in large numbers, using the present infrastructure, development of virtual ICT trainers, wherever possible will be explored CD and Web based courseware development and its use shall be encouraged to promote computer -aided education at all

level of education. PWDs will be provided special incentives to have maximum access to these facilities.

The Universities of Science and Technologies will be established in phases as center of excellence in ICT and these will be provided with higher allocation of resources. PWDs will be able to exploit full advantages of the available facilities to enrich them as efficient human resource in the field of ICT.

Multimedia institutes up to district level will be established to produce skilled human resources to exploit the opportunity offered by the growing multi-media market. Underprivileged people living in the district level including the PWDs will be able to exploit the opportunity.

The funds and resources for ICT in government and other potential sectors as indicated in the article explained that:

It has been envisaged to increase the government spending in ICT to at least 2% of ADP by 2006. New budget provision for ICT should be created for all Ministries, Division, Department and all autonomous sector will be encouraged to make their own investment in the application of ICT production, trade and services. Preference will be given for public support to those who will be able to meet up to 20 percent of its revenue expenditure from the earning of export of software and ICT enabled services.

More focus in the use of ICT is to improve the socio-economic condition of the people, particularly the PWDs with special importance on health care, poverty alleviation and agricultural development, social welfare, environment, transportation, e-commerce, e-governance etc.

It has been envisaged to introduce nationwide ICT systems for rural development activities, agricultural, horticulture, fisheries and livestock extension for farmers, career guidance for youth, technology guidance for rural enterprises micro-level planning etc. 10% of our population is disable. PWDs will be actively encouraged with financial and technical support in all such activities for full exploitation of the ICT facilities for the improvement of the quality of their lives.

Non-government organizations dealing with the PWDs will be encouraged to establish centers at the village level for providing hard ware/soft ware or other support services. At the same time concerned agencies of the government will use both the formal and non-formal channels to disseminate information about the application, advantages to the PWDs of the use of ICT.

In the health sector, tele-medicine system Network will be introduced throughout the country for cost effective delivery of health care services. The tele-medicine Network will be used for rural patient management, distant medical education, training of health professionals and to develop mass awareness for disease prevention. ICT would be used to develop such capabilities. PWDs, properly trained in ICT, will be able to exploit the full advantage of tele-health care facilities.

In fine, Persons with Disabilities will be provided with full support to build up their capacity, enabling their full accessibility to ICT ensuring their full and effective participation in the social and economic mainstream with equality. Moreover, steps will be undertaken for the empowerment of PWDs to promote their full involvement as development agents and beneficiaries in ICT through bringing them accessible to digital connection.

Moreover, special type diploma and trade certificate course on ICT will be offered in both private and public institutions with special courses for the PWDs and continual skill upgrading of existing professionals working in public and private sectors shall be ensured through in-service training programs.

To ensure standard and quality of ICT education, a national certification and accrediting system shall be developed and implemented.

To develop quality ICT professionals and skilled personal, internationally accepted standards in training program will be adopted to ensure access in the global soft-ware and ICT enabled service market.

Potential of ICT will be used for delivery of distance education to help stretch the country's limited teaching resources and ensuring quality teaching to all. This system will facilitate the PWDs to have access to education and skill development training on ICT.

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