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Bhutan

Sangay Wangchuk and Gopi Pradhan

Total population	634,982 (2005)
GDP per capita (USD)	USD 1,320.90 ^a
Key economic sectors	Hydropower, Tourism, Minerals, Forest products
Computer per 100 inhabitants	1.5 ^b
Fixed-line telephones per 100 inhabitants	4.7 ^c
Mobile telephones per 100 inhabitants	12.19 ^d
Domain names registered under .bt	247 ^e
Internet domestic bandwidth	2 Mbps ^f
Internet International bandwidth	30 Mbps ^g

Sources: ^aCabinet Secretariat; ^bDIT, MOIC; ^cBhutan Telecom and Druknet.

Overview

Bhutan is located on the eastern foothills of the Himalayan mountain range, nestled between two Asian superpowers—India and China. Covering an area roughly the size of Switzerland, the country is divided into 20 districts called *dzongkhag* and further subdivided into 201 communities or *geog*. Bhutan is a mountainous country, with rugged terrain that is often difficult to traverse. As of the 2005 census, it had a population of 634,982.

Despite the difficult terrain and sparsely populated human settlements, people in Bhutan have access to terrestrial, satellite and mobile telephones, radio, print media, television and the Internet. Having recently introduced modern ICTs, Bhutan is an example of a nation that is 'leap-frogging' over older and often obsolete technologies in the ICT sector. However, there is still a marked disparity between ICT access and usage across Bhutanese society. While urban citizens are making use of the latest ICT gadgets, rural folk have only basic telephone services.

Technology infrastructure

Analog radio was introduced in Bhutan on 11 November 1973. Today, radio remains the main source of information and entertainment in Bhutan's remote villages. Bhutan Broadcasting Service (BBS) is the only broadcasting agency in the country, providing both short wave (SW) and frequency modulation (FM) services. Radio reaches all parts of the country and is the most prolific form of media in all 20 districts. News, entertainment and development-related programmes in health, agriculture and education are aired daily for 12 hours in four languages—Dzongkha, Nepali, Sharchop and English.

In the last two decades, Bhutan's telecommunication network has evolved from a physical wire network to a digital network. The first television network and Internet Service Provider (ISP) were launched on 2 June 1999. Within six years of its introduction, television, particularly cable television, has reached all districts. There are 35 cable operators and about 38,000 cable television subscribers, with the majority concentrated in the capital city of Thimphu and the urban town of Phuentsholing, near the Indian border. BBS broadcasts local news and national programmes. With INSAT4A satellite broadcasting, BBS can be received in 42 countries throughout Asia Pacific. This satellite broadcasting was launched on 20 February 2006 with financial support from the ITU.

Bhutan's first telephone was installed in 1963 while mobile telephone services were introduced in 2003. Overall teledensity (including both fixed and mobile subscribers) as of December 2006 was 17.9 per cent—32,123 fixed telephone lines (5 per cent of the population) and over 82,000 mobile subscribers (12.9 per cent of the population). Within a year, the number of fixed telephone subscribers increased by 4,685 lines, while the number of mobile phone subscribers increased fourfold from 19,000 in 2004. Mobile services are currently provided by B-Mobile, which is fully owned and operated by Bhutan Telecom (BT). B-Mobile uses GSM technology and provides voice and SMS services. The number of mobile users continues to increase at a steep rate. According to B-Mobile, its service covers 16 districts and 12 satellite towns and it plans to provide service to the remaining seven districts by 2007.

At present, there are three ISPs in Bhutan: Druknet, Samden Tech and Drukcom. Druknet is fully owned by BT and is the oldest ISP in Bhutan. As of September 2006, it had 6,000 dial-up and 55 leased line account holders, mostly from

government, semi-government and international agencies. Druknet's main Internet node is located in Thimphu with nine other points of presence (POPs) in different parts of the country (Trashigang, Mongar, Bumtha, Chukha, Samtse, Samdrup Jongkhar, Paro, Wangdi and Trongsa). In May 2006, Druknet doubled its international bandwidth from 10 Mbps to 20 Mbps to accelerate Internet connectivity and overcome peak hour congestion. Druknet has three satellite upstream links with KKDI Japan, British Telecom and Lrel Skynet. SamdenTech Private Limited was established in May 2005 and provides a bandwidth of 2 Mbps (512 Kbps upstream and 1.5 Mbps downstream) through a satellite upstream link with Europe Star. Among its 50 customers, there are 30 leased lines and 20 small volume users. With the substantial increase in the number of mobile subscribers, SamdenTech aims to provide Internet services through mobile phones.

According to Druknet, there are approximately 20,000–25,000 Internet users, 13,000 e-mail accounts, 139 websites and 247 domain names registered in Bhutan as of 1 September 2006. Of the 10,000 computers in the country, it is estimated that 3,000–3,500 computers are connected to the Internet using leased lines. Two private VSAT operators were licensed in 2004 to provide Internet and wireless broadband services with a view to introducing competition in the value-added services market.

Key ICT institutions

The Ministry of Information and Communications (MoIC), which was established in July 2003, is the lead agency for Bhutan's information and communication sector, including telecommunications and traditional and new media. Under MoIC are the Department of Information Technology (DIT), Department of Information and Media, Road Surface Transport Authority, and Department of Civil Aviation. DIT is the national focal agency for the development, promotion and coordination of all ICT-related activities in the country. Specifically, it is responsible for policy formation, coordination and implementation of donor-assisted projects, and governmental communication planning, including standardization of ICT products. The Department of Information and Media is responsible for planning and research in support of mass media. It is also responsible for the drafting of policies and regulations related to information contents and media.

With the enactment of the Bhutan Information, Communications and Media Bill (also known as the ICM Bill or Act) in July 2006, the erstwhile Bhutan Telecom Authority has become the Bhutan Infocomm and Media Authority (BICMA). The new ICM Act gives BICMA full independence in exercising its functions and responsibilities, which covers regulation of

ICT facilities, ICT services, spectrum management and radio communications, content and media.

Apart from these major ICT institutions, all ministries and important government agencies have ICT divisions that play a strategic role in promoting the development of ICT in their respective ministries and agencies. The ICT divisions also work with the MoIC to coordinate ICT activities across the country.

ICT industries

Although computers were introduced in Bhutan in the early 1980s, it was only since 1999, after the introduction of the Internet, that a handful of private sector firms, most dealing with computer supplies, came into the market. With the government policy to outsource most of its ICT developmental activities to the private sector, the lifting of import duties for ICT products, and tax holidays for new ICT businesses, the growth of ICT businesses looks promising. While there is no noticeable increase in the number of firms, the size and dimension of existing businesses have improved. The 15 firms previously dealing only with supplies have now expanded their services, providing both software development and network solutions (*Bhutan E-Readiness Study* 2003). The same is true with the 13 training institutes. There are also a few repair and maintenance shops located mostly in the urban centres.

Furthermore, as of October 2006, the government has licensed two contact centres (or call centres) to private companies—one to serve as a call centre and another to provide medical transcription services. The selection and recruitment of employees and their training for these two businesses are being supported by the government through the DIT. The centres will commence operations in March 2007. Call centres are considered a potential growth industry, with the capacity to generate employment.

ICT policies and regulatory frameworks

Bhutan's ICT policy repertoire has expanded considerably in the past five years. The Bhutan Information and Policy Strategy (BIPS) issued in October 2004 and the ICM Act of 2006 are strong policy and regulatory instruments for the promotion of ICT in Bhutan today.

The BIPS addresses five key areas—Policy, Infrastructure, Human Capacity, Content and Applications, and Enterprise. Underpinned by the philosophy that 'with people at the centre of development, Bhutan will harness the benefits of ICT, both as an enabler and as an industry, to realize the Millennium

Development Goals towards enhancing Gross National happiness’, BIPS serves as a road map for ICT development in Bhutan. It covers three overall policy objectives:

1. to use ICT for good governance;
2. to create a Bhutanese info-culture; and
3. to create a ‘High-Tech Habitat’.

The Information, Communication and Media (ICM) Act enacted in July 2006 at the 85th National Assembly provides a modern technology-neutral and service sector-neutral regulatory mechanism to implement convergence of information, computing, media, and communication technologies, and to facilitate privatization and competition in the establishment of ICT and media facilities, interconnections, universal services, e-services, activities related to cyberspace, and media operations. The Act also provides the new regulatory regime for BICMA to independently exercise its power to regulate all aspects of ICT activities and resolve disputes between operators. The Act facilitates the formalization of interconnection and infrastructure-sharing frameworks to enable converged data, voice and video services, and thereby meet universal service and access obligations. Other service providers can now secure converged service licenses to provide voice, data and video traffic over Bhutan’s modern networks. This translates to reduced costs for ICT services.

The MoIC is also preparing other guidelines and regulations for electronic signatures, e-business and e-commerce, content regulation, security policies, and information management.

Enabling ICT projects

Thimphu WAN

A wide area network for Thimphu is currently under construction. This fibre network will connect all of the government agencies in the capital city. Completion of the project will facilitate the use of existing and future government information systems. It will also provide a fast, reliable and secure platform for e-governance and intra-government communication and information sharing.

District LAN

The DIT has also constructed, in each district, a local area network with 64 Kbps leased lines to connect the districts to the Internet. These leased line connections are leveraged to connect all of the surrounding offices with wireless technology. District Local Area Networks (LANs) have greatly enhanced the efficiency and effectiveness of the district administration offices

and improved communication between the districts and the central government. However, much more needs to be done in developing and managing the content of the district websites.

Community Information Centres (CIC)

Several community information centres are being set up to provide integrated ICT access to rural communities and thus mitigate the negative effects of the digital divide. The 10th Five-Year National Development Plan states that the DIT shall establish at least one CIC in each of the 201 *geog*. Each CIC will be equipped with computers, Internet connectivity, a telephone, a fax machine, and photocopying facilities. The intent is to use these tools to improve access to relevant information that would enhance the health, education and livelihood of the villagers. The Bhutan Portal (<http://www.bhutan.gov.bt>) would be a main source of information, and its contents—which will include e-health, e-education, e-agriculture, and e-commerce/e-business services—are being developed based on the results of the information needs assessment at each CIC.

To date, the DIT in collaboration with Bhutan Post and the Ministry of Agriculture, has established 30 CIC with support from the United Nations Development Programme (UNDP), Government of India, International Development Research Centre (IDRC) of Canada and Microsoft Unlimited Potential. An additional 50 CIC are to be established before June 2007 mainly through the financial support of the Asian Development Bank, UNDP, Microsoft and IDRC.

Online services

The Royal Government of Bhutan has set forth a policy to provide 75 per cent of its services online by 2010. In order to meet this goal, all government and semi-government agencies are exerting considerable effort to publish information about the services they offer on their respective websites. Almost all of the government ministries and agencies have a Web presence, including the National Elections Commission, which is providing online voter registration forms in preparation for the first democratic election in 2008. The majority of government acts, publications, reports, statistics, forms, guidelines and application procedures are available online.

However, most of the current online applications in Bhutan were developed to address the internal needs of organizations and do not support inter-operability or communication with the systems of other agencies. Even if systems support internal efficiencies, they do not fully exploit the opportunities for interconnection and integration. Also, the majority of the applications

The Tangmachu community information centre

The CIC established in Tangmachu (located in the Lhuentse district of Eastern Bhutan) with the support of IDRC is among the most notable of CICs in Bhutan to date. The centre is located in the remotest district in the east. It has five computers connected to the Internet via IP Broadband VSAT with a bandwidth of 64 Kbps and an asymmetrical connection (downlink 64 Kbps and uplink 32 Kbps) and low-cost wireless phones (802.11 b/g specification). Approximately 100 households, representing about 90 per cent of the community in this locality, are connected with IP phones using Wi-Fi technology.

The inhabitants of nine remote villages in Tangmachu use the CIC for telephone services (VoIP and wireless loop-based telephony), Internet access, printing of documents, photocopying, and use of business planning and management tools. The centre is used not only for information sharing among the communities in the district, but also for attending to emergencies such as in health care. An illustrative case is that of Ap Tandin, who was found seriously ill by field engineers when they went to his house to install an IP phone. The nearest health facility (a Basic Health Unit or BHU) was two hours walking distance from his house. The project team made a call to the BHU for emergency help using the IP phone. Following instructions by the health assistant to bring in the patient for treatment, the engineers carried Ap Tandin on their back and brought him to the BHU. Ap Tandin was to be kept under observation for one night. In her anxiety, his wife forgot to bring food and blankets. She was about to leave her ailing husband to walk the two hours home to get the supplies, when the engineers advised her to use the newly installed Wi-Fi phone in her home to call her daughter and have her bring the necessary items to the BHU.

The CIC also connects the BHU, the village headman's office, the middle secondary school, the primary school, and the Renewable Natural Resources Centre. Content and applications for use at the CIC are being developed in accordance with the information needs of the villagers and include agriculture and education, in addition to health. Applications like e-learning and online marketing are also incorporated in the system. The interface is in Dzongkha, the local language.

are government-centric and do little to ease the problems of the general public in accessing these services.

Some good examples of e-governance initiatives are as follows:

- The Automated Border Management System (ABMS) aims to achieve an integrated cross-sectoral approach to border management with efficient and secure flow of data/information between the various stakeholders.
- The Bhutan Civil Registration System (BCRS) was developed by the Ministry of Home and Cultural Affairs to collect, store and update data about every Bhutanese citizen. The system facilitates the issuance of new citizenship ID cards which are not only handy and convenient but also valuable for use in other information systems, including the banking, health care and education systems.
- A machine-readable passport system was developed by the Ministry of Foreign Affairs to facilitate immigration checks, minimize errors and reduce the chances of forgery.
- The Central Bank of Bhutan, Bank of Bhutan and Bhutan National Bank joined SWIFT in 2005. The latest version of SWIFT, running at the Royal Monetary Authority (RMA), is

linked to the SWIFT centre in Chennai, India via leased line. The implementation of SWIFT at the RMA was carried out with assistance from Scandent Solution, a SWIFT service bureau in Mumbai, India.

Recently, Bhutan's print media welcomed two new entrants. *Kuensel* (www.kuenselonline.com), the only national newspaper until June 2006, was joined by two government-licensed newspapers, *Bhutan Times* (<http://www.bhutantimes.com/modules/headlines/>) and *Bhutan Observer* (www.bhutanobserver.com). *Kuensel* is published twice a week while the other two newspapers are weeklies.

The most frequently visited websites at present are the Bhutan Portal, Kuzoo, Kuensel, *Bhutan Times*, The Job Portal and Druknet. Most of the tourist and travel companies also have an online presence to further their businesses.

The Bhutan Portal (<http://www.bhutan.gov.bt>) was developed through a UNDP-sponsored project titled 'Pilot Public Access to Information and Service'. The website contains a host of useful information and materials, including forms, publications and government legislation. It also contains links to the websites

of all government, semi-government, non-government and private organizations. The Bhutan Portal is a one-stop source for information about the country and is a window for providing e-services online.

The Job Portal (<http://www.molhr.gov.bt/DHR/>) was launched by the Ministry of Labour and Human Resources on 11 March 2005, to provide a platform for job seekers and job providers to obtain information and interact for mutual benefit. It allows registered employers to post job vacancies, which are categorized according to occupations and posts. Job seekers are able to receive notifications of the vacancies that match their preferred occupations or job category.

Kuzoo (www.kuzoo.net) was put up by the present King of Bhutan to serve as a platform for Bhutanese youth to meet and keep in touch. Young people can manage their own online profiles, connect with their friends, post their own blogs and announce and track upcoming events and social gatherings, among others. The website is becoming quite popular and is featured on Kuzoo FM 90, a live radio station airing youth-oriented programmes, including music.

Applications for development

The rural telecommunication project

Providing access to basic information to all Bhutanese is a key concern in the roll-out of ICT infrastructure and services. Despite the increasing rate of rural–urban migration, the majority of Bhutanese still live in the rural areas. The Rural Telecommunication project being implemented by Bhutan Telecom aims to provide at least 10 telephone lines in each of the 201 *geog* by end of 2007. As of December 2006, 21 per cent of the communities still do not have any form of electronic connectivity (Pradhan 2005).

There is also a plan to upgrade the current telecommunications network by 2010 to 155 Mbps from the current 34 Mbps digital microwave transmission system.

Agriculture

The Ministry of Agriculture, with support from the Food and Agriculture Organization (FAO), is developing the Virtual

ICT and rural development

Two-thirds (69.1 per cent) of Bhutanese live in rural and remote areas where they face many hardships. Only about 8 per cent of the country's land is cultivable. This small percentage of cultivable land is also due to stringent environment regulations that aim to keep 62 per cent of the land under forest cover at all times. The reverse effects of the strict conservation policies on farming are evident in the growing public outrage at wildlife destruction of farmlands and livestock. When 85 per cent of the rural population depend on agriculture and livestock, the smallest impact on productivity can have significant repercussions.

Rural–urban migration is another issue confronting Bhutan. Educated youth are leaving villages in increasing numbers for better opportunities in towns and cities. The net rural–urban migration is 14.45 per cent. A number of policies have been initiated to promote rural development. One promising solution is innovative exploitation of ICT at all levels of society. Bhutan has already implemented a number of community-focused ICT projects. The e-Post project (a combination of traditional postal services and electronic communications) has benefited some of the most remote and isolated communities. Microsoft's CIC project, implemented in partnership with the Ministry of Agriculture and Bhutan Post, has been enhancing the IT skills and knowledge of communities. This will go a long way in building a critical mass of users with sufficient knowledge to be able to benefit from the information revolution in the future. IDRC has piloted a very successful rural connectivity project in Tangmachu, giving much hope to other communities. The UNDP for its part, supported some of the first rural telecentres in Bhutan.

However, despite its commitment and consistent efforts, the Government of Bhutan will continue to face challenges in rural development. Illiteracy is an important aspect of the challenge. No matter how sophisticated or affordable the solutions provided, people should have a sufficient level of literacy. The affordability of facilities and services in rural areas is also a key concern. While the average Bhutan farmer earns only BTN 10 an hour (about USD 0.238), the cost of a national call is BTN 100 (about USD 2.38) per hour. Third, content and applications need to be useful and understandable. At present, most if not all digital content is in English, a language that has very little use in the rural areas. Fourth, coordination among public sector offices in the rural areas is essential for the provision of a one-stop shop for poor people who cannot afford multiple access points to information.

Extension Research and Communication Network (VERCON), which aims to use the Internet to strengthen communication linkages among the research and extension service components of the national agriculture knowledge and information system. The overall goal of VERCON is to improve agriculture advisory services to Bhutanese farmers in order to increase agricultural production through improved research-extension linkages. VERCON will have two inter-dependent components: (a) the human component, consisting of a network of people committed to communicating, sharing information and supporting agricultural producers; and (b) the technology component, consisting of an Internet-based tool for information development, sharing, storage, retrieval, dissemination and communication. VERCON is being piloted in three regional research centres and in the headquarters of the Ministry of Agriculture. There is a plan to expand VERCON to RNR Extension Centres at the community levels.

Health

The Ministry of Health is integrating the different components of its health services under one system called Bhutan Health Management Information System (BHMIS). The aim is to facilitate monitoring of changes in disease incidence/prevalence and thus be able to prioritize interventions at all levels for both modern and traditional medicine. The BHMIS will have the following components:

1. Referrals outside Bhutan: A database with administrative, clinical and financial information relating to patients referred outside the country for medical care.
2. Telemedicine: To rationalize the use of scarce specialized resources within the country or specialized services from outside the country using IT. While telemedicine has been introduced in six hospitals, it has not been fully operationalized due to lack of bandwidth and proper equipment. E-mail is being used to send ultrasound and X-ray images.
3. Individualized Patient Records (IPR): To store and easily retrieve administrative and clinical information relating to a patient within a health care facility. This system has been developed and is being piloted at the Thimphu General Hospital.
4. Laboratory Information System: To monitor diseases like HIV/AIDS and to keep track of clinical tests. This component is under development.
5. Pharmacy Information System: To facilitate the management of the pharmacies within health facilities, including tracking the movement of drugs. This component has been developed

and is being used by the pharmacy department of the Jigme Dorji Wangchuck National Referral Hospital in Thimphu.

Education

The Ministry of Education is currently implementing the Information Technology in Education Master Plan. Through an annual government fund and donor contributions, all 23 higher secondary schools and 16 middle secondary schools have been provided with computers. In March 2006, the DIT, with financial support from the Government of India, provided computers, printers, and Internet access and training to 100 primary schools across the country. This project complements the efforts of the Ministry of Education towards 'ICTization' of schools and implementing ICT curricula at all levels of basic education by 2010. However, more work needs to be done. Although the schools can be considered to be 'connected', the rather high student-to-computer ratio translates to limited exposure and use.

In terms of teacher training, Sherubtse College and the IT Education section of the Ministry of Education are offering a Post Graduate Certificate in Teaching Information Systems (PGCTIS) for in-service teachers in middle and higher secondary schools. The National Institute of Education (NIE) has likewise been offering IT as an elective subject in the Bachelor of Education programme since 2004 to ensure a steady flow of teachers who can teach computer courses in schools. Moreover, all teachers, regardless of specialization, are required to undergo an IT literacy programme called Functional IT, which was introduced in 2002.

The two principal ICT training providers in Bhutan are Sherubtse College and the Royal Institute of Management (RIM). Sherubtse College offers a Bachelor of Science Honours programme in Computer Science while RIM provides a two-year Diploma in Information Management Systems (DIMS) for those who have completed class XII. In addition, both institutes offer short-term and ad-hoc courses. Approximately 100 IT personnel from civil service and private organizations received training between 2005 and 2006 in the CISCO Certified Network Academy jointly managed by the DIT and RIM.

In addition to the state-run training institutes, there are 13 private IT training institutes offering standardized curricula in basic computer courses such as network administration, Web development, and desktop publishing. Although there are currently no institutes for more advanced vocational ICT skills such as telecommunications, mass communications and media studies, there are a wide range of courses offered, from basic to diploma-level courses in communication and information management system.

At the moment, there are approximately 500 ICT personnel in Bhutan, including around 300 certificate holders, which indicates a severe shortage of qualified ICT professionals. The Ministry of Education’s IT Master Plan and the academic programmes mentioned earlier aim to address this problem.

Open source initiatives

Although a written policy on open source does not exist, in practice, open source software like the Linux operating system is the *de facto* choice for servers in Bhutan. Most of the government-funded application projects seriously consider free and open source software (FOSS) and standards as a viable option. FOSS such as Apache for Web hosting, Squid proxy for Internet connection, and BIND for DNS are becoming almost a standard. PHP for Web scripting and MySQL and Postgres for database are also commonly used.

A significant illustration of the open source option coming to fruition is the successful development and launch of *Dzongkha Linux*. Funded by IDRC, this project forms part of a regional network examining tools and technologies to ‘localize’—that is, to develop fonts for commonly spoken languages.

Use of FOSS is also a feature of the digital library project of the DIT in collaboration with the University of Virginia. Preservation and promotion of tradition and cultural values is mandated by the Bhutan Information and Policy Strategy thus: ‘By 2008, Bhutan will use ICT to preserve and promote its cultural heritage and boost the creation of local content.’ Bhutan’s digital library is based on FEDORA (Flexible Extensible Digital Object Repository Architecture), an open source digital library developed by the University of Virginia. According to the DIT, this project aims to develop an invaluable record of Bhutanese culture for Bhutanese students, researchers, tourists and anyone interested in Bhutanese culture. It aims to bring all stakeholders together to develop one digital library encompassing bibliographies, folktales, digital reprints of religious and ritual texts, journals, and audio and video collections. It will create online cataloguing records, transcripts, and analysis of audio-video collections of all Bhutanese cultural contents and other artefacts. There will also be an online *Dzongkha–Dzongkha* dictionary with 23,000 entries and an online *Dzongkha–English* dictionary with 13,000 entries (Dzongkha Localization Project 2006).

In another open source project, the DIT has completed the localization of the open source *Drupal* content management system, which allows individuals and communities to publish, manage and organize a variety of content on a website. The department is planning to organize training sessions for users in March 2007.

Research and development

There is a keen appreciation for the importance of research and development in the ICT sector in Bhutan.

Since 2005, a great deal of research on localization has been carried out under the PAN Localization Project (see www.pan110n.net) of IDRC. *Dzongkha Linux*, an operating system with *Dzongkha* desktop, is a product of two years of R&D during which many new technical terminologies were coined and about 90,000 text messages were translated. Sorting rules, which were non-existent, had to be researched and embedded into the system. A whole range of open source engines, such as rendering engines for proper display of *Dzongkha* text, was developed. *Dzongkha Linux* supports all open source office applications, including Web browsers, chat programmes and an image manipulation programme equivalent to Adobe Photoshop, and all these have a *Dzongkha* interface. Other R&D projects to be pursued over the next three years are a text-to-speech system, a spell checker for *Dzongkha*, a morphology analyser, a word segment algorithm, letter-to-sound rules for *Dzongkha*, and an online lexicon. All will be developed using an open source platform.

To integrate ICT into the education system, a distance education service is under pilot implementation at Samtse district. Beginning in 2003, the project supported a teacher education programme using Web-based technologies. To date, the project has helped upgrade the NIE’s internal networking system, created a website to allow students to access academic information online, and installed new software for supplementary online learning materials, tutorials and academic counselling. Moreover, findings from the project have informed the development of a broader Distance Learning Technology (DLT) project (www.pandora-asia.org) consisting of nine sub-projects researching DLTs in 11 countries across Asia.

On the technology side, there is a limited amount of research on new products being carried out at the DIT to determine the right choice of technology for adoption as a standard. Other research worth mentioning are ICT impact studies and information needs assessments that are conducted for policy formulation.

The challenges and opportunities ahead

Much has been achieved in the ICT and telecommunications sector of Bhutan. However, the sector needs to address several challenges to achieve more.

The first challenge is the cost of infrastructure. Basic telecommunications infrastructure needs to be deployed throughout the country. However, due to difficult mountainous terrain and

sparse human settlements, the cost of providing basic ICT facilities and infrastructure to every village and community is huge. Bhutan Telecom estimates that it invests as much as BTN 200,000 (about USD 4,761.90) to install a telephone in a remote village. Despite its plan to provide at least 10 telephones in each community by end of 2007, Bhutan Telecom will still not be able to connect six remote communities that need more than USD 30,000 each to have a telephone system installed.

A second challenge is addressing 'capacity voids'. Specifically, the country requires significant investments in building capacity among its ICT and telecom personnel. Today Bhutan has only around 500 IT personnel in the public and private sector with a sufficient level of skills and knowledge of ICT. As the networks grow, businesses flourish, and opportunities expand, the capacity void is felt more and more. It is not only that skilled people should join the market to fill the vacuum; they also need to come with new and better skills and knowledge to keep up with the demand.

The third challenge is lack of ICT standards. Though ICT has proliferated in the last two decades, they are bifurcated and isolated from each other. Many of the systems currently being developed and deployed by different agencies adhere to different standards, resulting in lack of interoperability and eventually, limited efficiency and scalability. The cost of interconnecting existing applications and networks will be huge.

The fourth challenge is slow private sector growth. Most of Bhutan's few qualified ICT personnel are employed in the public sector, which is a contributing factor to the fledgling state of the country's private sector. Unless the government takes firm action to uplift and promote the private ICT sector, ICT development in the country will be confined to the public sector.

Despite these challenges, the future of ICT and telecommunications development in Bhutan is very bright. Bhutan is a peaceful and politically stable country that has been able to avoid many of the disadvantages that accompany legacy systems and obsolete infrastructure and applications. In addition, the government is aiming for 100 per cent coverage of electricity and telecommunication infrastructure by 2020. Offshore businesses, such as business process outsourcing (BPO) and contact centres, offer an opportunity for growth. In setting up these businesses, many of the multinational companies consider

security and political stability—which Bhutan has—as key factors in choice of location.

The plan to establish approximately 300 CICs primarily in the rural areas over the next five years highlights an important opportunity for bridging the rural–urban divide and for bringing rural communities closer to the information society. With the licensing of the second mobile telephone company in 2006, the use of ICT services across the country, overall connectivity and access will increase. Revenue sharing and infrastructure sharing schemes are being explored to reduce costs and maximize efficiency on the telecommunication front. On the governance side, ICT is being used to support transparency and good governance.

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