

Bangladesh

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Overview

Bangladesh is a symbol of progress for many developing countries in the world, due in part to the success of its overall growth development strategy and its continued emphasis on pragmatic policies to diversify the country's economic base. The diversification programme aims to add new industrial, technical and service-based sectors to the mainly agrarian sectors.

The country is cradled by the eastern part of the Indian subcontinent on three sides and is a land mass of nearly 150,000 square kilometres. The soil is alluvial and fertile, and there are considerable fishing resources in the Bay of Bengal, which encompasses the entire southern edge of Bangladesh. The physical location of Bangladesh in the subcontinent makes it a very natural nexus for communication between South Asia and the landlocked mountainous region comprising Nepal, Bhutan, Myanmar and parts of the western region of China. Many airlines operate international flights to Dhaka, Sylhet and Chittagong.

The economy is growing steadily and, despite occasional instabilities in the political system, the country has always provided a free environment where young men and women can receive quality education and learn skills suitable for employment anywhere in the world. This is evident by Bangladesh people abroad, who have proven that they can positively contribute to any country drawing upon their own effort and resources.

Steps have been taken by successive governments to achieve a balanced budget with emphasis on increasing inward foreign remittances from export of goods and labour. Recently, a good deal of attention was given to increasing the economic return from the public sector by either disposal of loss-making public sector corporations or allowing greater participation by the private sector, international investors and non-resident Bangladeshis.

The first PCs¹ were introduced to mainstream society in Bangladesh by electronics enthusiasts and engineers in 1983. Mainframe computer technology and multi-user terminals/workstations had been in widespread use much earlier, since 1964 (Choudhury, 2002; n.d.), by the scientific community for research into atomic energy and soon after by major banking institutions. However, very little progress was achieved for many reasons.² Until the mid-1980s, the

usefulness of the multi-user computer was limited to financial and statistical applications and basic data storage and retrieval functions.

In the same year that PCs were introduced, the National Computer Committee was formed, which instituted approval guidelines for government purchases of computers in a prescribed form. It required government officials to declare the specifications of the system they wanted to purchase. Among the details they had to provide was how much heat the computers would generate, the method of cooling required and, in some cases, the size and weight of the system desired!

Much advances have been made in our understanding of technology since those early naïve days of ICT usage in Bangladesh.³ Thanks to a very large network of computer dealers, resellers, distributors and system integrators⁴ the latest trends in computer technology are now found in all corners of the country barely two months after their release in Singapore, Hong Kong or Taiwan. The ICT industry is preparing for expansion in order to serve what is sure to become one of the largest e-commerce and e-governance communities in the world.

The government has continued each year to liberalise its control over infrastructure investment by the private sector. It is also adapting public administration policy to include ICT promotion in all sectors. The country is making an effort to become a market-friendly and market-oriented developing country. It has taken pragmatic steps⁵ and is actively preparing to open up the telecommunications sector to public and private entrepreneurship under a structured plan that has been several years in the making.

Many of the early engineers of the ICT industry, trained in the 1970s and 1980s and who had migrated to developed world markets, are now looking back to their home country and are sponsoring their own business ventures within the sector.

A cursory review of statistics shows that the economy is growing fast. The market size of all sectors is quite large given the size of the country's population.

However, investments and logistics need to be carefully managed for maximum realisation of objectives. Various sources (Central Intelligence Agency, 2002; Australian

Department of Foreign Affairs and Trade, 2002; Bangladesh Bureau of Statistics, 2001) show that Bangladesh has about 129 million inhabitants living in clustered locations distributed across an agricultural and riverine delta of approximately 147,570 square kilometres of which about 10 percent is water and the rest is arable land. A common misconception is that Bangladesh “has the highest population density of any country except city states such as Singapore” (United States Trade Center, 2002), or that it is crowded and difficult to live in. This is now considered an inadequate depiction and an antiquated classification which in part disregards the following facts.

A major part of the population reside in urban and metropolitan centres. The rest of the country is dependent on agriculture hence large tracts of land are open crop production areas; and even there habitation is concentrated in village clusters. The population growth rate is 1.48 percent per annum based upon 25.36 million households. Urban population is just under 25 percent of the total. The average population density is 834 people per square kilometre (Bangladesh Bureau of Statistics, 2001). By comparison, there are more than a dozen countries that are probably more crowded, according to available statistics (Yahoo Reference, 2002). The size of the population living below the poverty line is approximately 35 percent.

An extensive road and rail communication network exists to transport urban and rural residents to towns and cities, and in a limited sense the number of weekly commuters from suburban and rural areas visiting the cities is increasing. Large-scale mobilisation of resources can be seen in the transportation sector in the form of private bus and ferry services with a passenger-cargo mix. There also exists a very large number of trucks for the transportation of goods. In the general aviation sector, at the time of writing, there is only one private airline in service competing against the state-run national airline organisation for a share of the domestic market.

The increasing trend of migration by skilled workers out of rural areas in Bangladesh to work in various parts of the world means there is in fact little crowding among the adult population in rural habitats. This trend is proven in concept by the huge inward remittance of foreign currency from these wage earners abroad. The exposure these workers receive by working outside the country has contributed greatly to the acceptance into mainstream society of new concepts such as supermarkets with bar-code scanners, fast food centres, boutique hotels, contract cleaning services, catering services, mobile phone services and call centres. Such changes are not limited to metropolitan cities; it is a sea-change affecting all parts of the society in all metropolitan cities of the country. Markets with long-established, antiquated general stores will be torn down in future projects to be replaced with bright, consumer-friendly shopping malls with glass escalators and lifts.

Bangladesh facts

Total population: 131.27 million^a

Rural population as a percentage of total population: 76% (estimated)^b

Key economic sectors: Ready-made garments, frozen foods and shrimp, tea, raw jute and jute products, leather and leather products, chemical fertiliser, handicrafts, ceramic products.^c

Literacy in the national language(s): 56%^c

Computer ownership per 100 inhabitants: 0.19^a

Telephone lines per 100 inhabitants: 0.43¹

Total Internet hosts per 10,000 inhabitants: 0.015 (estimated)^b

Internet users per 10,000 inhabitants: 19.04^a

Cell phone subscribers per 100 inhabitants: 0.40^a

Internet cafés/telecentres per 10,000 inhabitants: 0.19 (estimated)^b

Number of websites in the national language(s): 50 (estimated)^b

Number of websites in English and other languages: 200 (estimated)^b

National bandwidth within the country: 68 Mbps (data) (estimated)^b

National bandwidth to and from the country: 112 Mbps (estimated)^b

Sources:

(a) ITU (2002). *Asia-Pacific Telecommunication Indicators 2002*. Geneva.

(b) Estimates by the author (see note 7 for the basis upon which the estimates were made).

(c) Ministry of Commerce. *Bangladesh Trade 2001 Catalogue (2001–2002)*.

The potential for the exploitation of a consumer market in Bangladesh is vast given the overall size of the population. An interesting figure for estimating ICT usage is the proportion of the population under the age of 15 years. This group represents one-third of the entire population and is estimated at 23 million young men and 21 million young women (Central Intelligence Agency, 2002).

A significant workforce of more than 160,000 adults per year work overseas in skilled, semi-skilled and unskilled jobs. A total of approximately 3.2 million workers have had the opportunity to work abroad. They have remitted home a total of US\$21 billion since 1976 (Bangladesh Association of International Recruiting Agencies, 2002). It is estimated that each community of about 150 families has at least one member working abroad.

ICT infrastructure

Before establishment of the Bangladesh Telecommunications Regulatory Commission

ICT infrastructure development in Bangladesh is undertaken by the government and the private sectors. The government sector has traditionally been identified with projects of national significance and broader appeal. It includes organisations such as the Bangladesh Telegraph and Telephone Board (BTTB), which continues to use its telecommunications network to provide its own brand of Internet service. Other major users of ICTs include the Bangladesh Bureau of Statistics, Bangladesh Computer Council (BCC), National Board of Revenue (NBR), and the Sustainable Development Network (SDN) Project of the Bangladesh Institute for Development Studies. These organisations typically face little oversight and few restrictions on the amount of budget that can be requisitioned to implement strategic goals, or on whether their projects are actually needed or that they may duplicate private sector initiatives.

Typical ICT infrastructure building activities commissioned by the private sector aim at setting up profit-oriented ISPs, Internet telephony service providers (ITSPs) or telecommunication operators. Their projects are focused on providing products for Internet access to members of the public and value-added service packages to specialised market segments.

The infrastructure of the ISP or ITSP typically includes one or two VSAT stations, a set of Internet access equipment, a collection of between 30 and 500 analogue telephone lines for dial-up access, a hybrid coaxial cable television service network, a DSL network over private copper pair to customer residences or, in rare cases, at least two of these three distribution methods.

On the other hand, traditional telecommunications operators build large infrastructure to carry commercial voice traffic. No ITSP or ISP has yet expressed plans to deploy a full alternative voice communications network, but several are known to have already ordered and installed the necessary equipment in anticipation of deregulation of the sector in 2003.

Prior to 31 January 2002, all operations and investments in the telecommunications sector came under the joint purview of the Ministry of Posts and Telecommunications (MOPT) and BTTB. All ICT applications would have been vetted solely by the incumbent national telecommunications network operator, unless they were designed to use private satellite communication (VSAT) or private microwave connections. In both cases, they would need to be approved by BTTB first.

A widely distributed microwave transmission network was built in 1971. It is being used as the conventional switched backbone for digital and analogue communications.

This has been recently augmented by a fibre optic cable network linking major metropolitan areas in several parts of the country.

Telecommunications services were originally limited to basic voice, telegraph and telex services provided by BTTB. It was granted, in 1979, monopoly rights and the power to issue licences for both telecommunications and wireless services with the exception of control over its capital and revenue budget. The government made the decisions on how much it would spend and where. BTTB currently operates in a quasi-independent manner with MOPT providing oversight of its activities. Its fiscal needs for operation and expansion are jointly vetted by the Ministry of Finance and Ministry of Planning.

The Wireless and Frequency Board was set up and staffed with BTTB officials and representatives from the utility service and defence service organisations to regulate spectrum access. Private operators were granted licences by BTTB to provide telecommunications services to rural communities on either a “build-operate-own” or “build-operate-transfer” basis. Up to 2001, there were three operators providing fixed, wireless and rural telephony as well as radio trunking; and four operators providing GSM and CDMA mobile phone services. Interconnection problems have plagued the growth of the telecommunications sectors as there is an absence of private switching and peering-point infrastructure. The only practical alternative was to negotiate, at length, with the incumbent operator (BTTB) for access to the telecommunications backbone and the international gateway exchanges, which have had chronic capacity constraints.

A memorandum of understanding has been signed by BTTB and mobile phone operators to establish additional digital trunk interfaces to connect all CDMA and GSM mobile phones to the fixed-line telecommunications network. It is anticipated that connections between services offered by the mobile phone operators and BTTB will be significantly enhanced by late 2003 or early 2004.

Winds of change

E-mail services started in Bangladesh as a direct result of the pioneering initiative of the author who had evaluated and reported on the use of data communication facilities by global ICT companies as a member of the special ICT industry trade mission to Softworld 1993 in Vancouver, Canada, which was jointly sponsored by UNDP, the International Trade Centre and the Bangladesh Export Promotion Bureau (EPB), as well as material help from a single UN volunteer to EPB, Dr Mary McPherson, who offered to pay US\$100 per month from her personal funds to any company able to provide her with e-mail services. This innovative incentive, of a customer paying for a service, helped to establish an important practice in the then infant IT industry. Commercial e-mail service started on 11

November 1993. This first link was established through a UUCP connection provided on a no-charge basis by Mr Harish Pillay of the Linux User Group (Singapore) with regular e-mail service operated by PraDeshta Limited founded by the author.⁶ Connections were initially made via international direct dialling to Singapore and from there via a leased line to the Jaring Network of Malaysia.

From 1996 onwards, businesses, service providers and multinational corporations have been permitted to rent VSAT stations from regional satellite network operators through BTTB with approval from MOPT. The original policy for permitting usage of VSAT systems in the country was on the basis of a five-year “build-operate-transfer” agreement with leading foreign telecommunications companies. The satellite operator designated was BTTB by default. However, extraordinary pressure from the user community led to the government approving the conversion of the “build-operate-transfer” VSAT agreements to “build-operate-own” VSAT agreements in October 2000. This effectively opened the market for customers to obtain competitively priced satellite products, and this in turn permitted the entry of leading telecommunications companies into Bangladesh in exchange for direct licence fees and indirect royalty payments on bandwidth consumed. This move has already resulted in the offering of significantly cheaper Internet services from a large number of providers.

ICT infrastructure projects

Several network services are available from BTTB to enable customers to build their own ICT infrastructure network as a value-added network. These services include X.25/X.28, digital data network service, international private line circuit and, should customers want to build their own WAN from ground up, leasing of bare copper local loop. However, the use of these networks is restricted as BTTB resources are limited and deployment and maintenance issues are prevalent. Not all areas have coverage and there is, as yet, no permanent engineering group to provide customer service.

Other than the NBR Customs Network (Asycuda), which is based upon multi-user computing, and the services provided by SITA/Equant for the airline reservation and logistics network in the aviation and travel industry, all projects in the government sector seem to be aiming to do the same thing: to set up their own top-level ISP for specific markets and audiences and to use the IP network access as a distribution medium for mostly static content. Online database and interactive applications are still in their infancy.

BCC uses its own VSAT infrastructure to provide connectivity to scientific research organisations and a broadband cable ISP in a residential district. SDN uses its network infrastructure and a series of narrow-bandwidth microwave communication links to extend the reach of its network to educational institutions and libraries. It has recently entered into an agreement with Bangladesh Sangbad

Shangstha to create a new financial information service. The Bangladesh Bureau of Statistics operates multi-user computers and provides access to its datasets over the Internet, but it does not have any WAN facilities except a non-interactive website.

Such duplication of effort and expertise is draining precious resources. For example, SDN recently promoted a workshop on country code top-level domain administration, while BTTB is advertising that it is the authority for the registration of all “.bd” domain names. In fact, the “.bd” service is not actively promoted to the ISP market at the time of writing.

In the private sector, most companies use VSAT for connecting to a regional IP exchange to allow their customers to browse the network on a paid subscription basis. Multinational companies run e-commerce applications or multi-user terminal-based SAP, ERP or JIT applications. They also sometimes use VSAT for audioconferencing, videoconferencing and intra-office communication. The use of VSAT for wholesale telecommunications switching applications has not been done to date as a ban continues to be enforced that forbids VSAT systems from carrying voice traffic in any form. VSAT usage for ICT application development (i.e. programming, subcontracting and call centres) is not significant at the time of writing. Private financial institutions have set up IP-based WANs using wireless access points in a hub-and-spoke manner, but weak security and disparate technical support have held back mass implementation.

At the time of writing, there were no private nor public sector telecommunications peering points for data and IP applications and electronic message switching. Such peering points would serve as the cradles of a domestic Internet backbone and could be used by all parties involved for efficient and economical sharing of the various ISP gateways, rather than peering via external ISPs or data communication operators over international trunk circuits.

After establishment of the Bangladesh Telecommunications Regulatory Commission

The commencement of the Bangladesh Telecommunications Regulatory Commission (BTRC) activities from 31 January 2002 marked the existence, for the first time, of an independent telecommunications regulatory body to oversee the proper growth of the communications industry. The objectives of the commission are to encourage: (a) orderly development for social and economic welfare; (b) reasonably priced universal communications services; (c) efficiency and competition; (d) abolishment of discrimination in providing services; and (e) introduction of new services and creation of favourable conditions for new local and foreign investments in the telecommunications sector. It is also important to note that the commission is committed to enabling licensed operators to provide “universal service”,

which can now be guaranteed as a right to be accessed by each and every citizen.

BTRC has so far issued guidelines in licensing operators, which may be grouped into the following categories:

- ISP (dial-up, broadband cable, broadband wireless, broadband DSL)
- Nationwide ISP
- Domestic data communications service provider
- VSAT provider (international)
- VSAT provider (international and domestic)
- Cyber café operator
- VOIP operator

Currently, there are no specific guidelines on the minimum investment or minimum organisational structure which needs to be set up by a licensed operator. Each application is handled on a case-by-case basis, and it takes approximately six to eight months for a new applicant to be awarded a licence. (Applications by existing companies and businesses are afforded priority via a special clause in the *Telecommunications Act*.) Specifications which define the types of operators are also lacking. VOIP operations were being considered at the time of writing and there was speculation as to the minimum size of investment that would be required of VOIP gateway operators.

All operators are, however, guaranteed equal due process and BTRC has the authority to decide on issues such as interconnection between operators, rights of way, service quality, tariff rate rationalisation, market segmentation, interference, penalty and allocation of permits according to the resources (spectrum, land, finance, traffic, etc.) required. A standardised but quite expensive licence fee is charged along with royalty on the amount of bandwidth (may vary among applicants) to be used.

BTTB has agreed to cooperate with BTRC and has approved the connection of an appropriate number of dial-up telephone lines to each licensed ISP, on the condition that such telephone lines are provided on a toll-free, incoming basis only in order to avoid abuse as illegal call termination portals. BTTB itself had been protected from all competitive actions of the licensees of BTRC (which has to eventually enforce its mandate over BTTB to ensure a fair and level playing field for all operators) until 31 January 2003, by which date it had to apply to BTRC for a licence to continue to act as a telecommunications operator. Until that time, BTTB enjoyed exclusive access to its own digital networks and could use them for any purposes including cross-subsidy of its Internet business. No significant progress on the changing of the status of BTTB can be reported at the time of writing.

BTRC has commissioned a study to be conducted by the Infrastructure Investment Facilitation Centre, an external consultancy group, to evaluate the feasibility of allowing private sector telecommunications companies to provide international VOIP services to meet national telecommunications needs.

New initiatives by the private sector

Many parties have found the new environment very attractive, and this has led to the formation of a new class of telecommunications service provider businesses in Bangladesh in 2002. These businesses aim to provide products and services that cater to new ICT users:

- Nationwide ISP with satellite infrastructure
- Nationwide ISP with fibre infrastructure
- Nationwide VSAT operators with data centres
- Value-added network operators who lease capacity on existing GSM or CDMA networks, including their fibre or microwave links
- Bandwidth resellers

There are professional bodies in the private sector that can and should influence further deployment of the ICT infrastructure. One of them is the Bangladesh Computer Samity, which represents hardware vendors and promotes liberalisation of import duties and removal of impediments to IT export. It is growing in influence as the principal national IT organisation. The Bangladesh Association of Software and Information Services promotes the software development industry's growth within the domestic and export markets. There is also the Internet Service Provider Association of Bangladesh (ISPAB) <<http://www.ispabd.org>>. The international group Global VSAT Forum <<http://www.gvf.org>> has established contacts with the regulator to push for full deregulation of VSAT technology in Bangladesh so as to facilitate rapid expansion of connectivity in the country.

People's access to technology

The most popular method of accessing B2C services has been via the dial-up modem connected to a telephone line. However, BTTB until recently was not fully supportive of other ISPs increasing such access as it has its own Internet service to market. It also enjoyed a monopoly, until 2003, for the supply of telephone numbers and lines for ISPs. So, not surprisingly, alternative data communication and Internet networks are being set up in large numbers at various urban and metropolitan suburbs in the country using a variety of methods:

Broadband cable Internet:

ISPs who are centrally located within a neighbourhood may choose to set up a cable modem termination system and deploy for their subscribers a geographically distributed coaxial cable network and distribute set-top boxes to each subscriber. This method provides a high data transmission rate to customers and a medium data rate IP service to the gateway through a shared radio frequency (RF) network. This is an "always-on" technology, but it can be slow and frustrating if all customers access the network at the same time.

Broadband wireless Internet through access point:

ISPs who are fortunate enough to be located in a neighbourhood with a tall structure (with a roof higher than 100 feet), or a high tower or pole, may choose to install a wireless access point (typically compliant to IEEE 802.11b at 2.4 GHz) to give “broadband” access to a shared wireless hub. Customers would have to use a wireless LAN adapter and run a length of low-loss RF coaxial cable to the rooftop and a high-gain antenna to connect their individual PCs to the wireless access point to gain access to the Internet. Significant delays in network access and slowdown in data rate will be experienced if the area covered is large. Also, the higher the tower, the greater is the exclusion zone where no service can be rendered. This is also an “always-on” technology.

Broadband DSL:

ISPs serving multi-unit residence and office blocks have found it quite cheap (typically in the low thousands of US dollars) to build a small-scale outside copper plant using regular multi-core communication cable manufactured for PABX systems. The quality of the cable does degrade in the field over time. This is fixed by progressively replacing older cable with new higher-capacity trunk cable over time (e.g. a 10-pair cable is first replaced with a 25-pair, then a 30-pair, a 50-pair and so on). By employing a distributed network topology of area data centre, block data centre, sub-block data centre and customer premise junction box, alternative telco-style copper plant is laid out in many residential areas in metropolitan cities and is almost always connected through DSL-equipped Ethernet switches or DSL access multiplexers (DSLAM). Since all DSL switches or DSLAM have provision for fail-safe voice service, which is akin to allowing an ordinary telephone service to be provided, broadband DSL service providers have the advantage over all other types of network operators. They can, if permitted, act as full telecommunications providers without any significant cost involvement; only a PABX or a telecommunications switch is necessary.

Broadband wireless router:

This is a relatively new concept introduced by an early-generation ISP who provides locally manufactured equipment in conjunction with a VSAT station. By adopting unique construction techniques, IP service at 3.5 Mbps or 5.5 Mbps can be provided to remote broadband wireless routers 16–30 kilometres away using multiple numbers of these routers in a partial-mesh network. An alternative broadband network can be created to act as a distributed switching network transmitting over the air with a smaller number of costly components compared with a standard telecommunications environment – and with much greater flexibility. A simple addition of a telecommunications switch platform with VOIP gateway capability (with perhaps 100–1,000 or 500–3,000 fixed subscriber ports) can be installed

side by side to this broadband wireless router network to achieve higher rates of telecommunications service rollout within areas currently not served by any telecommunications operator. The topology is experimental work-in-progress and the fifth generation of prototype devices were being manufactured at the time of writing.

Direct LAN connection:

Small to medium ISPs with local customers who wish to receive service but want it delivered at extremely low costs (typically no more than US\$10 per month) may opt to invest in conventional office or campus LAN infrastructure consisting of Ethernet hubs, switches, long-distance repeaters and modems, firewalls, etc. so that the last connection to the customer is a plain, simple Ethernet (10/100 Mbps) cable fed directly into their PC from a nearby distribution box. There is no doubt that this method of networking is probably a complete corruption of all the established norms of computer networking as it spreads LAN components around the neighbourhood in exposed environments. However, the idea has some merit since the technology, when utilised properly with high-grade copper wires with grounding, always results in very significant cost savings for a neighbourhood service provider. It may indeed be a good equivalent, or perhaps an even better model, to the much sought-after “fibre-to-the-curb” solution that is in demand in broadband markets in the developing world. If the model is investigated, the failure points could be easily identified and components developed specifically or reengineered such that their reliability is increased significantly.

Mobile phones:

The extended reach of mobile phone networks which are either of GSM or CDMA standard has given a new opportunity for customers to build or use alternative data communication networks without being dependent upon location and proximity to the fixed telecommunications network. A fair number of businesses have installed fixed wireless terminals which provide a standard telephone interface to a mobile network allowing communication both ways (inbound and outbound). On the GSM network, operators have started WAP and SMS services in a pilot project. They are still restricted in scope and popularity. SMS service has been recently introduced by various GSM operators, but its use is still limited to only the customers of a particular operator. There is no GSM and SMS inter-operator messaging switch at the time of writing.

Quality of connectivity

Bangladesh ICT infrastructures in both government and private ownership are relatively recent and therefore are built out of the latest or slightly used technology. Most, if not all, existing problems with connectivity are not technical in nature but are caused by capacity constraints on the

bandwidth available or by marketing and business policies adopted by service providers with regard to the need of the subscriber. For example, until recently, dial-up connections set up by users to their respective service providers allowed for the option of long-term connections lasting for days if so desired. Again, until recently, unlimited, unmetered connections were the norm in Bangladesh for standard telecommunications dial-up traffic and local voice call traffic. In June 2002, BTTB implemented a multi-metering system for all regular telephone calls; but, under pressure from BTRC and the ICT industry (here represented by the ISP community), it has implemented a toll-free system using a unique number scheme where calls to these numbers are not charged on a per-minute basis, but rather on a per-call basis as before.

Affordability of technology and connectivity

A typical family, with one parent working and supporting a spouse and two children attending school, would need about Tk 35,000 per month (about US\$611) for a basic, comfortable lifestyle in a home of about 1,800–2,100 square feet in size. In the past, car ownership was not possible as taxes were quite high, but after the fiscal budget of 2002 new car imports have been significantly relieved of taxes. Even though there is not much opportunity for long-distance driving, since much of life is city oriented, families are starting to purchase cars (ranging from 800 cc cars to 1,500 cc sedans or station wagons) while commercial taxi service is available as a ready alternative. The cost of maintaining one car, two school-going children and two adults in the family, with a housekeeping staff of three persons including the driver, would require the typical upscale family in Dhaka to earn about Tk 50,000 per month (US\$874) to live comfortably and save a small amount each month. The rent for a small apartment of 1,250–1,500 square feet would be in the range of Tk 7,500–12,500 (US\$131 to US\$218) in outlying neighbourhoods.

A computer (Pentium 4 or equivalent with more than 128 Mb of RAM) can be purchased with the required accessories from Dhaka, and other cities as well, at approximately Tk 35,000 (US\$611) for a clone and about Tk 55,000–70,000 (US\$961–\$1,223) for a branded one. Internet connections are billed at Tk 0.50 per minute (US\$0.008) and sometimes lower during off-peak hours. Bank loans are available to wage earners to finance the purchase of consumer products, including PCs. Such loans are payable with interest over a period of 24–48 months. Children of school-going age (class 8 and above) are already using computers purchased for them by their family; and if there is no computer at home, young men and women can enrol in neighbourhood computer training schools. These schools have dual roles: to teach as well as to serve as cyber cafés after class. Typical cyber cafes use dial-up Linux computers with PPP or wireless connections to a nearby ISP

or a wireless client using nearby 802.11b spread spectrum transceivers/access points and an internal LAN serving five to ten computers. For “always-on access”, the typical rates are Tk 1,500 per month (US\$26).

Diffusion of wired, wireless and direct satellite-based technologies

It is not possible to give an exact number of the various types of wired, wireless or satellite-based users in Bangladesh, simply because prior to the arrival of BTRC such statistics were not tabulated. The first industry-wide detailed survey will be completed during 2003 to provide a clearer picture of the extent of diffusion of ICTs.

Private research for the third quarter of 2002 provided the following statistics for each category of users:

- ISPs: 51–91 estimated, 24 according to ISPAB <<http://www.ispabd.org>>, 51 according to BTTB.

- VSAT systems: Not all VSAT users are ISPs and not all ISPs are users of VSAT. Also, not all users with VSAT admit that they have VSAT; some may be quietly involved in off-net VOIP gateway services and call-back services that illegally bypass the BTTB international telecommunications exchanges. There are an estimated 250–300 operational VSAT systems in the country based upon the number of telecommunications operators in the world advertising cut-rate telephone calling plans that are obviously below the BTTB international tariff table and settlement rates. This number includes the maximum number of legitimate users of VSAT systems.

- Microwave systems: These are stand-alone wireless links. Links are categorised below as one pair representing a transmitter and a receiver working in tandem.

- (a) Low data rate (64–384 Kbps): in excess of 300 links

- (b) Medium data rate (384–2,048 Kbps): in excess of 100 links

- (c) High data rate (2,048 Kbps–11 Mbps): under 75 links

- Microwave access points: These are wireless access points compliant to IEEE 802.11 standards; 20 points were estimated to be in operation at the time of writing. This is based upon the number of operators providing wireless Internet access and the area they cover in various metropolitan cities. These access points are not considered to fall under the same category as broadband wireless routers.

- Cable modem termination systems: Between seven and ten cable networks for ISP service are operational or being constructed at the time of writing.

- Broadband wireless routers: One network consisting of four nodes was in commercial service at the time of writing.

- Digital video broadcast (DVB) receiver: Many service providers use DVB receivers to obtain cheap shared bandwidth from a DVB service provider who uplinks a large (typically larger than 8–45 Mbps) carrier on a satellite and then beams it to as many clients as needed. There is an estimated 75 such DVB receivers in service today.

The case of the missing standard for Bengali Code

There have been several attempts at standardising a Bengali character set and keyboard. The principal attempt was a six-year effort which concluded in 1992. It was made by BCC's Committee for Implementation of Bengali Language in Computer, in which the author participated.

The draft standard was conceived as a derivative of standard 8-bit ASCII and had a three-layer keyboard which was validated during the period 1992–94.

The main advantage of this ASCII table for Bengali was that it covered all past, present and future conjoint characters (at that time, there were more than 1,200 possible variations of combined letters) and when stored online the text character set would be presorted in the correct dictionary manner in elemental form and therefore allowed for easy

storage of any future conjoint characters that may be conceived or prescribed.

Fonts for the Bengali language may be produced in various typefaces and may be assigned to any keyboard button and in any sequence, providing the conjoint characters are handled appropriately.

This plan was developed conceptually and its workings demonstrated. The committee approved it unanimously. However, BCC did not promote this standard in the early 1990s and lost the files at the same time. The original resource people are still available and should be able to revive the effort if requested to do so.

If required, new methods for implementation can be formulated, but due consideration should be given to research work already completed on this topic by various groups over the past decade.

Development, promotion and use of indigenous fonts, scripts and languages

The main language used online is English. Some websites which use the Bengali language do so in the form of text served out as graphics; others restrict their audience to the Windows operating system and the use of downloadable fonts; and yet others simply avoid the issue and provide PDF documents with embedded fonts to allow the content to be viewed in a visual manner. An example can be seen at <http://groups.yahoo.com/group/bangla_ict/message/621>. However, none of these methods are amenable to online context searching and indexing.

In the absence of a popular or appropriate standard, the word processing industry uses fonts and keyboards based on the software development work of an Apple Macintosh computer distributor. These have become the de facto standard in use today, even for PCs. There are a handful of less popular alternatives. A word of caution needs to be given here regarding Microsoft Windows (Bengali). It is considered by many to be not fully compatible with the traditional Bangladesh Bengali character set. There are omissions and additions as the font originated from a sister language used in India, which is slightly different from Bangladesh Bengali. The early argument for not accepting the Indian Standard Code for Information Interchange was that it omitted several Bengali letters. The Unicode character set may be in use in many Indian websites today, but not all users agree that it is any better than the earlier standard code as it now adds more

complexity. It will not be practical unless all computers support Unicode. This topic is discussed in the Yahoogroups mailing list bangla_ict.

Important national sources of content

News from Bangladesh (NFB)

<<http://www.bangladesh-web.com/news>>

This aptly named website has been observed to appeal to non-resident Bangladeshi Internet users, who are residing in the USA, Europe, Australia and Japan. The content is in English. The site is a combination of news articles sent in by contributors and edited by the NFB website operators. It is a conduit for highlighting relevant articles from Internet or non-Internet sources with a pro-development angle and a non-partisan viewpoint. Though the website deals with news items, it is not affiliated with any particular newspaper or news agency, preferring to take an independent stand on what information to provide on a daily basis. It is published from Dhaka, Bangladesh, and uploaded through low-bandwidth data lines.

Bangladesh.Net <<http://www.bangladesh.net>>

This site is not to be confused with the similarly named <<http://www.bangladesh.com>> and gets a very good recommendation for its logical and detailed organisation. While it may not have the resources now for being a knowledge portal such as the Western-family-oriented

website <<http://www.about.com>>, well-organised forum choices and links make navigation quite easy, and the messages of the forums were found to be quite current and active. The main index page is attractive and provides links, displayed as graphic icons, to newspapers. However, many of the graphic links show Bengali characters and have no English translation or description, which leads to confusion among non-Bengali speakers. The site originates from Austin, Texas, USA, and is a service of Bangladesh.Net Inc.

WebBangladesh.com

<<http://www.webbangladesh.com>>

This site has a content-driven and local flair to it. Some of the internal links connect to the websites of retail sales and service organisations in Bangladesh, so non-resident Bangladesh citizens living abroad can, in principle, place an order through the website and have their orders delivered to addresses within Bangladesh. Look out for the series of website links to WebBangladesh.com websites, which are identified by the names starting with “Deshi . . .”, which means “local”.

Bangladesh Fashion

<<http://www.bangladeshshowbiz.com>>

Garment exports from Bangladesh are already well known. This website features photo shoots and reports from the up and coming fashion and ready-made garment sectors. The use of male and female models in print media and television is already well established in Bangladesh and is done in good taste. This website covers activities in these areas as well.

Anita’s Bangladesh Links <<http://www.castlepollard.demon.co.uk/anita/linksbd.htm>>

Anita J. Brady, an Irish school teacher working in California, authors and maintains this website, which deserves recognition for the absolute simplicity of its presentation of Bangladesh links. The website demonstrates that non-Bengali speakers or foreign spouses of Bangladesh citizens can also contribute to the growth of the multi-ethnic diversity of the country. Anita’s webpage on learning how to speak and read Bangla language for non-Bengali speakers is co-authored with her husband and posted on his company website <<http://www.betelco.com/bd/bangla/bangla.html>>. It is a model for future developers intending to work in this area.

Bangladesh Government Official Webpage

<<http://www.bangladeshgov.org>>

The website banner uses the header “Bangladesh Government Official Webpage”, but no contact information is listed at the website and there are no means for visitors to confirm that the webpage is actually supported as the official outlet of information on the government of Bangladesh. It is confusing to note that while the officially sanctioned top-

level domain of Bangladesh is “.bd”, the government’s officially sanctioned website is registered as a “.org” website. The information available through the links on the website is a good step forward in e-governance, but it is ineffective if it is just a page of links, some of which are inactive or incorrect. The inclusion of the white paper alleging corruption of former government officials seems out of place, not because it is a paper outlining charges but rather the paper seems out of context for the world audience interested in investing or visiting Bangladesh or for citizens of Bangladesh looking to the leadership for guidance. There are plenty of issues that could be covered instead of focusing on a single issue. For example, the portal could be used to introduce the officials behind the machinery of government to facilitate access to public services by citizens.

Bangladesh Parliament Website

<<http://www.parliamentofbangladesh.org>>

This site is important and well organised but lacks content that is current. Visitors can read, in either Bengali or English, about issues which are being discussed in the legislature, but they cannot obtain online copies of the motions or proceedings submitted for discussion, debate and eventual vote by the elected representatives. The only active links are to external sites such as the Ministry of Finance at <<http://www.gobfinance.org>>, which contains some relevant fiscal and budget information. The glaring neglect in providing access to interested members of the public on issues that will ultimately affect them in all spheres of life contrasts with mature websites such as that of the US Senate <<http://www.senate.gov>> or the British Parliament <<http://www.parliament.uk>>.

English newspapers

The two most popular English language newspapers are the *Daily Star* <<http://www.dailystarnews.com>> and *The Independent* <<http://www.independent-bangladesh.com>>. Both of the sites have information that is always current and have good navigation features, but search facilities for keyword-in-context or free-form searches are not adequately provided. The usefulness of the websites is as such limited because readers cannot obtain historical perspectives on any topics. Even the articles are not indexed or cross-linked to previous issues, so readers do not get a whole picture of the events that have happened and are happening over time. Most of the articles are text only, reflecting the inability of the publishers to provide graphics and ultimately make news articles more informative for the general web-based reader and viewer.

Bengali newspapers

Of all the Bengali language newspapers, the most popular is *The Ittefaq* <<http://www.ittefaq.com>>. As it follows the layout of the print version, the homepage contains colour

graphics of newsworthy items for the day. Most of the links are graphical Bengali icons, which are difficult to see in low-resolution screens. The content is served as Adobe PDF pages, which require very long downloading time, but the result is a clear Bengali script, provided the right TrueType fonts are installed on the reader's computer.

Jobs in Bangladesh <<http://www.bdjobs.com>>

This is the cyber version of the old concept of a "job fair" where job vacancies in many fields are posted online. If the employer has set up a database, applicants can apply directly online. The publisher of this site also provides reviews of all job postings compiled on a monthly basis, presumably to provide assurance that the jobs are indeed being rotated and are current in scope and applicability. The statistics on computer-related jobs and employment may be useful in gauging the growth of the ICT sector.

Ready Made Garments Industry

<<http://www.bangladeshgarments.com>>

This innovative B2B site dedicated to the ready made garments industry is operating successfully. Registered parties from the industry can participate in online and trade-related communications at this site.

Online services

Online services are in the nascent stage. Prior to the formation of BTRC, private online services were not readily permitted by BTTB, the incumbent telecommunications operator. Therefore, many services, such as e-government, distance education, e-learning and e-community, did not take off. However, there have been notable exceptions. Some business groups are piloting telemedicine services via low-data-rate satellite connections or medium-data-rate wireless connections to far-flung remote village areas staffed only by paramedics. The introduction of this service is due to two factors: limited availability of trained medical personnel and good potential for profits to be made in the health-care sector. Health-care service is a booming business to invest in as evidenced by the increasing number of medical service centres equipped with magnetic resonance imaging, CT scan, colour USG devices and computerised pathology laboratories.

E-community is also beginning to develop. The increasing number of web-based portals offering bulletin boards and chat lines has already spawned e-communities. The ready-made garment industry described earlier is a good example. One interesting add-on to this concept is the instant messenger services, conducted in a blend of English and Bengali, connecting non-resident and resident Bangladeshi ICT users. Commercial customer technical support for telecommunications-related industries is provided via such messaging services.

ICT industries and services

The dominant type of ICT industry player in the country is the systems integrator, who customises computer systems to match a price which the customer can afford. Basic components, such as main boards and power supplies, are not manufactured in Bangladesh but are imported directly from factories in China and Taiwan and distributors in Singapore. PCs are then assembled in low volumes at family-operated shops all around the country. Owing to lax enforcement of copyright, systems integrator can easily bundle the sale of such hardware with any software packages.

Examples of innovative and key initiatives

SDN, a project funded by UNDP, is blazing the way to provide connections to educational and government institutions using hardware, software and engineering staff engaged in ongoing projects at the Bangladesh Institute for Development Studies, a think tank based in Dhaka. This is an innovative large-scale experiment which mobilises engineering talent to deploy ICTs in rural and urban areas. The project expects the engineers to continue backstopping the project for the long term after the initial period of support and funding.

SDN has applied for, and is in the process of receiving at the time of writing, a commercial nationwide ISP licence, which will obviously pit it in competition against all existing ISPs and telecommunications service providers. SDN is a catalyst project which would work in most countries, but in the case of Bangladesh it will be at the expense of a developing market. The desirability of such an initiative may need to be debated.

The incumbent national telecommunications operator, BTTB, is the other trail-blazer. It is using its digital telecommunications backbone to provide connections to cities where dial-up access nodes are set up, and packet-switched nodes are sometimes provided to customers. BTTB screens customers applying for such nodes and usually accepts only those who are listed in its existing subscriber database, which comprise largely government-funded semi-autonomous educational departments.

A good number of websites have been launched to preserve the country's cultural heritage and history. For example, <<http://www.liberationmuseum.org>> and <<http://virtualbangladesh.com>> provide non-resident Bangladeshis the chance to reconnect with their home country and to revisit their history. However, this can also lead to misinformation as shown in <<http://www.majordalim.com>>. Misinformation on the Internet can only be countered by accurate information to present a balanced picture; an example is the promising website <<http://www.bangladesharmy.org>>.

Since there are almost no attempts to keep track of the families who have migrated, perhaps a future website could tackle the mapping of genealogical trees of families and related communities in the same way as that found on <<http://www.familysearch.org>>.

TechBangla 2000 <<http://www.techbangla.org>>, Expatriate Bangladesh 2000 <<http://www.eb2000.org>> and the Yahoogroup [bangla_ict](#) are e-communities that help to keep technology awareness and the technology transfer process alive in the mainstream ICT community.

Enabling policies

The Ministry of Science and Information Communications Technology (MOSICT) <<http://www.most-bd.org>> has published the most current *ICT Policy (2002)*, which the government has agreed to implement. The document is quite detailed and can be studied online at <<http://www.most-bd.org/whatsnew.htm>>.

BCC is part of MOSICT but is independently managed. It has a mandate to take positive action under the direction of the government.

Regulatory environment

Other than BCC – which has the mandate to supervise breaches of the ICT policy with regard to procurement, services and intellectual property – the business of applying law to issues in the ICT sector is really not defined anywhere. It has been proposed that the existing intellectual property law be amended to include ICT issues, and progress has been made on this front, but at a slow pace. An ICT-enabled intellectual property law may be in force as early as mid-2003.

Broadcasting licensing and content regulation comes within the purview of the National Broadcasting Authority. The authority currently does not regulate the ICT industry and web-based content in any way. However, the streaming of video content belonging to established broadcasters, such as Bangladesh Television, was restricted following verbal caution made earlier in 2001, but enforcement is almost impossible at present as there is no single homogeneous gateway to the Internet.

Bangladesh is a signatory of WTO in many areas, including liberalisation of trade in the ICT sector.

Open source movement

The early e-mail service established in 1993, which provided subscribers in Bangladesh a taste of electronic communication worldwide from their desktop computers, was based upon a very early release of the Linux operating system with its penchant for small distributed software. Linux became the choice of the alternative ISP worldwide

because it supported PPP and multi-line PPP, allowing incredible data transfer rates using multiple numbers of standard telephone lines. As a result, almost all dial-up, dial-on-demand, wireless routers in use today within Bangladesh make use of Linux. Even flash-memory-based routers manufactured locally are supplied with customised Linux kernel engines. And most, if not all, ISPs and new-generation telecommunications operators are buying hardware, such as servers, with the option of running Linux as their operating system of choice. This allows them to save on software costs by using lower-cost freeware or custom shareware. The savings derived allow them to increase their hardware expenditure and buy components to stock as spares. There are an estimated 600 operational Linux servers operating within the ISP market at the time of writing.

Research into ICTs

The following are two sources of information on research related to ICTs:

- TechBangla ITRC Research Brief <<http://www.itrc.techbangla.org/report1/default.htm>>
- The E-Readiness and Need Assessment by Bangladesh Country Gateway <<http://www.sdnbd.org/sdi/issues/IT-computer/ereadiness-BCG.pdf>>

Future trends

An encouraging trend has emerged; a large number of expatriates have begun investing in ICT businesses in Bangladesh as well as in other ventures that will employ Bangladeshi ICT specialists in businesses based in the USA, UK and Australia.

In March 2003 the American Association of Bangladeshi Engineers and Architects (Silicon Valley Chapter) announced the opening of the Bangladesh ICT Business Center (BICTBC) in Santa Clara, California. The BICTBC project is financed by the World Bank and sponsored by local nonresident Bangladeshis. This centre will provide a shared-office facility for Bangladeshi software and IT companies in the Silicon Valley. The office was inaugurated in May 2003 by the Secretary, Ministry of Commerce, Bangladesh. By establishing a facility for the marketing of ICT products and services, including human resources, in the heart of the Silicon Valley Bangladeshi entrepreneurs are sending a clear message that they will be ready in a few years to do business with major corporate customers and to bid on outsourcing contracts.

While at home, in Bangladesh, versatile high-speed fibre, wireless and satellite data-communication transmission and switching facilities will need to be built to facilitate the growth of the ICT industry. ICT is an emerging area for investment that will tap the lucrative demands for improved telecommunications services. Established international data

communication service companies, satellite operators and teleport operators in the European-Asian-Pacific region should consider investing in Bangladesh to cater to the strong demand for international private leased circuits and virtual private networks.

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Notes

1. The first computers that were seen by the general public were Commodore VIC-20 and C-64 computers on the premises of Concept Computer Network at the legendary Science Laboratory of Mirpur Road, an early computer training academy which has the distinction of training many of the industry pioneers and leading IT professionals.
2. From 1971, East Pakistan gained independence from West Pakistan and became known as Bangladesh after a brutal, costly war. The country underwent several rapid changes in governments, each with differing policies and priorities, during the period 1972–1983.
3. In 1988, the National Computer Committee became the National Computer Board, and in 1989 an Act was passed in the National Parliament that created Bangladesh Computer Council (BCC), which embarked upon a programme to hire IT-aware professionals or bureaucrats to shape policy and strategy for the government. However, the effectiveness of BCC has been debated by the ICT private sector, and it has since changed its focus from regulation to promotion over the years, with a focus at the time of writing on human resource and infrastructure development.
4. Collectively, they are represented by the Bangladesh Computer Samity, a body representing commercial parties with a successful track record of lobbying for lower taxes and reduced import regulation and industry promotion.

5. The passing of the *Telecommunications Act 2001* created the environment which enabled the Bangladesh Telecommunications Regulatory Commission (BTRC) to commence activities on 31 January 2002. Prior to this date, the incumbent telecommunications operator, Bangladesh Telegraph and Telephone Board and the Ministry of Posts and Telecommunications were acting as joint regulators of the telecommunications industry.
6. PraDeshta continues to undertake R&D work into communications services. It is now a VSAT service provider licensee under BTRC in 2002. The company operates an ISP network and develops broadband wireless routers. It is also developing the network design methodology known as “broadband multi-service switching transmission and distribution architecture”, which was presented at COMMSPPHERE2000.
7. The author based his estimates on various sources and amalgamated selected data in the following way:
 - 51 ISPs with 4 servers each and a total of 204 servers; 4 servers include primary and secondary DNS, mail and authentication/billing servers.
 - IP bandwidth consumption reporting is not a requirement for operating an ISP. However, it is required for licence application but is not currently verified by any authority.
 - Website statistics are based upon direct searches through primary search engines.
 - Bandwidth statistics are based upon estimations of maximum capacity of installed VSAT antenna, fibre optic ports, microwave radios, leased-line modems and DSL modems. They are expressed as a combined figure representing possible aggregate data rate of two-way traffic.