ICT-Driven Knowledge Economy In Bangladesh: Issues And Constraints

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ABSTRACT:

The paper reveals that the knowledge revolution, led by information and communication technology, lies at the heart of economic development of Bangladesh. The inability to access and use of ICT is a barrier to the creation of knowledge-based society in Bangladesh. The paper has identified that in order to create an ICT-driven knowledge society Bangladesh needs a knowledgeable workforce, government support and incentives, transparent and democratic institutions, innovativeness of the society, and a sound telecommunication infrastructure. The universities of the country need to be encouraged and adequately financed so that they can become the true abode of research and development - just like other universities in other parts of the world. In the area of communication technology, the competitiveness of the country in today's information rich world will depend on its ability to access and exchange information both locally and globally.

Key words: *Information technology, Communication technology, Transparency, Knowledge economy, Hardware infrastructure, Software infrastructure, Innovation*

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1. Introduction

Information and Communication Technologies (herein referred to as ICT) consist of hardware, software, networks, and media for collection, storage, processing transmission, and presentation of information in the form of voice, data, text, and images. They range from the telephone, radio and television to the Internet (World Bank 2003a, and 2003b). Today's economy depends on the increased flow of ideas and information across firms, organizations, governments, and countries nationally and internationally. In the developed countries, ICTs have been the drivers of economic growth (see Jorgenson and Stiroh, 2001, Oliner and Sichel, 2000, Stiroh 2002). Recent economic growth in China and India indicates that increases in technological capabilities are the driving forces behind knowledge and innovation (Evoh, 2007). Thus, with the advancement of ICT, now-a-days knowledge has become a factor of production.

Over the last decades though the countries like China, India, and Malaysia have made remarkable progress in exploiting ICT in their socio-economic development, Bangladesh has virtually lagged behind these countries. ICT infrastructure has virtually remained poor and inadequate. Therefore, the challenge for Bangladesh is how to develop its ICT infrastructure to provide access to advanced information services in order to create a knowledge-based society and remain competitive in the world of information and communication technology. This research article is aimed at addressing those issues and concerns that affect the creation of an ICT-based knowledge economy in the country. The study will contribute to the literature since ICT-driven knowledge economy in a developing country like Bangladesh is an area, which has not yet been widely researched and validated.

The assumption is that ICT will enable this country to experiment with emerging tools, models and ideas for building their societies (leveraging opportunities with leapfrogging) as the dynamics of an ICT-based knowledge are better understood. It means that if the citizens of the country are well equipped with the knowledge, qualifications, and skills of ICT, bypassing heavy infrastructure building it is possible for a country to transform itself directly into a knowledge economy. If we look at India and its $17 billion share of global offshore Business Process Outsourcing (BPO) market

(Kasbeakar, 2005), it becomes easy to see the attraction and follow the line of thinking of transforming the country into a knowledge economy. The purpose of this study is, then, twofold: first it investigates into the constraints and issues that ICT industry of Bangladesh faces in creating a knowledge society. Second, it suggests measures how to remove these constraints to knowledge development.

2. Background Of The Study

Formerly East Pakistan, Bangladesh came into being in 1971, when the two parts of Pakistan split after a nine-month long bitter civil war, which drew in neighboring India. With 150 million people in an area of 55,598 square miles, Bangladesh is now the eighth largest in the world in population with high density (CIA World Fact Book, 2008). With such a large population, poverty is rampant, and there is a lack of educational and medical resources. Political strife since its inception in the 1970s has also made the country one of the poorest. The adult literacy rate is 43.1 percent (53.9 percent for males) and the average life expectancy at birth is 64 years (CIA World Fact Book, 2008). The county is trying to diversify its economy, with industrial development a priority. As a result the growth of industrial sector averaged 8.25 percent during 2001-02 to 2006-07, compared with 2.1 percent growth rate in the agriculture sector over the same period (Mansur 2008). This indicates the transition of Bangladesh from agrarian economy to industrial economy (manufacturing and services).

For sustaining this transition from agrarian to industrial economy, Bangladesh must create and exploit knowledge through the widespread use and application of ICT. ICTs have the potential to support the development strategy of "leapfrogging" i.e., bypassing heavy infrastructure building it is possible for a developing economy to transform itself directly into a knowledge economy. For example, during the last half of the twentieth century, substantial achievements in few countries which succeeded in narrowing the economic divide separating them from the industrialized world often involved the export-oriented production of ICTs (Kim, 1997, Hobday, 1995, Amsden, 1989).

Although a bright prospect exists for Bangladesh in the export oriented production of ICTs (especially software), the industry is engulfed with many problems: very low telephone density, insufficient number of ICTs as a new tool to attract and teach present and future work force and to improve co-operation with different stakeholders, low pace of computerization in various offices and sectors, absence of cyber laws, power outages etc (Islam, 2005). Therefore, this study will investigate the strength and weaknesses of the ICT industry in this country and suggest measures for the development of a sound ICT infrastructure.

The study is divided into the following sections:

- Current Status of ICT in Bangladesh
- Strengths and weaknesses
- Major issues and concerns
- Strategies for transition to knowledge-based society
- Conclusions and recommendations

Methodology: The study is based on secondary sources of information: web-sites, books, national dailies, statistical reports, research articles, World Bank report, Asian Development Bank report, reports of Bangladesh Association of Software Information Services (BASIS), Bangladesh Computer Samity (council) referred to as BCS

3. Current Scenario Of ICT In Bangladesh:

The government of Bangladesh formulated an ICT policy aiming at building an ICT-driven nation comprising of knowledge-based society. In the light of this policy Bangladesh ICT sector is growing at a quick pace, with an increased involvement from local and foreign investors and companies.

Submarine cable has connected Bangladesh to the global information super highway. According to Bangladesh Association of Software and Information Services (BASIS) as cited in Saukat and Hoffman (2005), the estimated value of Bangladesh ICT industry is USD$ 150 million, growing at an estimated 20 percent per year. Growth of ICT sector in terms of business conglomerates and professionals is predominant in Bangladesh. The table below, according to Bangladesh Computer Samity (BCS) shows the number of sector wise companies during 2000-2006

Table 1: Growth Of ICT Sector

	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 (BCS)

Table 1 depicts that from 2000 tom 2006, there have been tremendous growth of hardware (108 percent), software (250 percent), ISP (400 percent) and training and other (50 percent). The training institutes are concentrating their efforts on software development and providing training in basic and advanced computing skills.

First introduced at Atomic Energy Commission of Bangladesh in 1964, computers are now widely used in offices, businesses, educational institutions, at home and in the field. Computer literacy is imparted, computer applications are taught, training is given, and diplomas, bachelors and master's degrees are awarded by colleges and universities. Training centers, educational institutions, corporate world all are contributing in different ways. The related departments are IT (Information Technology), ICT, Computer Applications, Computer Science, Computer Engineering and Telecommunication Engineering. A number of Cyber cafés providing e-mail and internet browsing facilities have opened up in all major cities of the country.

Though software has been a relatively late entrant in Bangladesh ICT market, it has become now the most promising export sector of Bangladesh. At present, there are over 4500 registered software companies in the country with over 5,000 professionals working in this sector. Quality software is being produced in the country and exported regularly to 30 countries in this world including USA, Japan, Canada, Australia and different European states (Bangladesh Economic Survey, 2007, cited in Laila, 2008). The export of software in the fiscal year 2003-04 stood at USD 7.2 million, a growth rate of more than 70 percent over the previous year. In the fiscal 2004-05, the growth rate has been more than 60% and exceeded US $10 million (Khasru, 2006). Another feature is that Bangladesh offers a very cost-effective wage level to the programmers and data entry personnel. For example a programmer's monthly pay ranges from USD 400 to 800 as opposed to US$ 4500 in U.S.A. and USD 1200 in India (Chowdhury, 1997).This wage level attracts foreign investors to invest in software industry and train the youth in developing software industry in Bangladesh. There is, therefore, a good opportunity for local ICT companies to enter into joint venture agreements with foreign companies and to take advantage of a large unutilized and unemployed educated youth force by providing training and education in ICT to produce, use, and export ICT. Besides, Bangladesh does have some inherent strength that can be used as the launching pad for making this country a potential offshore source of Software and Data Processing Services within a short time. The next section discusses some of these strengths.

4. Strengths:

The government of Bangladesh has declared ICT as a "thrust" sector. The creation of a separate Ministry for ICT (Ministry of Science and Information Technology) and initiation of government ICT projects are encouraging steps for the local and international investors in ICT industry in Bangladesh.

The country has become an ideal ground for advanced knowledge economies to invest due to its friendly policy for the foreign investors as they are provided various incentives including tax holidays and simplified regulations.

The core strengths of Bangladesh is its people, the unleashed English speaking youth force, skilled professionals, universities and other educational institutions turning out huge ICT graduates, and the availability of wide range of Hardware platforms, from mainframe to PC. Knowledge and research portals are being developed through civil society initiatives. Many private ICT training institutes have sprung up in a large number over the years. Bangladesh needs ICT professionals with capacity to network with people, ideas, and initiatives. All these are necessary for the proper development and nourishment of ICT sector in Bangladesh.

Isolated villages in Bangladesh have directly adopted cellular phones. This has become a legendary success in improving the livelihoods of farmers and others who were given access to critical market information and life time communication that were previously unattainable to some 28000 villages of Bangladesh. More than 55,000 phones are currently in operation, with more than 80 million people benefiting from access to ICTs (Yunus, 2006). Besides Grameen Bank founder Noble Laureate Professor Muhammad Yunus has created Grameen Phone (a mobile telephone company), Grameen Cyber Net (Internet Service Provider), Grameen Communication (Rural Internet Service Provider), Grameen Software Company, and Grameen Information Technology Park, designed to address the diverse issues of poverty and development.

A reasonable number of skills exist in the following areas:

- Operating System-Windows, Windows XP, Window Vistas, MAC/OS, Novell Netware, Windows NT, UNIX, OS/400
- Programming Language—C++, Visual Basic, Visual FoxPro, COBOL, RPG, J++
- RDBMS---Oracle, Informix, DB/2

All these skills have the potential to create new types of economic activity and employment opportunities, and enhance the quality of life, making it necessary for workers to acquire a broader and more adaptable knowledge base. ICT is, therefore, critical to nation building. Without this, no amount of investment in economic activities will have a substantial impact in this country with a population of 150 million.

5. The Other Side Of The Story

Despite promise and prospects of ICT development in Bangladesh, ICT in this country is still in its infant stage and ranks the lowest in ICT-based knowledge index, as depicted in table 2. The indicators (phones, mobile phones, internet, and broadband) in the table measure the depth of connectivity in a country.

Table 2: Indicators Of ICT-Based Knowledge Index (2006)

	Fixed line per 100 inhabitants	Mobile subscriber per 100 inhabitants	Internet users per 100 inhabitants	Broadband subscriber per 100 inhabitants
Sweden	59.52	98.98	76.97	25.87
Canada	64.49	57.57	67.89	22.91
Australia	48.81	97.02	52.05	19.15
Italy	47.15	92.5	49.63	14.86
U.S.A	57.15	77.40	69.10	19.31
Chile	20.20	75.62	25.24	5.08

Tunisia	12.42	56.32	12.68	0.17
Brazil	20.54	52.90	22.55	3.14
Egypt	14.33	23.86	7.95	0.27
China	14.06	34.83	10.35	3.85
India	3.64	14.83	5.44	.21
Bangladesh	0.79	13.25	0.31	0.0
Pakistan	3.34	21.98	7.64	0.04
Nepal	2.21	41.81	1.14	0.0
Myanmar	0.58	0.42	0.18	0.0

Source: World Telecommunication indicators database, country data by region, 2006

As depicted in table 2, Bangladesh's telecommunication sector is extremely poor with low fixed line penetration. The ICT infrastructure is quite inadequate for a country to enter into knowledge economy. The telephone system is outmoded, and there are only .79 telephone lines per 100 people. Computer ownership is .08 per 100 people (see table 3). The table 3 further reveals low penetration levels of internet access, inadequate tele-density and inadequate and unreliable infrastructure for the development, generation, and reception of information and knowledge.

Table 3: ICT Profile Of Bangladesh 2007

Literacy in the national language	56 percent**
Fixed telephone lines per 100 inhabitants	0.75
Internet hosts (per 10,000) inhabitants	0.015
Internet users (per 100) inhabitants	.31
Internet cafes/telecenters (per 10,000 inhabitants)	0.19
Cell phone subscribers per 100 inhabitants	21.66
Number of web sites in the national language	200
Number of websites in English and other languages	600
National bandwidth within the country	68 Mbps
National bandwidth to and from the country	112 Mbps
Computer ownership per 100 inhabitants	0.8
Broadband Internet Subscribers per 100 inhabitants	00 (2005)
Radio sets per 100 inhabitants	6.37
TV sets per 100 inhabitants	10.59 (2006)

Source: World Telecommunication/ICT indicators database (2007): Country data by region.

** Literacy figure is from Bangladesh Bureau of Statistics

Telecommunication reduces the need for traveling and thus saves money, time and energy for businesses. Telecommunication is both an industry and infrastructure, helping other infrastructures to grow. Absence of good telecommunications deters access to information and opportunities for entrepreneurship (McDowell, 997) and therefore, can hinder the socio-economic development of the country. Penetration of PCs, the Internet connections and the total bandwidth capacity with a connected ICT infrastructure are low, as depicted in table 3, that even the reliable sources of data on the subjects under search are not available. The total Bandwidth capacity is much below the desired level for an efficient transmission network. The inadequacy of this basic telecommunication infrastructure has become an obstacle for Bangladesh to participate in the global ICT revolution.

5.1. Major Issues And Concerns

The major issues and concerns surrounding ICT in Bangladesh may be enumerated as the following subsections.

5.1.1. Electricity and Power Stability

Power is the biggest logjam in physical infrastructure. Per capita power generation is only about 158 kilowatt-hours a year, among the world's lowest. Although a third of the population has access to electricity, they even can not have a dependable and reliable service because of frequent power failure and low voltage (ADB, 2007 cited in Khan and Hoque, 2008). Frequent power failure and low voltage stand as a big hurdle for software companies in Bangladesh. Shortage of electricity is another major deterrent to the use of ICT. Bangladesh uses uninterrupted power supply (UPS) and instant power supply (IPS) for equipments and computer system. But he cost of product increases under these situations. Therefore, the access to the internet becomes very limited and remains disrupted for frequent power failures and poor electricity.

5.1.2. ICT Education and Training:

An old Chinese proverb says: "Give a person a fish: you have fed the person for today. Teach a person how to fish: You have fed the person for a life time."

In today's knowledge economy, one more level needs to be added for developing countries: Teach the person how to process and package fish for export and market it, and then we can see the stimulation in knowledge and economic development.

This, therefore, warrants the demand that today's ICT-driven knowledge economy requires strong human capabilities to process and package ICT products for marketing nationally and internationally. The wide spread and effective use of ICT technologies warrant the need for strong human capabilities in information processing, transmissions, and communications by means of computers and telecommunications. Therefore, human resource development is considered to be a core component of an ICT strategy. Though Bangladesh places tremendous importance on the development of human resource for ICT development, this is still an area of weakness for Bangladesh (see table 4). The table shows that ICT penetration at primary and secondary level is very limited. Educational attainment of the total population aged 15 and over is much higher than that of post-secondary level, whereas ICT education is given at post-secondary level, especially at universities.

Table 4: Educational Attainment Of The Total Population In Bangladesh (2002)

Aged 15 and over	In percent (%)
No schooling	50.1
First Level	32.9
Second Level	14.0
Post-secondary	.03.0

Source: Bangladesh Demography

Since ICT education is mainly concentrated at post-secondary level, this industry always faces a shortage of qualified workers. As such, a wide spread introduction and facilities of ICT education at both secondary and post-secondary level in educational institutions is a prerequisite for providing skilled ICT manpower.

6. Hardware/Software

Bangladesh PC/Server market, with total shipment of 8,244 units in quarter 3 of 2007, registered a phenomenal year to year growth of 331.1%, as compared to the same quarter of the previous year, as reported by Springboard Research (2008) a leading innovator of Information Technology (IT) market research industry. Hardware Industry often requires a huge capital investment. Bangladesh is a so-called developing country with huge volume of population of 150 million in an area of 55598 square miles. Poverty is rampant. Computer education is mainly given at post secondary level and education attainment of post –secondary level is .03 percent (see table 4). Capital requirement and education, thus, stand as big hurdles to the growth of this industry.

On the other hand the present size of software industry is very small. Only few firms are involved in export of software and data entry services. The major problems (Chowdhury, 1997) identified by the Ministry of Commerce, government of Bangladesh impeding the growth of ICT sector relate to:

- Fiscal—these consist of high rates of duties and taxes on software and hardware, complicated banking procedures like absence of bank borrowing rate to the level of other export sector, absence of funds for research and development and for market promotion, high interest rate on loans (15 to 17 percent annually).

- Human resources--these relate to the absence of qualified and skilled computer teachers and tutors, absence of strong private and public agencies to promote the growth of ICT industry.

- Infrastructures-these, among others, are absence of copyright protection of software, limited facilities for high speed data communication, expensive but slow internet connection etc.

- Marketing—these include tendencies to use pirated software, lack of efforts to Bangladesh software, non-existence of marketing efforts in large software markets, lack of overseas market information etc.

Given the importance of a more developed knowledge economy for productivity, its current low level is a critical constraint on productivity. Bangladesh lags her neighbors (India, Pakistan, Nepal) on a number of indicators capturing the essence of the innovation system and information and communication technology (see table 1). Knowledge sharing in Bangladesh will continue to be impeded by the digital barrier unless there is a universal access to ICT in all parts of the country. Despite government's declaration of this sector as "thrust sector" of the economy, the country still faces the challenges of how to become a learning society and to ensure that her citizens are equipped with the knowledge, skills, and qualifications on ICT needed for the economic and social development of the country.

7. Strategies For Developing Knowledge-Based Society

To capitalize on the knowledge revolution, Bangladesh needs to build on their strengths and carefully plan appropriate investments in human capital, effective institutions, relevant technologies, and innovative and competitive enterprises. Countries such as India, Korea, Ireland, Malaysia, and Chile illustrate the rapid progress that can be made. Every effort should be made to remove obstacles to the implementation of ICT-driven knowledge based society. The following five actions, therefore, are suggested:

i. Access at an affordable price to advanced telecommunications and information technology infrastructure including high bandwidth

This includes reliable and sustainable infrastructure support systems within and between education, training and research providers to ensure inter-operability and facility offerings of technology parks or zones. ICT use and information services must be rendered more affordable

and accessible through healthy competition in the ICT sectors, and telecommunications be specifically made available to all societal segments.

Telecommunications can lead to a new urban and regional spatial organization (Graham and Marvin, 1996). Several studies (e.g., Hudson and Parker, 1990, Egan, 1992, Richardson and Gillespie, 1996) identified telecommunication infrastructure as key to rural economic development through improved efficiency in managing rural enterprises and savings in travel costs and time. Since Bangladesh is predominantly a rural country, it is imperative that Bangladesh develops relevant ICT infrastructure with special emphasis on rural, education, health services, and other business enterprises of both private and public sector. The telecommunication sector be deregulated and opened to private investment, and the development of the telecommunication infrastructure prioritised. Moreover, the availability of adequate bandwidth country-wide must be ensured, and the development of local ICT industry must be emphasised as well. All parts of education and training industry need access to telecommunications and information technology infrastructure including highbandwidth at an affordable price.

ii. Soft Infrastructure, encompassing skilled human resources, entrepreneurship programs and ICT-driven education and training

To create a sustained cadre of "knowledge workers," Bangladesh needs to develop a relevant ICT-based educational system and reorient classroom teaching and learning objectives, starting from primary school.

"We are living in an age of knowledge and information, fraught with opportunities and dangers. There are opportunities for the underprivileged and poor to become rich and strong. But at the same time there is a danger that gap between rich and poor could widen. The message is clear. We must continue to develop our human resources. The success or failure of individuals and nations as well as the prosperity of mankind depends on whether we can wisely develop our human resources" (UNDP, 2001).

A number of factors are impeding the wholesale uptake of ICT education in Bangladesh. These are factors such as a lack of funding to support the purchase of the technology, a lack of training among established teaching practitioners, a lack of motivation and need among teachers to adopt ICT as teaching tools (Starr, 2001). Policy in this area should focus on standardising and supporting ICT education and training in public and private institutions at all educational levels, leveraging the assistance of donors, non-governmental organisations (NGOs) and other partners in capacity-building in ICT education.

ICTs encourage and support independent learning. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (e.g. Jonassen & Reeves, 1996), the influence of the technology on supporting how students learn will continue to increase. Therefore, basic education in Bangladesh should provide the foundation for learning ICT, and secondary and tertiary education should develop core skills that encourage creative and critical thinking. Contemporary ICTs are able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curricula that make sound use of the affordances of these technologies (e.g. Oliver, 2000).

The education system of the country should focus on learning, exploring efficiencies in terms of program delivery, the opportunities for flexible delivery provided by ICTs (e.g. Oliver & Short, 1996); and the capacity of technology to provide support for customized educational programs to meet the needs of individual learners (e.g. Kennedy & McNaught, 1997). There is also the growing use of the Internet and WWW (World Wide Web) as tools for information access and communication in this technological world. In the light of these strengths of ICT in education, Bangladesh, to improve the quality of tertiary education and provide opportunities

for lifelong learning, should develop a comprehensive ICT-driven education and training for emerging as a knowledge economy in this 21st century.

Entrepreneurship needs to be incorporated in education to induce progressive and creative thinking amongst students. The educational institutions need to ensure that graduates are able to display appropriate levels of information literacy. It is essential to have community participation, which continually identifies their needs and gives feedback to make the program relevant and effective in their development process (Alam and Alam, 2007). The corporations should also lend support in the form of practitioners by providing valuable practical insight, scholarships and internships for students, research grants for faculty members, and other forms of operational and monetary support for these institutions. There must be increased allocation of resources to universities imparting computer education and should generally be linked to quality improvement of academic environment.

iii. Government Support and Incentives, including various ICT policies and legislation

The government must continue to play as a supporter, user, and facilitator of ICT development. In China government views the ICT sector as an engine for economic growth (Liang, 2003). In Egypt a dynamic Ministry of Communications and Information Technology has played a strong role in catalyzing ICT development in collaboration with the private sector (Feller, 2005).

For creating a smooth ICT-driven knowledge environment in the country, suitable legal policies and legislations are much needed in the country. This can create an ICT friendly legal environment which will help this sector grow by attracting investment. In terms of broader economic and institutional regime, this is recognized all over the world that ICT-based knowledge economy is a critical tool for developing economies to tackle many development issues and requires cross -sectoral coordination and partnership among government, private sector and civil society. In this endeavor the promotion of ICT integration in all economic sectors to encourage transparency, efficiency, and good governance is needed. The creation of infrastructure facilities and an ICT legal framework to facilitate the integration of ICT and the development of the software industry along with the provision of incentives to local and foreign entrepreneurs to promote ICT sector development are essential. In order to let the ICT sector take off, government should pass a comprehensive cyber law without any further delay.

iv. Transparency and Democratic Government

Perhaps the most important change that needs to occur if Bangladesh is to partake to ICT-driven knowledge economy is the cultivation of a spirit of openness and transparency and democratic governance. Corruption has become the bane of all aspects of life of the people of Bangladesh. Political structures remain confrontational. Personal and political enmity between political rivals, frequent haratal (strikes), lack of respect for elementary principles of democratic governance have become the principal characteristics of political system of the country. (Chowdhury, 2007). No society, no matter the amount of knowledge embedded in its people, can prosper if corruption rules as king. ICT will improve coverage and citizen access to public services in the country's most remote regions. The creation of an ICT cell and website for information dissemination is needed to store and supply essential country information.

v. An Efficient Innovation System

Schumpeter (1934) defines innovation as the process by which new products or new methods of production are introduced. Traditionally, the importance of innovation is ascribed to the new competitive landscape stemming from increased economic globalization (Amin, 2004), improved ICT-technologies and lower prices on transportation (Forbel, et al 1980). Therefore, firms , research centers, universities, think tanks, consultants, and other organizations that can

tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new technology must come forward with the new ideas of the application of ICT to create a knowledge economy. Scientific and technological information should be captured in a centralised on-line database, accessible by educational and research and development (R&D) organisations. Inter- and intranet content must also made available in Bangla (national language) along with English, and large corporations must be encouraged to establish R&D centres in-country. A university library and research network is needed for the development of a central depository for ICT information and research. Development of an efficient ICT infrastructure that provides open access to national and international network and the promotion of and encouragement of the use of ICT in all sectors of the economy for transparency, good governance, and efficiency impeovement will pave the way for an efficient innovation system in the country.

8. Conclusion And Recommendation:

The paper has discussed in detail the features of the ICT and its application shedding lights on its strengths and weaknesses in creating an ICT-based knowledge economy in Bangladesh. The discussion has revealed that the knowledge revolution, led by information and communications technology, is at the doorstep of all countries. In case of Bangladesh, this door has to be opened up for turning ideas and technologies into competitive businesses. To achieve this objective five main pillars are recommended: (a) modern telecommunications infrastructure and facility offerings of technology parks or zones; expansion of telecommunication net-work and facilities to the rural areas through fiber optic transmission capabilities (b) government support and incentives, including various ICT policies and legislation, instituting transparency and democratic procedures and (c) soft Infrastructure, encompassing a highly skilled and internationally recognized workforce , capacity building plans, and entrepreneurship programs, (d) transparency and democratic government, and (e) innovation system. Through the application of ICT and learning from the experiences of other developing countries, especially neighboring country like India, Bangladesh can "leap-frog" ahead several stages in the development process. Bangladesh, to embark upon the information age, should open its telecommunication sector to private investment with government incentives to help the country achieve high-speed driving.

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