Chapter 5

Towards an Information Society for Botswana

Information, Information and Communication Technologies and human development[1]

The introduction and rapid uptake of ICTs have expanded opportunities for people and increased the social and economic benefits of creating and using technology. The information economy spawned is pervasive and no government, organization, business or community, whatever the scale of its operation, can afford to ignore it.

Along with other breakthroughs, ICTs, are pushing forward the frontiers of how people can use technology to eradicate poverty. The development dilemma is that, for those with access to ICTs, the opportunities for individual and community empowerment have increased, whilst for those without, ICTs might remain elements of curiosity as the picture below seems to suggest. They could equally exacerbate the already widening access and empowerment gaps between urban and rural communities.

People and PCs in rural communities - useful and yet useless

Technological innovation affects human development in two ways: by enhancing human capabilities and by generating economic growth through increased productivity.

For people and communities, ICTs can enhance information sharing between development actors and connectedness with the mainstream of society and of the economy. By helping people acquire and share knowledge and be creative and by facilitating participation in the social, economic and political life of a community, ICTs empower and build human capabilities. They expand the choices people have to lead lives that they value.

The ability to use information and to communicate is fundamental to human welfare. In Section 19 of the Universal Declaration of Human Rights, the international community via the United Nations recognises that "*everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers*"[2].

In integrating this question of equity and freedom of expression and of access to information, human development shares a common vision with human rights. The common goal here is human freedom (see Box 5.1). Empowerment and freedom are closely related. Access to information and related factors, especially information policies, are fundamental when considering the role that ICTs can play in human development.

Box 5.1:

ICTs for human development: goal, objective, strategy and outcomes

The goal is empowering people by mainstreaming ICT use.

Goal: The human development goal of using ICTs is empowerment through information.

Objective: To open up new opportunities for people.

Strategy: To facilitate greater access to information, knowledge, resources and people by the mainstreaming ICTs at all levels of society in all sectors of the economy across the country and where and as appropriate, around the world.

Outcome: People and communities who can manage their own destiny better and reach their individual human development objectives because they are informed and because they are knowledgeable and free to act on decisions that influence them.

Information and Communication Technologiess and the Millennium Development Goals

There is no doubt that ICTs can help in the fight against poverty[3]. A considerable amount of evidence has been documented by organizations such as OECD, DFID, the World Bank, the International Development Research Centre (IDRC) of Canada, and by The Economist magazine in The Economist's Technology Quarterly.

At the Millennium Summit of the United Nations, to ensure that the benefits of new technology, especially information technology, are available to all, several targets were agreed upon, with Target 18 specifically relating to the diffusion of ICTs.

Target 18: In cooperation with the private sector, make available the benefits of new technologies,[4] especially information and communications technologies. While the Summit agreed on the following indicators of ICT diffusion, specifically the number of telephone lines per 1,000 people and

1 The exposition follows the UNDP. 2001. Human Development Report 2001. Making new technologies work for human development. NY

2 Office of the United Nations High Commissioner for Human Rights. Universal Declaration of Human Rights http://www.unhchr.ch/udhr/lang/eng.htm

3 vSee for example: Kenny, C., J. Navas-Sabater and Qiang, C.Z. 2001. Information and communication technologies and poverty. Draft for comments. World Bank. April 2001. 45 pp. and Department for International Development, U.K. 2002. The significance of information and communication technologies for reducing poverty.

4 http://www.un.org/documents/ga/docs/56/a56326.pdf

Table 5.2: How ICTs can help achieve the Millennium Development Goals[5]

Target	Role of ICT
Reduce the proportion of people living in extreme poverty by half between 1990 and 2015	Increase access to market information and lower transaction costs for poor farmers and traders; Increase efficiency, competitiveness and market access of developing country firms; Enhance ability of developing countries to participate in global economy and to exploit comparative advantages in factor costs (particularly skilled labour).
Reduce infant mortality rates by two-thirds between 1990 and 2015 Reduce maternal mortality rates by three-quarters between 1990 and 2015 Provide access to all who need reproductive	Enhance delivery of basic and in-service training for health workers; Increase monitoring and information-sharing on disease and famine; Increase access of rural care-givers to special support and remote diagnosis; Increase access to reproductive health information, including information on AIDS prevention, through locally appropriate content in local languages.
Implement national strategies for sustainable development by 2015 so as to reverse the loss of environmental resources by 2015	Remote sensing technologies and communications networks permit more effective monitoring, resource management, mitigation of environmental risks; Increase access to/awareness of sustainable development strategies in areas such as agriculture, sanitation and water management, mining, etc.; Greater transparency and monitoring of environmental abuses/enforcement of environmental regulations; Facilitate knowledge exchange and networking among policy makers, practitioners and advocacy groups.
Enrol all children in primary schools by 2015 Make progress towards gender equality and empowering women by eliminating gender disparities in primary and secondary education by 2015	Increase supply of trained teachers through ICT-enhanced and distance training of teachers and networks that link teachers to their colleagues; Improve the efficiency and effectiveness of education ministries and related bodies through strategic application of technologies and ICT-enabled skill development. Broaden availability of quality educational materials resources through ICTs; Deliver educational and literacy programmes specifically targeted to poor girls & women using appropriate technologies; Influence public opinion on gender equality through information communication programmes using a range of ICTs.

Source: ITU, adapted from United Kingdom Department for International Development (DFID), The significance of information and communication technologies for reducing poverty, January 2002

the number of PCs per 1,000 people, there are clearly other indicators that can also be used.

The International Telecommunications Union (ITU), based on the conclusions of a recent report prepared by tDFID of the UK, has reported on the links between the MDGs and ICTs. The details appear in a Text Box 5.2 entitled "How ICTs can help achieve the Millennium Development Goals".

Information and Communication Technologies and the global information society[6]

Several factors are now combining around the world to foster the creation of an information and knowledge based global society driven by nearly unlimited access to people, ideas, information, knowledge and resources of all kinds. The information economy is one outcome of this[7].

This globalised, knowledge and technology-facilitated economy of people, goods and services has the Internet as its major driver. The internet is uniquely placed as a technology that converges many of the most recent innovations into an increasingly pervasive, open and user-friendly platform allowing for near instantaneous access to and sharing of information across boundaries.

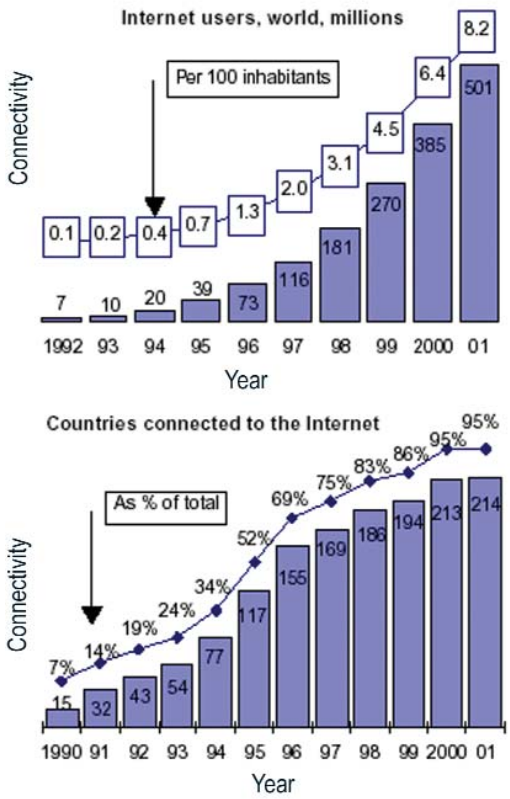
Box 5.3: Definition of the information economy

The term "information economy" refers to "a new global electronic structure, wherein the production of information goods and services dominates wealth and job creation, and is underpinned by the use of ICTs and the global information infrastructure".

Information and Communication Technologies and the internet around the world

As Figure 5.2 makes graphically clear, the use of the internet has grown rapidly over the past decade, reaching an estimated 606 million people[8] by 2001. The figure further illustrates the near universal presence of all countries in the internet superhighway (95% of all countries at the end of 2001).

Figure 5.1:
Number of internet users & number of countries connected to the internet



Number of internet users, millions, and number of countries connected to the internet. In the right chart, countries refer to 225 countries or territories. 'Connected' refers to the establishment of a direct link to the internet enabling it to be accessed by a local telephone call. Source: ITU World Telecommunication Indicators Database.

5 International Telecommunication Union. 2002. World Telecommunication Development Report. 2002. Reinventing telecommunications, Geneva and Department for International Development, U.K. 2002. The significance of information and communication technologies for reducing poverty

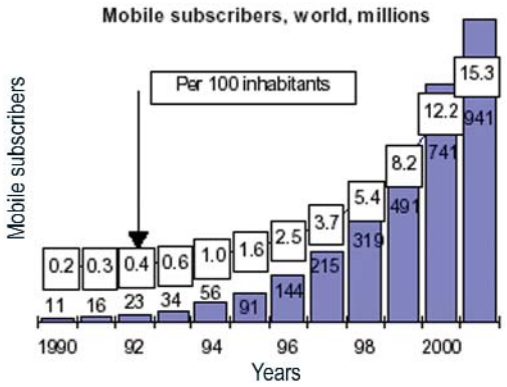
6 Adapted and updated from: Richard Labelle. 2000. Plan of action. ICT development in Mongolia over the period 2000-2003. http://www.infocon.mn/english/reference/ict_projects/p_left.html

7 Cogburn, D. 1999. Globalization and the information economy: challenges and opportunities for Africa. African Development Forum. ADF '99. www.un.org/depts/eca/adf/pub.htm. Taken from James, T. 2001. (See below).

8 Nua Internet Surveys. End November 2002. http://www.nua.com/surveys/how_many_online/index.html

The only communication technology that has grown faster than the internet is the growth in the number of users of cellular telephones (see Figure 5.3). Cell phone growth has contributed significantly to the access and use of ICTs particularly in the developing world where the ratio of mobile to mainline phones is more than one to one. In fact, the mobile has surpassed fixed lines the world over since the year 2002[9]. Convergence between the mobile and the internet is emerging since the latest cell phones come with micro browsers and email or messaging facilities that link seamlessly to the internet. The growth of the mobile phone is captured in Text Box 5.4, where it has improved the teledensity figures for the least developed nations of the world.

Figure 5.3:
Growth in no. of cellular phone subscribers worldwide.



Number of mobile cellular subscribers. Source: ITU World Telecommunication Indicators Database[10].

Box 5.4: Key ICT statistics and developments worldwide

The information economy: the worldwide IT industry is currently valued at over 1 trillion USD and is dominated by 29 countries[11]. It is expected to grow to more than $1.5 trillion by 2006. Spending on services and software will grow twice as fast as spending on hardware.
More than 483 million cell phone handsets will be sold to end-users globally, and one third of the world's population will own a wireless device by 2008.

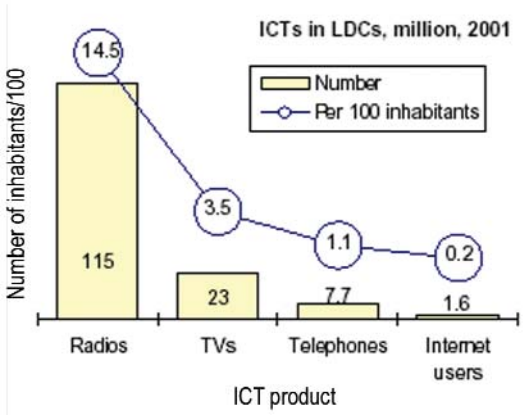
Mobile messaging is a "killer application' of the internet: the GSM Association estimates that 24 billion SMS (short message service) messages were sent over GSM networks in May 2002 alone, compared with 15 billion a year earlier, and it estimates that 360 billion messages will be sent in 2002[12].

The world's Least Developed Countries (LDCs), surpassed the important threshold of one telephone subscriber per 100 inhabitants in the year 2001 and now have the world's fastest growing networks, due in large part to competition in mobile cellular markets[13].

The Challenge of the Digital Divide

The digital divide between developed and developing countries is huge. If one takes the widely held belief that the proliferation, diffusion and appropriate utilisation of ICTs presents enormous opportunities for economic and social development[14] as given, then in the least developed countries (LDCs), where ICTs have diffused the least (Figure 5.4) then prospects of an information society are far from assured. In Sub-Saharan Africa, where the digital divide is the greatest, radios are still the most pervasive ICT, achieving 25% penetration[15].

Figure 5.4:
ICT products and services in LDCs, millions, 2001 (ITU)



ICT products and services in LDCs, millions, 2001. Source: ITU World Telecommunication Indicators Database[16].

E-business and E-governance

Electronic business refers to electronically assisted business processes in general. E-business ranges from simple office productivity applications such as word processing and data entry and manipulation, to specific and more complex corporate exchanges using tools such as electronic data interchange (EDI) and electronic funds transfer (EFT) and electronic networks such as the internet. More advanced and valuable e-business applications are essential for companies wishing to compete internationally and are the basis for the globalisation of the economy.

Electronic commerce and its variants business to business (B2B), e-commerce and business to consumer (B2C) e-commerce are part of e-business, as are e-government, government online, distance learning and telemedicine. In countries and jurisdictions where it works, e-governance has entailed using ICTs to turn government into a better servant of the public. It institutionalises and enhances access to information and services as well as access to government decision makers including parliamentarians, thus enhances transparency in decision making.

The Information Communication Technology Landscape and Human Development in Botswana

Botswana has acquired many of the assets and met some of the requirements that constitute the foundation of the information economy: a broad overarching vision; commitment to implementing this vision; a tradition of consultation and democracy; a state of the art high speed telecommunications network; an impartial and independent regulatory regime that is recognised the world over for having levelled the playing field in the ICT market for telecommunications services while remaining committed to achieving universal access; respect for the rule of law; functional and independent courts and most important of all, a commitment to equity for all in Botswana.

However, the vision is far from being achieved in part because ICTs and the benefits they engender have not been mainstreamed in Botswana society and in the economy. Although some aspects are better developed than others, the poor and those in rural and remote parts of the country are yet to benefit from the information revolution. As a result, there is a real digital divide in Botswana. Similarly, while there

9 International Telecommunication Union. Statistics. 2002
10 International Telecommunication Union. 2002. World telecommunication development report 2002. Reinventing telecommunications. Geneva
11 IDC 2002. The Impact of IT on Local Economies. http://www.idc.com/en_US/st/itlmpact.jhtml
12 GSM Association. 2002. GSM statistics. http://www.gsmworld.com/news/statistics/index.shtml
13 International Telecommunication Union Press Release. 2002 http://www.itu.int/newsroom/press_releases/2002/05.html
14 Orbicom. 2003: Monitoring the Digital Divide and beyond. http://www.orbicom.uqam.ca
15 Jensen, M. 2002. The African Internet status report. Updated July 2002. http://www3.sn.apc.org/africa/afstat.htm
16 International Telecommunication Union. 2002. World telecommunication development report 2002. Reinventing telecoms. Geneva.

are elements of a national strategy that have resulted from the Vision 2016 exercise and as a result of initiatives in several specific sectors, for example in the telecommunications sector, there is really no national ICT strategy or action plan in place[17].

In other sectors, including government, computers are relatively pervasive. It is estimated that there are about 65,000 PCs[18] in the whole of Botswana and between 10,000 – 15,000 of these are in the government[19]. Many key government operations and some services have been computerized (payroll, passport control, drivers license, omang[20], etc.). But much remains to be done in order to fully automate document and data flow and management, ensure interoperability, streamline workflow and make best use of collaborative software applications that people actually use, open up access to the public while at the same time adhering to accepted standards of data security and emergency or disaster recovery.

More than Just Infrastructure

Botswana's National Vision, Vision 2016, and ICTs for Development

The Vision: Botswana's national vision, Vision 2016[21], envisions "an educated and informed nation that has mainstreamed computers and the internet and that has entered fully into the information age. Botswana will have sought and acquired the best available information technology, and have become a regional leader in the production and dissemination of information".

"All Batswana will have access to the media, all schools will have access to a computer and to computer-based communication such as the internet in a free and democratic society where information on the operations of government, the private sector and other organizations will be freely available to all citizens. There will be a culture of transparency and accountability. By 2016, the people of Botswana will be able to apply the potential of computer equipment in many aspects of their lives".

Living the Vision: Botswana starts its quest to live its vision well endowed in the African context, having enjoyed decades of social, political and economic stability, a world-class transport and telecommunications infrastructure, all pre-requisites for attracting the investments in the necessary communications and network infrastructure needed to fulfil the vision's ideals.

The open and fair telecommunications policy regime that has been put in place with the creation of the BTA is another significant asset that constitutes a real opportunity for Botswana. Few other countries or jurisdictions in Africa and around the world have levelled the playing field for telecommunications operators and service providers as has Botswana. The recent creation of MCST as the parent ministry of all S&T research and development institutions including the BTA, is a step that one hopes will help Botswana mainstream ICTs and information management issues.

In spite of its problems, Botswana has a well developed and resourced educational system, which attracts the highest spending in the world as a percentage of GDP[22]. This level of investment in education includes footing the bills for over 8,500 Batswana studying abroad at any given time, of which about 2,860 study overseas and the rest in South Africa. The outputs of this investment are well educated young people with a broad range of skills pertinent to having a world-class work force.

As stated in the previous chapter, the Government has embarked on an ambitious programme to equip all secondary schools with computers and related equipment, thus bringing the bulk of the school going citizens nearer the information highway.

The Challenges

Listed below are some of the more critical challenges to be addressed if the vision is to be realised:

1. Development and retention of ICT and other skills in the face of the devastation wrought by HIV/AIDS on the workforce.
2. Appropriate infrastructure (and information) developed to allow access.
3. Developing the plurality of media in all its forms; radio, television and print.
4. Guaranteeing ready and uninhibited access to useful and reliable government information in addition to assuring press freedom, two things which are impossible to achieve unless they are codified into law as part of a "freedom of information act".
5. Increasing labour productivity, along the lines of "working smarter and not necessarily harder."
6. Reform of the civil service and instilling the ethos of service to the public, by improving the efficiency with which they provide service.
7. Diversifying the economy by strengthening its commercial and industrial base, whilst growing its employment creation potential.
8. Decentralising government and deploying infrastructure and services to the smallest and remotest of population centres.
9. Putting in place an ICT policy (that integrates into the bigger Vision framework) that enables the use of ICTs to deliver the tenets of the national vision.

Intellectual Property Rights and the Legal Environment

Intellectual Property Rights regimes are legal instruments developed to allow inventors, artists and other creators to control and benefit from the fruits of their creativity. IPR regimes must strike a balance between "the need to protect intellectual property that is expensive to produce but easy to replicate, with the desire to promote competition and further innovation"[23]. IPRs can take several forms including patents, trademarks, trade secrets and copyright.

A clearly defined IPR framework is an essential component of advancement in science and technology because it creates the kind of enabling environment that encourages investors to pursue their interests, knowing they will be able to generate public as well as private interests[24].

In Botswana, legislation is now largely in accordance with the Agreement on the Trade Related Aspects of Intellectual Property Rights (TRIPS), and in 1998, it became a member of both the Bern and Paris Conventions, the international baseline intellectual property rights agreements. The Botswana Copyright and Neighbouring Rights Law was passed by Parliament in March 2000. However, whilst the law satisfies the minimum TRIPS provisions, it has not come into operation as yet. Botswana's patent and trademark legislation has also been recently updated. The Industrial Property Act was enacted in 1997 and it's implementing legislation in late 1998. The new act provides internationally recognized standards of protection for both foreign and domestic holders of patents, industrial designs, and trademarks, and fully complies with the TRIPS agreement[25].

17 The policy, under the heading Maitlamo is under development and maintains information at URL www.maitlamo.gov.bw
18 International Telecommunication Union. 2002. Internet for a mobile generation. ITU reports 2002. Geneva
19 Government Computer Bureau. 2002
20 The national identity card
21 Presidential Task Group for a long term vision for Botswana. 1997. Long term vision for Botswana. Towards prosperity for all. Gaborone
22 Milne, D., C. Palmer and J. Yeabsley. 2000. Focusing investment in innovation. On the co-ordination and rationalisation of science and technology and research and development in Botswana. Report for the Min. of Finance and Development Planning. New Zealand Science and Technology Consortium. Wellington.pp.
23 Mann, C.L., Eckert, S.E. and Knight, S.C. 2000. Global electronic commerce. A policy primer. Institute for International Economics. Washington. D.C. 213 pp.
24 United Nations Development Programme and Institute of Statistical, Social and Economic Research, University of Ghana. 2001. Ghana Human Development Report 2000. Science, technology and human development. Accra.
25 US Commercial Service. 2001. Botswana country commercial guide FY2002. Investment climate statement. http://www.usatrade.gov/Website/CCG.nsf/CCGurl/CCG-BOTSWANA2002-CH-7:-005CDCA9

Botswana is now an original registry for Trademarks, Patents and Designs. Previously, any trademark, patent or design was required to first be registered in South Africa or the United Kingdom and only thereafter was protection given in Botswana[26].

However, the documentation and registration of ownership or authorship by Batswana artisans, artists and inventors appears to be rarely undertaken. The inventions of Batswana are not patented in Botswana perhaps because changes have just been made permitting registration of patents in Botswana, as mentioned above. According to the WIPO[27], only one patent was granted to a citizen of Botswana in 2000 whereas the patent office of the GoB recorded fifty-one patents registered to foreign entities in 1999 and five in the year 2000[28]. Not one patent recorded by the Patent Office of the GoB over the period 1985 to date recorded during research undertaken in the preparation of this report was considered of national origin. On another note, the patent office and registrar of companies in Botswana are not computerized and a search through the files must be done manually. In addition, some patents are registered in Harare, Zimbabwe. There were seven patent applications of Batswana origin recorded in the WIPO database in 1998 according to the World Development Indicators published in 2001[29].

The cost and complexity of taking full advantage of patent protection is probably a serious deterrent to an individual Motswana as well as many other entities and companies because the patent must be filed in several jurisdictions around the world in order to secure the maximum protection and benefit. Only large companies can afford the cost of this level of patent protection.

While it is generally recognized that local and traditional knowledge and know-how may not always be properly documented and protected by copyright, modern day inventions, especially those that have been developed in Botswana should be protected and documented.

In the case of local and traditional knowledge, and especially for natural products, complexity is an issue – it may just be too difficult and costly to document and apply for a patent, let alone be granted a patent. That is only a starting point however, as the question of how the community should benefit also arises. Indigenous knowledge creation and innovation is usually collective, intergenerational and for the social good[30]. Seeking a way to channel the benefits to the community may require the creation of a legal entity[31]. Another way forward may be documenting and recording in a database all of the natural products and local practices that form what may be called indigenous knowledge. In the event of perceived unauthorized or restrictive use of these local knowledge resources, a legal challenge may be considered on the basis of information in the database[32].

Parastatals in Botswana as well as the UB and other organizations have made a significant contribution to the country by creating, developing and adapting technologies and processes appropriate to local needs and circumstances. The BOTEC has developed a solar powered hearing aid as well as a centralised photovoltaic (pv) electrical system. The MoA has implemented a livestock identification and trace back system (LITS) designed to ensure that cattle produced in Botswana are identified and traceable throughout their lives in order to meet EU Regulations for imported beef products. GODISA, a non-governmental organisation (NGO) that employs physically and mentally handicapped individuals has developed and produces a solar rechargeable battery that is used for powering hearing aids[33].

The NFTRC is using modern technologies and processes for preparing, marketing and labelling local foodstuffs. The work of RIIC develops and/or adapts new and/or existing technologies in the area of renewable energy, agricultural and building technologies. RIIC reports having registered one patent for an animal proof bin with the relevant authorities in Harare.

There is a need to strengthen these institutions to help them assist Batswana to exploit the benefits of patenting their inventions and innovations for the greater good of all in the country. IPRs are at the core of the cultural and intellectual assets that Botswana will want to strengthen and project globally as it comes to participate fully in the knowledge society.

Energy Technologies

The deployment and use of ICTs often depends on the availability of older technologies such as electricity for powering new innovations. The implication here is that lack of access to older technologies such as power and land-based telephones hinders new uptake of the innovations and hence renders a country uncompetitive, further worsening the divide between leading countries and those in the developing phase. A brief look at the prospects, availability and use of energy technologies gives an indicator of the current and future prospects of improving the information state of the country.

Grid Electricity

Membership in the South African Power Pool gives Botswana access to reliable electrical power. This arrangement added to the small generating capacity from the coal powered Morupule power station, has resulted in the country importing upwards of 60% of its electric power. The expenses incurred in generating and distributing power over a largely sparse country have rendered Botswana's electricity bills some of the highest in the region. A result of this is that in most rural households, electric power is used almost exclusively for lighting.

The distribution network of the Botswana Power Corporation (BPC), the power utility, covers potentially 90% of the population, transiting along the main telecommunications and transport corridors. Even with this extensive network, only 25% of households in Botswana have accounts with the BPC, with the mining sector accounting for 52% of BPC's electricity sales[34] in 1999.

There is however an ongoing, government sponsored, accelerated rural electrification programme which has covered most settlements other than about 230 settlements populated with less than a thousand people each that remain outside the power grid. These settlements account for over 122,000 people, or about 7% of the population.

As of the beginning of 1999, total electricity consumption was in the order of 1.5 billion Kilowatt hours[35]. In 2002, it was estimated at about 1,100 Kilowatt / inhabitant or about 1.76 billion Kilowatt hours. It has undoubtedly increased significantly since. As already mentioned, electricity tariffs in Botswana are the highest in the Southern African region and these high tariffs have been blamed for the re-location of certain energy-intensive industries to neighbouring countries[36]. On the whole, business operators consider the electrical power supply in Botswana to be one of the most reliable in Africa[37].

Solar Energy

According to the US Department of Commerce and the US State Department[38], "solar power is another method of energy production in use

26 http://mbendi.co.za/werksmns/lexaf/busbo.htm#Intellectual
27 World Intellectual Property Organisation. http://www.wipo.int/ipstats/en/
28 United Nations Development Programme. 2002. List of patents collected by Botswana Human Development Report research team
29 World Bank. 2001. World Development Indicators 2001. Science and technology, Table 5.11
30 United Nations Development Programme and Institute of Statistical, Social and Economic Research, University of Ghana. 2001. Ghana Human Development Report 2000. Science, technology and human development. Accra
31 Inger, D. 2002. CEO. Veld Products Research and Development, Gaborone. Personal communication
32 Van Dijshorst, Hilde. 2002. Protecting indigenous knowledge by intellectual property rights: a suitable solution? Report for Veld Products Research and Development. Gaborone

33 Weinstein, H. 2002. Godisa. Technologies for the developing world. Solar rechargeable hearing aids. Personal communication. mwb@info.bw
34 Ruffini, A. 1999. Botswana focuses on electricity network. African energy. Vol. 1 no. 3 http://www.africanenergy.co.za/magazines/evol1no3/story02.htm
35 http://www.botswanapower.com/
36 Mbendi. 2001. Botswana: electrical power – overview. http://mbendi.co.za/indy/powr/af/bo/p0005.htm
37 World Economic Forum. 2000. The Africa competitiveness report 2000/2001. Oxford University Press. Ny. London
38 US Foreign and Commercial Service and US Department of State. 1999. Botswana Energy Sector. http://www.tradeport.org/ts/countries/botswana/mrr/mark0006.html

in Botswana. Botswana receives over 3200 hours of sunshine per annum, and the average daily radiation on a horizontal surface is 21 MJ/meter squared. The GoB initiated the National Rural Photovoltaic Electrification Program (NRPEP) in March 1997 as an alternative source of power for those people or areas that cannot afford or do not have access to grid electricity or diesel. Under this program, which is run by the Rural Industries Innovation Centre based in Kanye, the GoBprovides loans to purchase solar power installations. From March 1997 to the year 2000, the NRPEP has put in 234 solar installations, mostly in the central district of Botswana".

Although Botswana is ideally suited for solar energy applications, its contribution to the national energy balance is insignificant. Solar energy is currently used for home lighting and water heating, electricity production for telecommunications equipment, and in the rural areas where access to conventional electricity is difficult[39]. There have equally been uses in borehole water pumping for farming purposes, but the uptake is still far from well registered on a national scale. Considering the ample solar irradiation that Botswana receives throughout the year, the lack of development of this alternative source of energy is a weakness, despite the fact that input costs are much higher relative to grid electricity.

Solar power is not widely used

Wind Energy

Wind is another potential source of electric power to power ICT tools, equipment and services, but the wind regime in Botswana, ranging in speed from 2.0 to 4.0 m/s, is too low to be useful as a commercial resource. However there is potential for small scale aero-generators for use by several households particularly in the more remote parts of the country where prospects for the extension of the national grid are minimal.

The Information Communication Technology Policy Regime

The Parliament approved Botswana's first Science and Technology Policy in July 1998. This policy clearly articulates the intent to encourage and incubate innovation and research, and goes on to define technology as "the application of science through practical utilization in the development of products and services, which can create wealth and improve the quality of life." One arm of three structures proposed by the policy, the NCST has been appointed with a mandate to advise Government on any policy matter in the S&T sphere. The second organ, the funding agency in the incentive model adopted post the consultancy review of the Science and Technology Policy, BRSTIA[40] is awaiting legislation to exist and begin funding research as per priorities identified by the NCST.

Work on developing a national ICT policy and strategy, which is to be driven by MCST, is nearing completion, with a target date for legislation being March 2005. The policy is to be anchored on the principles of e–Governance; (rural) community access to ICTs; education particularly on-line or distance education; ICT enabled access to health services in rural areas; productivity improvements; e-commerce and developing ICT services as both an industry and an employment generator. Whether the final policy document will run true to this expectation, only time will tell. Both government and the telecommunications regulator, BTA, are committed to implementing and funding a universal access policy. The exact funding arrangements and obligations are subjects of discussion, however operators are expected to contribute to the cost of rolling out access as part of their obligations.

"Freedom to hold opinions without interference, freedom to receive ideas and information without interference, freedom to communicate ideas and information without interference" are constitutionally guaranteed freedoms in Botswana, however without an explicit freedom of information act being in place these cannot, in practice be taken as given and the threat has been recognised internationally as the following quote from Transparency International[41] exemplifies:

"In Botswana, the head of television news and current affairs resigned in April claiming government interference prevented him from carrying out his task properly. Two of Botswana's leading newspapers, The Guardian and The Midweek Sun, were in danger of closing, following instructions to all ministries, state departments, parastatals and private businesses associated with the government to freeze their advertising in the papers. Government pressure on the media indicated the weakness of political commitment to anti-corruption measures and increased transparency."

Whilst lack of policy might have hindered a structured growth of the ICT industry, the realisation in government since the last National Development Plan (NDP 8, 1997-2003) is that computerisation must become a core aspect of government operations. This realisation was a direct result of the Government having computerised various functions such as: payroll, social security pension payments, drivers licenses and the national identity card register (Omang). The automation of customs administration through the deployment of UNCTAD's Automated System for Customs Data Application (ASYCUDA)[42] since July 2002, which allows customs traders to handle most of their transactions – from cargo manifests and transit documents to Customs declarations – via the internet is another practical manifest of this desire to computerise by government. This EDI platform is one element of the broader e-commerce.

During NDP 8, the GoB established an inter-office network, boosted computer literacy and introduced core business applications. Along with Long Area Networks (LANs), a high speed backbone wide area network infrastructure – the Government Data Network (GDN) - was established. The GDN is a high performance TCP/IP based network that uses frame-relay technology and a high speed fibre optic LAN backbone to link key government servers in Gaborone.

Print Media

Botswana has a well developed print media, with several national private newspapers, the largest of which has circulation figures of 27000 (see Table in the annex) and has converted from a weekly to a daily paper since 2003. Several other private regional papers and limited circulation magazines exist, but by far the most dominant print media is the free, government owned and provided daily, the Daily News, which given government's reluctance to guarantee access to state information must play the role of stifling alternative views. This apparent danger has been a concern for private publishers.

39 http://www.botswanapower.com/

40 Milne, D., C. Palmer and J. Yeabsley. 2000. Focusing investment in innovation. On the co-ordination and rationalisation of science and technology and research and development in Botswana. Report for the Min. of Finance and Development Planning. New Zealand Science and Technology Consortium. Wellington. 182 pp

41 Transparency International. 2001. Global corruption report 2001. Southern Africa. www.globalcorruptionreport.org

42 Botswana implements ASYCUDA. http://www.asycuda.org/

Botswana's Information Communication Technology - Asset Base

Telecommunications Infrastructure and Data Communication Services

Infrastructure is a prerequisite for ICT deployment. Botswana has fully digital telecommunications infrastructure that is deployed along a circular transportation corridor that links the major population centres with spurs leading to other rural centres off this central corridor. The Eastern portion of this telecommunications backbone is based on fibre optic cabling and with the rest of the network based on high-speed microwave. The microwave network, which is in the process of being replaced by fibre optic cabling, is one of the most extensive in Africa, linking 50 automatic exchanges and providing connections to South Africa, Zambia and Zimbabwe[43]. However, the core national network comprising telephone exchanges and transmissions systems has not been upgraded in recent years and is performing sub-optimally[44]. This prompted an on going upgrade by BTC starting with Gaborone, which will also allow for deployment of ISDN.

This infrastructure, which belongs to the BTC, serves BTC's telephony and data communications services to its clients. The two national Cellular phone operators (Orange and Mascom) use the infrastructure of BTC to deliver their services across the country (See Figure 5.8). The BTC network provides telecommunications data services with rates of up to 2 Million bits per second (Mbps) to internet service providers (ISPs). For users accessing the internet over telephone lines, the telephone network allows for log on rates close to 56 Kbps for dial-up access. The BTC also provides leased lines with data throughputs available at 64,128 and 256 Kbps. A more recent innovation is the wireless connection with rates of 128 Kbps.

Botswana has a sound telecommunications infrastructure

Leased lines are the most popular mode of data transmission and internet access for corporate entities, whilst analogue dial-up is more popular amongst small business and home users. Alternative technologies such as Very Small Aperture Terminal (VSAT) have proved relatively unpopular so far, but BTC is planning a rollout of VSAT offering up to 2 Mbps of data, voice and video by the end of October 2004.

More recently, corporate and home users can use Integrated Services Digital Network (ISDN) technology operating at 64 Kbps via dial-up. The service providers do however allow sharing of bandwidth at minimum 'chunks' of 16 Kbps. Frame-relay services are also available.

High speed internet on ramp technologies such as Asymmetric Digital Subscriber Line (ADSL) and cable Internet that are popular elsewhere are not yet available in Botswana. The promotion and diffusion of broadband or high-speed access to the Internet is considered a hallmark of e-enabled jurisdictions because it opens up a whole range of online products and services. ADSL uses existing copper telephone lines and cable Internet takes advantage of co-axial cable connections. At present, there is no cable television provider in Botswana. The BTC is currently testing broadband access which will herald an even better network readiness in the future. Botsnet, BTC's ISP subsidiary, is currently testing and piloting WIFI[45] access using a service provider at a local hotel.

The BTC's customer base for fixed line telephony has increased from 80,000 in 1997 to 150,000 in 2002. BTC introduced new services including voice-mail, paging, toll-free calling, global pre-paid calling, as well as various value added services. The BTC, in keeping with the GoB's commitment to providing basic services across the country, completed projects in the Barolong, Bobirwa and Tswapong sub-districts covering a total of 48 villages. A further 132 villages were connected by the end of 2002.

Telecommunications Regulation and Liberalisation

The telecommunications sector has been liberalised following the set-up of the sector regular, BTA in 1996 through the Telecommunications Act of 1996. A year lator, the national carrier (BTC) faced competition in all fields, with the exception of fixed line telephony, with the awarding of GSM licences to Mascom and Vista (now Orange). One international satellite service provider offering international connectivity for data communication, Africa Telecommunication PTY, forms part of the competition. UUNet, one of the 15 ISPs in Botswana also offering leased lines services which until a ruling of the BTA, was considered the exclusive domain of the BTC.

The brief history of the BTA has shown it to be a successful and forward looking regulator. The International Telecommunications Union (ITU[46]) attributes this to Botswana's post-independence history of good governance, democracy, intolerance of corruption and respect for legal processes. Some of its successes include fixed-line network more than doubling in size from 1997 to 2002, and the mobile network growing from zero to well over 330000 subscribers over the same period. These outcomes are due to the fact that the the BTA enjoys complete freedom in the functions of licensing operators and in establishing and financing its own budget (of which 90% derives from operating licenses and spectrum fees). In addition:

- It has developed policy through consultative processes, including a series of open meetings held in all major cities.
- It has moved relatively quickly, for instance converting the telecommunications policy into an Act within a year, and completing the process of awarding GSM cellular licenses, to Vista and Mascom, within just nine months.
- It has not been afraid to take controversial decisions, most notably by not awarding a mobile license to the incumbent fixed-line operator, BTC.
- It has consistently invested in human resources development and gender equality.
- BTA has established through an act, rules on numbering, property access, radio communication equipment and testing and type approval of telecommunications equipment.

Broadcasting Services

Botswana[47] has two private commercial radio stations operating exclusively in Gaborone. Radio Botswana includes the non-commercial Radio Botswana One, which plays no advertising, and the commercial station, Radio Botswana Two. Both broadcast nationwide. The national television broadcaster, Botswana Television (BTV), is a non-commercial station that is part of the Department of Information and Broadcasting with

43 Jensen, M. 1999. AISI-connect national ICT profile Botswana
http://www2.sn.apc.org/africa/countdet.CFM?countries__ISO_Code=BW
44 Government Data Network. 2002
45 Short for wireless fidelity and is meant to be used generically when referring of any type of 802.11 network, whether 802.11b, 802.11a, dual-band, etc

46 : International Telecommunication Union. 2002. World telecommunication development report 2002. Reinventing telecoms. Geneva. 188 pp.
47 Botswana Telecommunications Authority. http://www.bta.org.bw/broadcasting.html

Radio Botswana. Botswana Television started broadcasting in July 2000. There is no commercial television station in Botswana and no cable TV (CATV). A pay satellite service, MultiChoice (DSTV), headquartered in South Africa, broadcasts commercial stations from Botswana's southern neighbour. Gaborone Broadcasting Corporation (GBC) is a television re-broadcaster.

Radio is the most important ICT in Botswana, with about 68% of households owning a radio. In Africa as a whole, one in every four people or 25% own a radio[48]. Radio Botswana transmitter coverage offers medium wave and FM coverage around the main towns in the country where most people are located[49]. There does not appear to be any Botswana radio stations or other Botswana based or focused operators streaming sound programming over the internet[50].

BTV broadcasts eleven hours a day during the week and twelve hours on weekends in English and Setswana[51], with the rest of the hours covered through the monitoring of the BBC World broadcast. BTV broadcasts using terrestrial transmitters and also via commercial satellite transmitters. Terrestrial transmission is greatest near the main towns and more transmitters are being installed to reach communities throughout the country. Several other independent providers of telecommunications services have made available telecommunications infrastructure that is used by independent service providers. VSAT terminals are operated independently of BTC, which is also on the verge of launching its own VSAT network.

A National Broadcasting Board established through the National Broadcasting Act of 1998 has been busy preparing the ground for a policy shift towards allowing community radio stations. Nothing much has been done in that direction, but with the expected policy, communities will be able to run small radio stations dedicated to their needs. There is equally talk of merging the two regulators to form a unified communications regulator, a scenario that might help streamline some of the processes and perhaps allow an integrated approach to universal access provision.

Botswana's InfoState and Technology Achievement

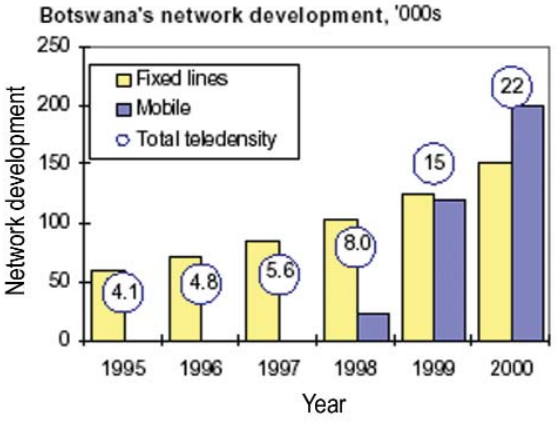
Measured on a per capita basis compared to other countries in Africa, Botswana has one of the highest nominal levels of bandwidth, finishing ninth overall in Africa on a bandwidth (measured as bits) per capita basis. Orbicom[52] has developed a new index, the InfoState, that measures the (relative) digital divide between and among countries. This is in addition to the 2001 UNDP Human Development Report Technology Achievement Index (TAI) that measures the "performance of countries in creating and diffusing technology and in building a human skills base".[53]

Information Communication Technology diffusion and the InfoState for Botswana

Telephones and the impact of mobile telephony

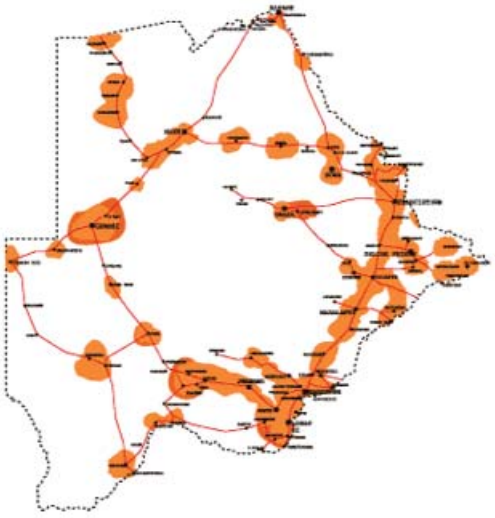
In common with many other African countries, uptake of the mobile phone in Botswana has been a great success, and now far exceeding the capacity and reach of the fixed-line. From virtually no subscribers in 1997, there are now more than 367,000[54] subscribers and with one of the two local operators claiming its subscribers exchange over 100,000 SMS messages daily.

Figure 5.7: Development of the telephone network in Botswana



Source: Summarised from the ITU case study of effective regulation in Botswana, available at: http://www.itu.int/ITU-D/treg/Case_Studies/Index.html .

Figure 5.8: Map of cellular phone availability across Botswana



(a) Orange Botswana

48 Jensen, M. 2002. The African Internet – a status report. July 2002. http://www3.sn.apc.org/africa/afstat.htm
49 Government of Botswana. 2001. Botswana National Atlas. Dept. of Surveys and Mapping. Table 22.9 Radio Botswana transmitter coverage contours. And figure showing radio transmitter coverage.
50 TVRadio World. 2002. Botswana. http://www.tvradioworld.com/region3/bot/
51 http://www.btv.gov.bw/btv/programme_lineup.html

52 Orbicom, 2003,Monitoring the digital divide and beyond, http://www.orbicom.uqam.ca, 2003.
53 United Nations Development Programme. 2001. Human Development Report: Making new technologies work for human development,NY
54 Botswana Information Technology Society. Annual conference. 2002.

(b) Mascom Wireless

As figure 5.8 shows, the cellular operators have expanded coverage to virtually all the inhabited parts of Botswana, following the major transportation routes. The expansion will go on as part of universal access obligations that the regulator imposes on all major operators including the BTC.

PCs and the Internet

The data showing ICT diffusion in Botswana as a whole and in households is presented in the annexes. According to the ITU, there were over 65,000 PCs in Botswana in 2001. In 2000, the Central Statistics Office (CSO), reported 15,795 PCs in households across the country, of which 66% were located in households in urban centres. The Government Computer Bureau reports between 10-15,000 PCs in the civil service. According to Network Wizards[55] the number of internet hosts under the .bw domain were 1,920 in January 2004. This number however is an estimate and does not take into consideration Botswana based or registered servers listed under other domains, of which .com, .net. .int, or .org are possible examples and private servers located behind corporate firewalls. Most internet hosts are located in urban areas where network and support services are most likely to be found.

The total iInternet bandwidth to Botswana is about 14 Mbps[56], of which 10.5 Mbps is used by the national carrier, BTC. These channels link to the global internet backbone via service providers located in the following countries:

- 8 Mbps asymmetrical (8 Mbps downlink, 2 Mbps uplink) to Canada
- 2 Mbps duplex fibre-link to South Africa
- 512 Kbps duplex to USA via France

Points of presence (POPs) and virtual points of presence affording Internet access across the country are available in Gaborone, Francistown, Lobatse, Selebi-Phikwe, and Maun which altogether have a population of 392,344 people. Factoring in Greater Gaborone, which includes Mogoditshane and Tlokweng, brings the total population to 446,320. The CSO data further shows that 22% of the population has access to 44% of the fixed lines and 66% of the home-owned personal computers. Clearly there is an information divide between rural and urban areas. It is possible that these figures understate the digital divide because many people access the internet at work and in urban areas predominantly where companies with internet access and LANs are more likely to be located. Similarly, virtually all cyber-cafes are located in urban areas.

About 27% of the population has a choice from a number of local internet points of presence to access the internet. Botsnet, the public owned service provider is the only ISP to provide a national telephone number for dial-up access at local telephone call rates from across Botswana. As a result, a further 60% of the population could potentially access the internet using a dial-up connection.

Factors limiting access to PCs include the high cost of PCs relative to average wages and the ability to use a PC. As a result, most users access the internet at work or in cyber-cafés that typically charge P10.00 per hour. Cyber-cafés, of which there are about fifteen in Botswana, are usually located in urban areas, further underlining the digital divide. Nevertheless, cybercafes are the predominant form of public access to the internet. There are no community based public access centres to the internet or to PCs and there are no telecentres.

An assessment of computer use in rural areas undertaken by BOTEC, the Study on Community User Information System, revealed that 91.5% of the sample population of 1,000 people had never used a computer yet 70.5% of the same sample had a desire to learn about computers. The sampled communities rated telephones as their most important communication tool ahead of post mail. These figures indicate that Batswana as a whole are keen to exploit ICTs but are unfortunately unable to do so.

The market for the provision of internet services has been liberalized in Botswana. There is competition between the ten registered ISPs in Botswana. The total number of users was estimated to be around 40,000 at the end of December 2001, compared with 10,000 users in 1999.

There are also four licensed private network telecommunication service providers and six data gateway service providers. The majority of these are found in the business entities, institutions, and Government organizations.

BTC's backbone data and telephone network is 100% digital. Recently, fixed wireless loop technology was introduced to reduce connection-waiting times. BTC's advanced telecommunications infrastructure means high-speed or broadband access to the Internet is a possibility throughout much of the country. Some operators are making use of satellite telecommunications services with six operators already using VSAT to provide both national and international data services.

State of the Internet in Botswana

On the basis of the total bandwidth per capita, i.e. close to 15 Mbps / 1.7 million people, Botswana has one of the highest measures of internet use in all of Africa[57]. Internet access costs are relatively modest compared to the rest of Africa. In Botswana, the cost of 30 hours of internet access permonth was about USD 28.30, in 2001 or about 0.12% of GDP per capita. The cost per capita for 90 minutes per month of mobile phone use in 2001 was estimated at 0.16% of GDP per capita. This compares favourably to the averages for these figures in Africa as a whole, i.e. 2.50% and 1.14% respectively[58]. However for most of the population and especially those living in rural areas, these figures are still relatively high. As a result, PCs and the internet remain largely inaccessible.

Botswana's internet space has been estimated to include over 7,240 unique Web pages associated with about 122 main Web hosts under the .bw domain (109 using the 2004 survey by Network Wizards) (see Table A.3 in Annex). Over 5,790 (80%) of these pages are estimated to be in the English language. It was not possible to establish the number of pages in Setswana. Other languages listed under the .bw domain include Chinese

55 Network Wizards. January 2004. http://www.isc.org/ds/reports/2004-01/dist-bynum.php
56 International Development Research Centre. 2002. The Internet: out of Africa. http://www.idrc.ca/acacia/divide/
57 International Development Research Centre. 2002. The Internet: out of Africa. http://www.idrc.ca/acacia/divide/
58 International Telecommunication Union. 2002. Internet for a mobile generation. International Telecommunication Union Report 2002. Geneva.

(245 or 3.4%), and German (206 or 2.8%). A German domiciled site is also located under the .bw domain (Baden Wurtenberg).

The majority of government web sites are of the "brochure" type with information presented in linear form, with little opportunity for interactivity. A government procurement site also exists which provides access to information in the form of downloadable bid documents and requires online registration. Some sites such as the BTA site do allow for downloading application and tender forms online, but they must be printed out and completed manually before being delivered by post or in person.

The Technology Achievement Index (TAI)

The TAI measures achievements in four areas: technology creation as measured by the number of patents granted to residents and by receipts of royalties and license fees from abroad, diffusion of recent innovations as measured by the number of internet hosts per capita, diffusion of old innovations (telephones per capita, electricity consumption per capita) and human skills as measured by mean years of schooling and the gross tertiary science enrolment ratio.

The calculation of the TAI for Botswana appears in the Appendix in a Box A.1 entitled Calculating the TAI for Botswana. According to currently available data, the TAI for Botswana is estimated to be 0.377. The UNDP Human Development Report 2001 calculated the TAI for 72 countries for which data was available. At the time of the preparation of the Human Development Report 2001, data for Botswana was not readily available. Using the currently available data for calculating the TAI, a score of 0.377 places Botswana among the potential leaders in terms of technology achievement, roughly in 35th place at 2001 figures, thus assuming all the other countries have remained static, which is extremely unlikely. Finland had a top score of 0.744 and Mozambique had the lowest score at 0.066.

This means that Botswana is situated in a group made up of nineteen countries including South Africa, Spain, Italy, Malaysia, Mexico, Argentina and Costa Rica assuming these are static at 2001 figures which is certainly not reflective of current realities. So in fact Botswana is more likely much further back than this computed figure, misaligned in time with other countries' statistics, seems to suggest. These potential leaders are characterized by having invested in high levels of human skills. They have diffused old technologies widely but innovate little. Each country in this group tends to rank low in one or two dimensions, such as diffusion of recent innovations or of old inventions. Most countries in this group have skills comparable to those in the top group of technology leaders.

Because of the lack of data in rural areas, it has not been possible to compute the TAI or its component indicators on a per district basis.

It is to be noted that this comparison suffers somewhat because the data used for the calculation of the TAI reported in the UNDP Human Development Report 2001 was derived in 2001 or before, whilst the data presented here in the calculation of the TAI for Botswana is based on data from 2000 to 2004. Botswana has made great strides in the diffusion of mobile telephony that would have meant a lower score in 2001 when the TAI was first introduced. A more revealing index would be the country's InfoState relative to the rest of the world as developed by Orbicom.

Structure and use of Information and Communication Technologies: An InfoState[59] for Botswana

The Information Communication Technology Market and Structure

The ICT market in Botswana has grown rapidly in the last decade. As at August 2004[60], the total value of the ICT market in Botswana is estimated to be between Pula 700 million and Pula 1 billion. The value of the ICT market in 2005 is estimated to be higher, with predictions that the market is close to Pula 1 billion. This, places Botswana among one of the most technologically advanced countries in Africa.

Traditionally, the government has been the largest single operator in Botswana and is by far the greatest purchaser of ICT goods and services. In 2002, it was responsible for an estimated 65-68% of the market value, with the private sector responsible for a paltry 7.5% of ICT market purchases. Total public sector spending on ICTs in 2004 is estimated to be about Pula 250 million, of which Pula 160 million was hardware expenditure and Pula 1 million software expenditure. Contrary to past acquisition behaviour as at August 2004 there appears to be a decisive shift towards acquisition of hardware as opposed to software and services. It is interesting to note that the ICT expenditure outside the government sector is now as high as 600 to 700 million Pula per annum. This is a clear indication that the private sector is has taken over from the Government and requires more attention and support in its efforts in the ICT sector.

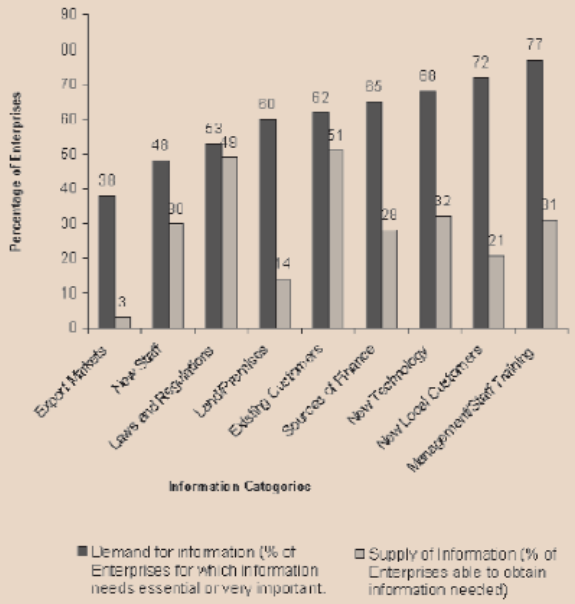
Government expenditure on services has over the years been declining and in 2004 was estimated to be at approximately Pula 975,838 as compared to close to Pula 3 million in 2003. This is a clear indication of the increased number of qualified local IT specialists and is also an indication that Botswana's market for ICT specialists and managers has matured. Outsourcing of maintenance and support of government computers to the private sector is increasing in line with government objectives to strengthen the capacity of the private sector and to lessen the role of government in the economy.

The value of ICT spending in Botswana is a likely reflection of the computerization of the workplace throughout the country. Consequently, the ICT market may stabilize in the future, but this is unlikely to take place in the near future given the increased diffusion of the internet and new access technologies including wireless access technologies.[61]

The US Commercial Service estimates the size of the market for computers (hardware, parts, accessories and software) in Botswana at USD 28 million or about Pula 168 million[62]. In the PC market, Microsoft products dominate, with the Government of Botswana tenders for PCs requiring Microsoft operating systems. The use of Open Source software such as Linux does not appear to be significant.

59 Infostate is the measure of relative digital divide as proposed by Orbicom. It combines both infodensity and info-use.
60 Government of Botswana 2004, National E-Readiness Assessment: ICT Sector Survey, Gaborone. This assessment is an input towards development of Maitlamo Botswana's National ICT Policy.
61 Government of Botswana 2004, National E-Readiness Assessment: ICT Sector Survey, Gaborone. This assessment is an input towards development of Maitlamo Botswana's National ICT Policy.
62 US Commercial Service. 2002. Botswana country commercial guide FY2002. http://www.usatrade.gov/Website/CCG.nsf/CCGurl/CCG-BOTSWANA2002-CH-5:-005CDCA0.

Figure 5.9: The information needs gap



Clearly, there is an unsatisfied need for information among business enterprises in Botswana. This same survey established that:

- Most companies in Botswana stored their records on paper;
- 70% of surveyed service enterprises stored accounts on computers and;
- 9% of non-exporting manufacturers stored accounts on computers.

Information Communication Technology use in Government

The Government data network (GDN) has expanded to 99 towns and villages and now reaches over 7,000 civil servants. Departments typically connect to the network at data rates ranging from 32-128 Kbps using a variety of technologies. These rates are very low on a comparative basis and maybe insufficient to sustain access to network resources.

A skills development scheme has been initiated where 6 civil servants are sent on long term IT training and 24 others for short term training yearly, which has not been enough to build adequate skills into the civil service cadre. A recent study undertaken by Price Waterhouse on IT use in government showed that several, sometimes key, Government procedures and data registers are still operated and maintained manually[63]. For example, there is no document management system in government and all archiving is done using microfiche, a cumbersome and inefficient process. Citing some of these use examples can only be anecdotal, to get a clearer picture of where Botswana stands vis-à-vis the digital divide, an extract from the Orbicom[64] report using data ranging from 1996 to 2001, to map the relative InfoState for the country is made.

Botswana's Infostate[65]

As discussed previously, the Infostate is a new index proposed to indicate the relative digital divide between and among countries. It has two elements, a country's relative infodensity and info-use. Infodensity is in turn decomposed into networks, which are made up of eight other sub-components, and skills that include adult literacy and the trio of gross enrolment ratios. Info-use is on the other hand a composite of two elements, info uptake (decomposed into 4 sub-elements) and intensity of use of ICTs with its three sub-elements (see Text Box 5.6 for the sub-elements and the Appendix for its calculation).

Tables 5.2-5.3 and Chart 5.1 below summarise the major findings of the Orbicom report. As indicated, Botswana falls below the world average (given the name Hypothetica) in all measured elements and subcomponents, coming close only in terms of enrolment (Chart 5.2). What table 5.2 shows is that the leading countries score four times on a scale as Botswana and Namibia. Even against the best performing African countries, Mauritius and South Africa, the number one country Sweden scores upwards of twice as much on all the indices. Table 5.3 and Chart 5.1 indicate the evolution of the infostates and the closing of the gap by the poorer countries over the period 1996-2001.

Box 5.6:
Components of Orbicom's Infostate Index for the Digital Divide

INFOSTATE

Infodensity

Networks

Main telephone lines per 100 inhabitants
Waiting lines/mainlines
Digital lines/mainline
Cell phones per 100 inhabitants
Cable TV subscription per 100 households
Internet hosts per 1000 inhabitants
Secure servers/Internet hosts
International bandwidth (Kbs per inhabitant)

Skills

Adult literacy rates
Gross enrolment ratios
Primary education
Secondary education
Tertiary education

Info-use

Uptake

TV equipped households per 100 households
Residential phone lines per 100 households
PCs per 100 inhabitants
Internet users per 100 inhabitants

Intensity

Broadband users/Internet users
International outgoing telephone traffic minutes per capita
International incoming telephone traffic minutes per capita

Source: Orbicom 2003. Monitoring the Digital Divide and Beyond

As is apparent from Chart A.1, the average infostate for the world (Hypothetica) has been steadily rising over the study period. However, whilst Botswana's has risen upwards as well, it has not kept pace with the rapid global trend. Only during a brief period between 1997 and 1999 has Botswana's growth rate been above average, having managed to overtake Namibia between 1998 and 1999. But beyond 1999, the growth rate has slowed so much that Namibia went ahead just before 2000. The explanation for the rapid growth is in part due to the rapid growth of the cellular phone network, starting from virtually zero up until then. While this growth has continued it has not kept pace with other developments in other countries such as the use of the deployed infodensity.

63 Government Computer Bureau. 2002.
64 Orbicom 2003. Monitoring the Digital Divide and Beyond
65 This part has extracted from the Orbicom study, Monitoring the digital divide and beyond

From Table 5.2 one would have expected that compared to Namibia which only has an infodensity of 58.1 (ranking 75 in the world), Botswana's infodensity of 60.6 (rank 72) would have translated into a higher info-use index. However on use, Namibia leads at 49.6 (rank 80) compared with Botswana's 41.8 (rank 88). What is instructive from this is that a way must be found for ensuring that Batswana use the deployed ICT infrastructure, particularly the Internet where despite the country's high bandwidth per capita, it still ranks very low in terms of use. The same is reflected in Chart 5.2 showing the relative component infostates of both countries.

Table 5.2: Infostates and Rankings, 2001

	Infostate		Infodensity		Info-use	
	Index	Rank	Index	Rank	Index	Rank
Sweden	230.5	1	228.2	2	232.8	6
Netherlands	224.2	4	232.6	1	216.1	9
Hypothetica	100	-	100	-	100	-
Mauritius	92.5	47	79.7	55	107.4	41
Costa Rica	86.0	55	71.1	61	103.9	44
South Africa	74.5	59	81.8	53	67.9	64
Namibia	53.7	77	58.1	75	49.6	80
Botswana	50.3	81	60.7	72	41.8	88
Ethiopia	6.1	138	7.4	137	5.1	138
Chad	5.2	139	7.3	138	3.7	139

Chart A.1:
The Evolution of Infostates in Select Countries

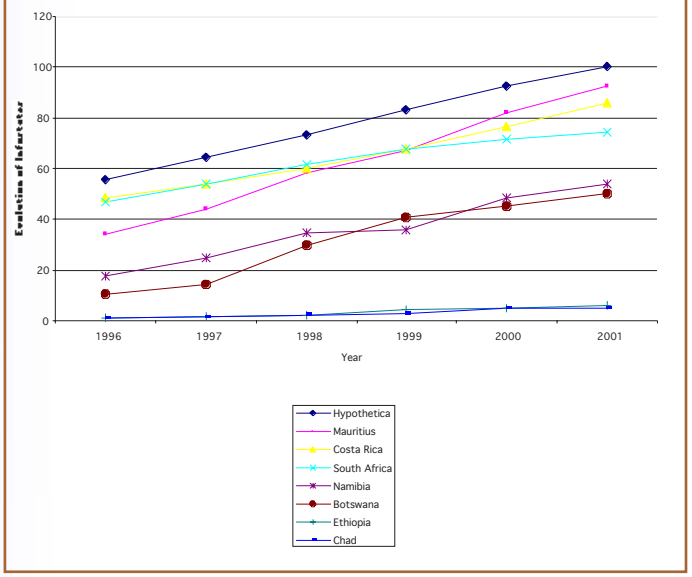
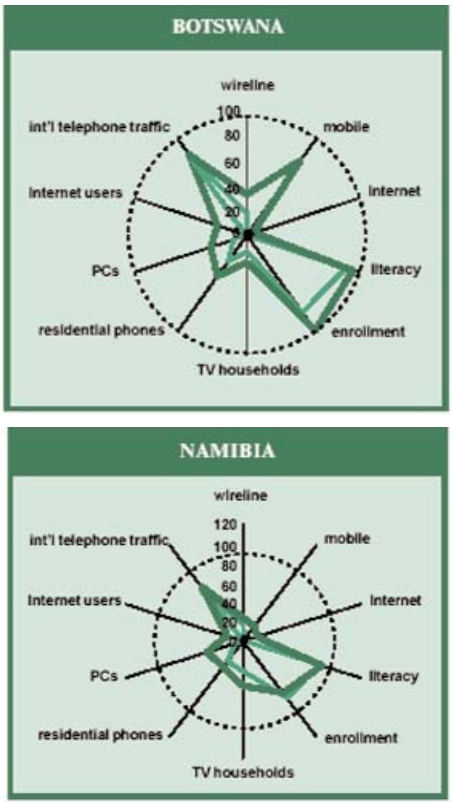


Chart A.2:
Chart showing evolution of component infostates for Botswana and Namibia[66]



An Information Society for Botswana: Challenges, Prospects and Solutions

The GoB recognises the need to diversify its economy as the country inevitably integrates into the global economy. The critical issues that the Government faces in doing so are: unemployment in general and the lack of trained specialists, business managers and especially entrepreneurs willing and able to take advantage of ICTs in Botswana. Other issues of direct relevance to the private sector are: poverty, economic diversification and public sector reform. Since NDP 8, the following critical issues have also emerged: HIV/AIDS, financial discipline, citizen economic empowerment and recurrent and maintenance costs[67].

The challenges and proffered solutions are presented in tabular form in tables 5.6 and 5.7. The tables respectively capture the challenges and prospects in general as they relate specifically to the GoB. The third column in each table contains running commentary on likely successes or failures, or where no solution has been thought of, a hazarded solution route is thrown in as a challenge to the country if it desires to do better than it has already.

The GoB has recognized that it needs to look outward to achieve the objectives of economic diversification. Two projects illustrate this more than any other, namely IFSC concept that is captured in text box 5.6, which is moderately successful. The other project is a case of missed opportunity, but one that can be salvaged in the form of developing the textile industry to take advantage of the AGOA (Text Box 5.7). Both of these are respectively actual and potential sources of FDI flows and points of presence for Botswana in the global village.

66 As per the Orbicom Report
67 Miinistry of Finance and Development Planning. 2000. Mid-term review of NDP 8. Government Printer, Gaborone

Table 5.4: Challenges and Prospects for an Information Society for Botswana

Challenges	Tried/Proffered solutions	Commentary
Optimal management of .bw domain, plus quality of operation of Internet network given available bandwidth		Need for an independent audit to pinpoint where problems are and offer solutions.
Citizen (corporate and individual) participation and ownership of ICT stake given SMME status	30% local reservation scheme Government subsidised credit schemes, e.g. CEDA[68]	Government not enforcing (better enforcement – but offers a temporary solution). No guarantee recipients would be in the ICT sector or get the reserved allocation.
Build ICT capacities and skills	Uncoordinated training at the UB and other private training institutions	Carry out a skills audit, and then project the kind and quantity of required skills in the next 5-10 years.
Increasing specialist skills such as IP network engineers, managers and analysts	MSCE training being offered by some private companies	Not enough uptake and the level of training not high enough, however the prospective establishment of Cisco academy perhaps in collaboration with the University of Botswana might go a long way in addressing some of these.
A globally competitive Botswana	Some formative success in some areas, e.g. IFSC (see Box 5.7)	No strategic focus on ICTs as guarantors of a competitive edge.
Economic diversification	International Financial Services Centre initiative (see Text Box 5.7) Attracting FDI flows (BEDIA plus IFSC) Government incentive schemes: CEDA, local procurement and reservation policies.	Some positive outcomes so far, but not enough nor diverse to sustainably be relied upon (more engines of growth needed). FDI flows have dwindled over the time whilst the expenditure on attracting them has ballooned (BEDIA[69]).
Retaining the skills in the economy		A reversal of a skills drain needed, since government is failing to compete both with (local) industry, but more critically, globally (South Africa, USA and Europe).
Security of e-business plus recognition of electronic signatures		Develop EDI and EFI beyond just Customs. Legislate for e-commerce in general and recognise digital signatures/ contracts. Deploy secure socket servers (SSL).
Innovation of use of existing platforms, such as mobile phone		Deploy SMS as an information engine/discussion forum; e.g. health hotline or news breaker; traffic information etc.
Build new business models for public access centres (teleaccess)		M-commerce (mobile commerce) applications using the local language compatibility of the SMS should be adopted to take advantage of the explosive growth of mobile phones. A business model along the lines of cyber cafes or the Senegalese teleaccess centres would go a long way in allowing service in the remotest of areas.

68 Citizen Entrepreneurship Development Agency, which charges below market interest on loans up to a maximum P2 million
69 Botswana Export Development and Investment Agency Annual Report 2003

Table 5.5: Information Society for Botswana: Challenges for the Government of Botswana

Challenges	Tried/Proffered solutions	Commentary
Civil service reform and service delivery	General computerisation of functions in government, e.g. Asycuda (customs), driver registration etc.	By working in real time, a mindset change might be instilled into service providers, and as shown in the text box 5.11, Government must learn to do more with less.
E-governance and providing access to public information	Some intention on the part of the MCST to provide access to all citizens.	Lack of Access to Information Act (AIA) will remain a hindrance and a sore issue where the Government's commitment to the public's right to access to information is concerned. AIA must be enacted as a matter of urgency.
Decentralisation	Councils have been given power to decide and generate some of their revenues.	Devolution of (decision making) powers to people at the front desk. Economic (and legal) empowerment of districts/local authorities to drive own agendas. Remuneration in local Government must be competitive and comparable with those in central government for the same skills set.
Building and sustaining niche areas of excellence	The MCST dreams of Botswana being the ICT hub for the SADC region.	Words need to be translated into action. Intentions should be backed up by deliberate policy initiatives and implementation to make them a reality (see a potential in the textile industry, Text Box 5.8).
Turning information into knowledge	On going schools computerisation program Computer awareness classes at the junior certificate level.	Develop innovative, project based computer use in schools for all pupils. Will only happen through use (see below for specific suggestions).
Capacitating (e-enabling) the SMME sector		Develop model business and technology incubators, as well as information/resource centres that are accessible to all.
The ultimate challenge: moving away from the paradigm of universal access to universal service	Government through its utility parastatals (power, telecomms, water etc.) has laid infrastructure that is (potentially) accessible to 90% of the population.	Providing facilities has not translated into actual service, meaning the purported policy of universal access is not enough to guarantee use; and it is through use that the greater benefits will accrue to the citizenry and the SMME sector. Policy should shift to universal service, which presupposes demand on the part of potential users, meaning their economic well being must be such that they can pay. Thus the impressive per capita economic performance must translate into actual money in the pockets of the greater majority of Batswana, a situation that still eludes more than half of the population.

Box 5.7:

FDI flows – the case of the International Financial Services Centre

The GoB has developed IFSC[70] with the objective of creating sustainable employment opportunities, enhancing the skills base of the Botswana workforce, diversifying the revenue base of the country and fostering the deployment of modern financial services technology in Botswana. Much of this will depend on the successful and strategic use of ICTs and of the internet especially.

The IFSC will attract foreign capital and strengthen the capacity of Botswana to serve the financial services needs of the region and of the world. However, to fully take advantage of new technologies and management practices, and especially ICTs, Botswana will need to help the private sector grow, use and apply these technologies and practices.

The GoB continues to focus on the development of the financial services sector as part of its policy of economic diversification. According to the Economist, *"the IFSC will act as a conduit for funds from South Africa and the rest of the world… and some banks are relocating from central Johannesburg … the outlook for some success is positive"*. The IFSC is based on a legal jurisdiction rather than a physical location and attracts companies based on Botswana's international reputation which has recently been enhanced by its high sovereign credit rating[71].

The IFSC is an innovative project that builds on sound business intelligence and marketing and on the strengths of Botswana. To nurture this opportunity into one that can significantly transform the business landscape in Botswana and contribute in a real and significant way to economic diversification, much more will need to be done.

Further success of this project will require sustained use of ICTs to allow for services (electronic data interchange (EDI) and electronic funds transfer (EFT) services) in real time. This thus calls for the development of higher skills and more secure servers. EFTs are an essential component of B2B and of e-commerce in general. They are the financial transactions that underpin e-commerce in all its forms through the intermediation of the global banking system[72]. However, for this to happen *"banking and payment systems need to be able to process transactions in real time, both domestically and in multiple currencies on international markets"*[73]. One way to achieve this would be for the IFSC to encourage international firms that already have this capacity to participate in the local economy and transfer technology and knowledge to the domestic market.

Box 5.8: FDI flow potential through the Textile sector

Under the Africa Growth and Opportunity Act, a US law), some countries in Africa, including Botswana are allowed to produce and sell their products in the USA without tariffs. Local producers in Africa are scrambling to build supply chain networks of producers of locally spun yarn and woven fabric, that for example, can be cut and sewn in local factories and then exported to the multi-billion dollar ready-made garment industry in the USA. Simply finding the location of and communicating with suppliers in a region like Southern Africa requires quite a bit or work[74].

Perhaps ICTs can be used to help build and sustain these supply chains and help enhance trade with US based suppliers and markets. The establishment of public or community based access centres combined with business incubators could be undertaken to build the capacity of the Botswana textile industry along with other sectors and businesses to exploit this and related opportunities. In Botswana, there are about 16,500 listed textile companies presently operating[75]. Of these, manufacturing establishments contributed 7.7% to the total operating establishments. The Clothing and Other Wearing Apparel industry was the leading contributor to manufacturing with 221 establishments. Clearly there are a sufficient and probably larger number of enterprises in place to consider establishing such a supply chain in Botswana.

Another useful application is based on using the internet to scope market opportunities. In Mauritania, work undertaken by the World Bank to explore market opportunities for niche agricultural products has determined that high value melons for example are in great demand at certain times of the year in Europe. Certain melon varieties sell for close to USD 10,000 per hectare. Using the internet and agricultural data from the Eurostat[76] statistical database, which logs all exports and imports of agricultural products by country in the European Union, it is possible to accurately monitor and predict the peaks and troughs of demand for agricultural produce and to plan cultivation accordingly[77].

Given the incredible growth in the number of cellular phones and in the use of related applications such as SMS, the potential of mobile or M-commerce should not be underestimated. Several countries are experimenting with mobile voice and SMS based applications. In Botswana two examples exist of where enterprises have tried to add value by using the availability and reach of the mobile phone, First National Bank (FNB) have recently started an SMS (or email) notification to customers who opt for it, every time there is a transaction on their accounts through their InContact service; equally a local radio station (Gabzfm) and one of the two mobile operators (Mascom) have an arrangement where Mascom subscribers can call a number and access news and other programming of the radio station[78]. Cellular phones can and have been put to other uses as shown in box 5.9 below.

70 International Financial Services Centre. 2002. http://www.ifsc.co.bw/welcome.htm
71 The Economist Intelligence Unit. 2002. Country profile 2002. Botswana Lesotho. London
72 DeMaio, H. 2001. B2B and beyond. New business models built on trust. Deloitte & Touche. Wiley. NY
73 Mann, C.L., Eckert, S., Cleeland Knight, S. 2000. Global electronic commerce. A policy primer. Institute for International Economics. Washington. D.C.
74 Cochrane, J. 2002. USAID Bureau for Economic Growth, Agriculture, and Trade, Washington, D.C. Excerpted from electronic message posted to the AFRIK-IT public mailing list ("African Network of IT Experts and Professionals (ANITEP) List" <AFRIK-IT@LISTSERV.HEANET.IE), Sep. 18, 2002. jcochrane@usaid.gov
75 Central Statistics Office. From CSO Web page under Industrial Statistics
76 Eurostat. http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat
77 Gouvernement de la Mauritanie. Programme de developpement integre de l'agriculture irriguee en Mauritanie. http://pdiaim-div.org/archives/Nouvelles%20janvier%202002.htm
78 Sebusang, S.E.M. and Masupe, S. (2003) ICT development in Botswana: Connectivity for rural communities The Southern African Journal of Information and Communications, Issue No. 4

Box 5.9: Select mobile voice and SMS messaging applications

What kind of information can be exchanged using mobile phone technologies?

Commercial and financial information
- Exchange rates
- Commodity, agricultural market prices and movements
- Stock market prices and alerts (e-ticker)
- Access to individual and business accounts with banks, utilities and other services
- Funds transfers, e-cash
- Targeted news: technologies, markets, practices, contacts, etc.
- Advertisements

Other information
- Instant messaging, simplified chat
- E-mail alerts linked to main e-mail box or other needs
- Government info. On policies, speeches, etc.
- Weather info.
- Emergency information
- Personal information

E-government for Botswana: Challenges, Priorities and Benefits.

Government, like any other business, stands to benefit from the productivity gains afforded by increased use of ICTs. But what specifically can these tools bring to people and how can they benefit human development (see Box 5.10).

To start with, ICTs can transform the business of government by increasing the effectiveness of information storage, retrieval and management. Many business processes in the GoB are still operated manually. Given the size and operational budget of the Government, there is clearly room for improvement.

Box 5.10: E-government - benefits and outcomes

Key benefits
- More accessible government information and services
- Faster, smoother transactions with government agencies
- Increased access to government decision makers and to parliamentarians
- More local (distributed) access – greater ubiquity
- Increased participation in government by all Batswana
- Increased efficiency in government operations
- Enhanced opportunities for smart partnerships with civil society and the private sector

Principal outcomes
- Service expectations of the public increase and increasingly satisfied
- Increase in the efficiency and effectiveness of government
- Greater access to and availability of public information: less need to travel and queue
- Automation of most government services and transactions
- Increased participation in government
- Increased public satisfaction with government
- Increased trust in government
- Decentralization and strengthening of district and local government

The further development of the information economy clearly depends on putting in place a culture of information that will attract and retain talent, the most important of which is home - i.e. Botswana - grown and financed at a significant cost to the GoB. The loss of this talent either because it is unavailable or under utilised is a loss for the country.

E-government Priorities

A number of priorities set or needed to be set by government, where a strategic use of ICTs could yield excellent results are crucial. Table A.1, in the annex summarises the current and proposed ICT applications in government. Three of the critical ones are covered below as Text Boxes 5.11-5.13, namely civil service reform, decentralisation and access to public information in that order.

Box 5.11: Civil service reform

The public sector in Botswana accounts for 47% of formal employment and dominates the economy and society. Compared to Malawi, a country with six times the population of Botswana, the number of staff in the central GoB in 1998 was approximately 82,000[79] while employment in the central government of Malawi was estimated at about 99,000 staff.

According to the World Economic Forum, Botswana "is overburdened with institutional structures to the point where delivery of services has become lethargic[80]". Similarly, the poor quality of service provision is regularly blamed for lower than expected social indicators in Botswana. The lagging performance of the civil service has been noted in the Vision 2016 statement and is recognized by government.

79 Proceedings of the Sixth National Business Conference. 2000. Botswana Confederation of Commerce, Industry and Manpower

80 World Economic Forum. 2000. The Africa competitiveness report 2000/2001. Oxford University Press. NY. London

81 United Nations Development Programme. 2001. Common Country Assessment. Botswana: towards national prosperity. Gaborone

Box 5.12: Decentralisation

The GoB has embarked on a decentralization programme to boost capacity at district level by providing more technical and managerial staff, together with a devolution of financial and administrative powers. Decentralization with devolution of financial and administrative decision making to the district and local levels is one objective[81].

However, the interface between local, district and central government decision makers needs to be improved. Strong professional links between central and local government are needed to ensure that staff and programmes at local level receive adequate technical back-up and support. Similarly, there is a great need to ensure that government works more closely with the private sector and with local NGOs and with civil society in general. Government in Botswana, as elsewhere, cannot and should not do it all.

How can ICTs help this come about?

The current drive to further enhance government performance and facilitate decentralization can greatly benefit from the development of the GDN and from greater use of ICTs and especially of the internet. ICTs can bring the usual efficiencies and increases in productivity, but the real benefits accrue as a result of facilitating greater access to public information and to basic government services across the country, and especially in the rural areas. Instead of travelling long distances to Gaborone, Francistown or Maun, individuals can go to a closer location.

Appropriate and community based models of public access to the internet need to be developed. Community PC and internet access centres or telecentres need to be experimented with. Along with the general public, there are several target groups that could benefit from public access facilities.

Box 5.12 continued

Among these, the private sector as resellers of ICTs and related services and possibly as operators of these facilities, as per the example in other countries such as Senegal (See reference to telecentres in Senegal cited previously). SMEs and SMMEs may need assistance with new methods of doing business and district based business incubators may be a vehicle for helping small business operators learn how to use ICTs to market their products and services, and to be informed about market opportunities and conditions.

Box 5.13: Access to public information – the example of health

It is important that researchers, planners and policy makers are able to access the most recent information about the science of HIV, currently viable options for both prevention and care, and the current status of the HIV/AIDS epidemic in the country. At present, it is not straightforward to access all of the relevant information from the MoH, ACHAP, BOTUSA, the Botswana - Harvard Aids Institute for HIV Research and Education, and others. Although some of the organisations involved in HIV/AIDS work maintain websites, there is no central location where a researcher can obtain an overview about what is happening with regard to HIV/AIDS in the country.

The function of information coordination is part of the mandate for the NACA, which is the obvious location for a centralized information service per database. A starting point for an information system would be to establish a regularly maintained website for NACA, where a user could obtain up-to-date information about HIV/AIDS in Botswana, and information about the different organizations that are active, and the projects that they are undertaking. This would include reports and analyses from the sentinel surveillance system, and from the VCT centres. It is clear that NACA will require capacity for this function in the near future. It is probable that the process of obtaining and disseminating test results and diagnoses could be greatly facilitated by the use of ICT. Information supplied by NACA should also be more readily available to assist with counselling.

Although greater use of ICTs would facilitate the process of information dissemination in the health sector, and for HIV/AIDS in particular, it must be stressed that the HIV/AIDS epidemic is not primarily fuelled by lack of information. Wherever it has been measured (for example within the UB student body), the state of knowledge about how to prevent HIV has been found to be reasonably high.

Similarly, in many sectors of society, increased knowledge has not led to a change in risk behaviour – primarily because many people are constrained by poverty or social attitudes, and are unable to exercise their rights to reproductive health. Effective interventions to halt the further spread of HIV will have to address these fundamental underlying causes. There is a continuing need to conduct research to identify these causes, and to design strategies to counter them.

One definite need is to increase the efficiency and effectiveness of the clinical trials by improving data collection. The manually repetitive work associated with health maintenance and the monitoring and follow-up of patients receiving treatment for HIV-AIDS is demanding and cumbersome, involving entering data repetitively and manually. For an already overburdened health system, increased efficiency in day to day operations is desperately needed. One application of ICTs is in the anti-retroviral treatment (ARV) programme. ARV treatment has brought new hope to people living with HIV/AIDS. However, treatment using combination therapies involving multiple drugs with many different side effects, plus the fact that ARV treatment is for life, means that patient treatment and follow-up can be a taxing information and logistics management task.

An e-learning steering committee which brings together representatives of initiatives that are fostering ICT use and access, including ACHAP, the MoE (the Educational Network – EDN), the GDN, BTC, and others, has been formed.

Monitoring follow-up in ARV treatments is essential. Patients who do not follow their prescriptions have to be reminded and called up for follow-up otherwise they risk not only a relapse but also the possibility of drug resistance. Contact lists and scheduling has to be computerized to help the health system cope. Otherwise, only a far fewer number of people can be treated using strictly manual techniques. A simple ARV follow-up database programme is being developed by ACHAP.

Simple computerized applications, usually databases listing patients and their status and the drugs used to tread them, along with the responses and side effects noted are required. Systems to monitor the availability of drugs are likewise needed and are being implemented by the MoH. Eventually, and much sooner than later, integrated systems bringing this functionality together in a seamless and user friendly way will be needed. The MoH is currently negotiating for an integrated health information management system to this effect.

Table A.1: Current and proposed ICT applications in government

Objective	Implementation Status	Remarks
Botswana a regional leader in exploitation and the use of IT in achievement of national objectives	There is an increase in the use of information communications through the Intranet and internet.	The establishment of the Information and Communication Technology Policy Taskforce will enhance the Government Computer Bureau's role in facilitating the utilisation of IT in the country.
Quality IT Systems	Systems have been put in place in important sectors like vehicle registration, income tax and state land management.	
Well Trained IT Workforce	6 and 24 persons per annum go on long-term and short-term training respectively.	
Data communication Infrastructure	Implementation of data communication infrastructure has been achieved.	The IT industry is dynamic, it is crucial to keep pace with the dynamism e.g. through provision of high bandwidth.
Common IT system across all Ministries	Common systems in Ministries, e.g. Human Resource, National Registration, National Libraries and accounts have been provided.	
Each ministry to develop and generate it's own information database	Ministries such as Minerals, Energy and Water Affairs (Water Affairs) MoA (Livestock Identification and Trace Back System) have developed and generated their own relevant information databases and also have control of their own IT systems.	
Each Ministry responsibly run its own IT systems	Most Ministries are able to run their IT systems in close consultation with Government Computer Bureau (GCB).	In view of the shortage of IT personnel GCB service to other ministries could improve.
Government and local authorities to exchange information electronically	Local authority computerisation has just been initiated and is still at its infancy stage.	Some information is currently being interchanged electronically with Insurance companies and banks.
Less paper work	The implementation of mail servers in ministries and use of electronic mail has reduced the amount of paper work within the workplace.	Due to the absence of a legal acceptability of electronic documents, formal communication is still done on paper. A legal framework is necessary to recognise the validity of electronically transferred documents.
Botswana GIS Centre	Work in progress towards establishing a GIS centre	
Government to promote private IT service and industry	In progress	

Table A.2 : Aggregate Information & Electricity Statistics for Botswana

	1998	2002	Per 1000	Source
Telephone Mainlines	85,590	150, 068	89	BTA
Cellular subscribers	32,644	332,314	198	BTA
ISP's		10		BTA
Internet Hosts		1,605	1	NW[82]
Internet users (estimated)[83]	10,000	40,000	24	BTA
Internet Cafés		15		UUNET
Average monthly cost of Internet account	P100.00	P100.00	n/a	BTA
Cost of a six minute local call	P0.23	P0.23	n/a	BTC
Cost of a six minute zone call	P2.07	P2.07	n/a	BTC
Cost of a six minute inter-zone call	P5.52	P5.52	n/a	BTC
Waiting list for mainlines	10,600	14,800	9	BTA
Electricity – accounts		98,958	59	BPC
Per capita kilowatt hours electricity consumption	900	1100		BPC
Newspapers printed (Private)		160,000	95	Publishers
Highest Newspaper readership (Private)		27,000	16	Mmegi
Television sets (household)		101,718	61	CSO
Satellite TV accounts				DSTV
Radio's (household)		273,380	162	CSO
PC's (household)		15,000	9	CSO
PC's per 1000 Civil servants (central Govt)				GCB
PC's per 1000 Employees (Local Govt)				GCB
PC's per 1000 junior secondary students				MoE
PC's per 1000 senior secondary school students				MoE
PC's per 1000 university students				MoE
PC seats / schools for ongoing studies (IT)				BOTA

Table A.3: Estimate of the number of Web pages and hosts under .bw

No. of Web pages (total)	7,241
No. of main Web hosts	122
Distribution of Web pages by language	
Pages in English	5,792 (80%)
Chinese	245 (3.4%)
German	206 (2.8%)
French	22 (< 1%)
Other European languages	21 (< 1%)

Source and comments: Data computed 2002/11/19 using the AltaVista search engine, advanced function (http://www.altavista.com/web/adv). Data are estimates because the AltaVista engine, like all search engines, only indexes or sees part of the global Internet and is usually not up to date as updates to the index of the search engine can take several days or weeks. Sites that are behind firewalls are not visible and are not counted.

82 Network Wizards. July 2002. http://www.isc.org/ds/WWW-200207/dist-byname.html
83 BTA. 2002.

Table A.4: ICT diffusion in households (2001)

	Radio	T.V.	Computer	Phone	Total	Population	Per Capita
Gaborone	44538	28409	7375	34138	114460	186007	0.62
Francistown	17852	8639	1260	10783	38534	83023	0.46
Lobatse	6390	3318	411	3695	13814	29689	0.47
Selibe-Phikwe	11130	5078	529	6352	23089	49849	0.46
Orapa	2035	1786	322	1693	5836	9151	0.64
Jwaneng	3459	2120	394	2572	8545	15179	0.56
Sowa Town	771	606	101	602	2080	2879	0.72
Southern	15691	3948	359	6241	26239	113704	0.23
Barolong	6176	2018	102	1772	10068	47477	0.21
Ngwaketse West	1121	95	9	404	1629	10471	0.16
South East	11148	5671	928	7307	25054	60623	0.41
Kweneng East	30520	9852	1107	12590	54069	189773	0.28
Kweneng West	3977	924	81	1136	6118	40462	0.15
Kgatleng	12512	4576	411	6042	23541	73507	0.32
Serowe Palapye	22152	5929	512	8574	37167	153035	0.24
Central Mahalapye	15389	4233	331	5437	25390	109811	0.23
Central Bobonong	9782	1730	142	3199	14853	66964	0.22
Central Boteti	6532	1346	97	2468	10443	48057	0.22
Central Tutume	16214	2881	289	5426	24810	123514	0.20
North East	7064	1722	163	2811	11760	49399	0.24
Ngamiland East	10949	2978	468	5238	19633	72382	0.27
Ngamiland West	4677	536	51	1350	6614	49642	0.13
Chobe	3266	1059	125	1645	6095	18258	0.33
Ngamiland Delta	302	13	3	19	337	2688	0.13
Ghanzi	4226	1025	120	1756	7127	32481	0.22
C.Kgalagadi G Reserve	48	3	0	6	57	689	0.08
Kgalagadi South	3229	782	57	1178	5246	25938	0.20
Kgalagadi North	2230	441	48	1105	3824	16111	0.24
	273380	101718	15795	135539	526432	1680763	0.32
%of Total ICT Terminals	52%	19%	3%	26%			

Urban Population	375777	22%
Urban Terminals	206358	39%
Urban Radios	86175	32%
Urban Phones	59835	44%
Urban TV's	49956	49%
Urban PC's	10392	66%

NB: South east & Kweneng east figures are influenced by Mogoditshane & Tlokweng which use Gaborone's infrastructure

The TAI applied to Botswana

Technical note - Calculating the Technology Achievement Index

The technology achievement index (TAI) is a composite index designed to capture the performance of countries in creating and diffusing technology and in building a human skills base. The index measures achievements in four dimensions:

- Technology creation, as measured by the number of patents granted to residents per capita and by receipts of royalties and license fees from abroad per capita.
- Diffusion of recent innovations, as measured by the number of Internet hosts per capita and the share of high- and medium-technology exports in total goods exports.
- Diffusion of old innovations, as measured by telephones (mainline and cellular) per capita and electricity consumption per capita.
- Human skills, as measured by mean years of schooling in the population aged fifteen and above and the gross tertiary science enrolment ratio. For each of the indicators in these dimensions the observed minimum and maximum values (among all countries with data) are chosen as "goalposts". Performance in each indicator is expressed as a value between zero and one by applying the following general formula:

$$\text{Indicator index} = \frac{\text{Actual value} - \text{Minimum observed value}}{\text{Observed maximum value} - \text{Observed minimum value}}$$

Values obtained for Botswana:

The index for each dimension is then calculated as the simple average of the indicator indices in that dimension. The TAI, in turn, is the simple average of these four dimension indices.

Table A.5: Indictor Indices For Botswana

Indicator	Observed maximum value	Observed minimum value	Values for Botswana
Patents granted to residents / million people	994	0	7[84]
Royalties and license fees received (USD / 1,000 people)	272.6	0	0[85]
Internet hosts / 1,000 people	232.4	0	1.61[86]
High and medium technology exports (as % of total goods exports)	80.8	0	Minimal[87]
Telephones (mainline and cellular / 1,000 people)	901[88]	1	304[89]
Electricity consumption (kilowatt-hours / capita)	6,969	22	1,100[90]
Mean years of schooling (age 15 and above)	12.0	0.8	6.3[91]
Gross tertiary science enrolment (%)	27.4	0.1	37[92]

Box A.1: Calculating the TAI for Botswana

1. Calculating the technology creation index

Patents and receipts of royalties and license fees are used to approximate the level of technology creation. Indices for the two indicators are calculated according to the general formula.

Patent index = (7– 0) /(994 – 0) = 0.007

Royalty and license fee index = (0.0 – 0.0) /(272.6 – 0.0) = 0

The technology creation index is the simple average of these two indices:

Technology creation index = (0.007+ 0.0) / 2 = 0.004

2. Calculating the diffusion of recent innovations index

Using Internet hosts and the share of high- and medium-technology exports in total goods exports, the same formula is applied to calculate the diffusion of recent innovations index.

Internet host index = (1 – 0.0) / (232.4 – 0.0) = 0.004

High- and medium-technology export index = (0.0 – 0.0) / (80.8 – 0.0) = 0

Diffusion of recent innovations index = (0.004 + 0.0) / 2 = 0.002

3. Calculating the diffusion of old innovations index

The two indicators used to represent the diffusion of old innovations are telephones (mainline and cellular) and electricity consumption per capita. For these, the indices are calculated using the logarithm of the value, and the upper goalpost is the OECD average.

Telephony index = (log (304) – log (1)) / (log (901) – log (1)) = 0.834

Electricity index = (log (1,100) – log (22)) / (log (6,969) – log (22)) = 0.679

Diffusion of old innovations index = (0.834 + 0.679) / 2 = 0.756

4. Calculating the human skills index

The human skills index is calculated according to the general formula, using mean years of schooling and the gross tertiary science enrolment ratio.

Mean years of schooling index = (6.3 – 0.8) / (12.0 – 0.8) = 0.491

Gross tertiary science enrolment index = (27.4 – 0.1) / (27.4 – 0.1) = 1

Human skills index = (0.491 + 1) / 2 = 0.746

5. Calculating the technology achievement index

A simple average of the four dimension indices gives us the technology achievement index.
TAI = (0.004 + 0.002 + 0.756 + 0.746) / 4 = 0.377

84 World Bank. 2001. World Development Indicators 2001. Based on data for 1998. Data for 2000 = 0 patents according to Botswana Patent office, but 1 patent according to World Intellectual Property Organisation database
85 World Bank. 2001. Idem
86 Netcraft. 2002. http://www.isc.org/ds/WWW-200207/dist-byname.html for July 2002
87 United States Department of Commerce. 2002
88 Organisation for Economic Cooperation and Development average
89 Botswana Telecommunication Authority
90 Botswana Power Corporation. 2002.
91 World Bank. 2001. World Development Indicators 2001
92 World Bank. 2001. World Development Indicators 2001

Box A.2: **Calculating the Infostate**

Starting from the raw data indicators are constructed with the appropriate denominators. Then the smoothing adjustment for outlier values was applied, using the following rule:

$$\text{for } 1.5 < CV < 3, \max = \bar{x} + 3std$$
$$\text{for } CV < 1.5, \max = \bar{x} + 4std$$
$$\text{for } CV > 3, \max = x + 2std$$

with CV being the series' coefficient of variation, its mean and its standard deviation.

While many indicators are used individually, some others are combined to form composite indicators. These indicators (and the associated indices) are arrived at as follows:

For the fixed telecommunications network;

$$I^{fixed} = \frac{\text{mainlines} \times 100}{\left(1 + \frac{\text{waiting lists}}{mainlines}\right) + \left(2 - \frac{\text{digital lines}}{mainlines}\right) \times \text{population}}$$

Fort the Internet;

$$I^{Internet} = \frac{1 + \left(\frac{\text{secure servers}}{\text{Internet hosts}}\right) \times 100}{\text{population}}$$

The gross enrolment indicator;

$$I^{gross\ enrollment} = (\text{primary} + 2 \times \text{secondary} + 3 \times \text{tertiary})/6$$

The traffic indicator;

$$I^{traffic} = (\text{int'l outgoing} + \text{int'l incoming})/2$$

Some indicators were subject to the monotonic transformations discussed earlier. These are the linear type, with a scalar. Again, rather than arbitrarily selected, the scalars were arrived at through a simple and systematically applied rule based on statistical; analysis of each individual series. Specifically,

$$\text{for } CV < 1.5, \text{scalar} = 4\bar{x}$$
$$\text{for } 1.5 < CV < 3, \text{scalar} = 3\bar{x}$$
$$\text{for } CV > 3, \text{scalar} = 2\bar{x}$$

Each indicator is converted to an index regardless of its original unit of measurement. During the conversion, a reference country (Hypothetica) and a reference year (2001) were specified, to allow comparison both across and within countries over time. This is done at the level of each and every indicator, country and year.

Thus for the reference country © we get:

$$It^{i,c} = (Vt^{i,c} / Vt_0^{i,c}) \times 100$$

where I stands for the value of the index, i refers to individual indicators, V to raw values of indicators, to refers to the reference year and t to any other year.

Using the notation j for all other countries we have:

$$It^{i,j} = (Vt^{i,j} / Vt_0^{i,c}) \times 100$$

This normalisation allows immediate comparisons between other countries and the reference country, and for any country over time.

Once each indicator has been expressed in index form, we proceed to aggregate across each component. Indexes are obtained as:

$$\hat{I}t^{i,j(c)} = \sqrt[n]{\prod_{i=1}^{n} I^{i,j(c)}_{n,t}}$$

with _ denoting product and n the number of each component's individual indices. In 2001, for networks, n=5 (fixed, mobile, cable, Internet and bandwidth), for skills, n=2 (literacy and gross enrolment) and for uptake n=4 (television, residential lines, PCs, Internet users).

We continue likewise for the subsequent level of aggregation. Networks and skills are combined into the Infodensity index as:

1. Calculating the Infodensity

Infodensity = $\sqrt[k]{\prod_{i=1}^{k} I^{i,j(c)}_{n,t}}$

With k = 2.

2. Calculating Info-use

While no index is computed for intensity of use, Info-use is arrived at as:

Info-use = $\sqrt[z]{\prod_{i=1}^{z} I^{i,j(c)}_{n,t}}$

Where z = 6, that is all the four uptake indices plus broadband users and combined international traffic.

Finally, when we have both Infodensity and Info-use, we arrive at the highest level of aggregation, a country's infostate, simply as:

3. Calculating Infostate

Infostate = $\sqrt[2]{(\text{infodensity} \times \text{info - use})}$

Clearly, once indicator have been constructed, what follows is an unweighted average, indifferent to each individual ICT good or service, as we have no knowledge basis to do otherwise. The choice of a geometric rather than an arithmetic mean represents a value judgement that favours symmetrical rather than lopsided development across indicators of interest.

Table A.6: ICT Indicators for Botswana's Global Position (ITU 2002)

	Total tel. subscribers /100	PCs/100	Hosts / 10,000	Internet Users /10,000	Internet Tariffs % GDP /caput	Mobile tariffs % GDP /caput	2G	3G	Broadband subs. /100 Testing	ISDN / 100	Bandwidth (Mbps) (2003)[93]
Botswana	21.35	3.87	7.57	297	0.12	0.16	-	-	-	-	16.08
Africa	5.56	1.06	3.38	85	2.50	1.14	1	-	1.28	0.05	
High income	120.48	41.77	1,486	3993	0.03	0.03	29	2	0.61	2.74	151779.7
World	32.42	8.44	230	820	1.18	0.54	47	5	-	0.80	
Costa Rica	30.54	17.02	20.79	934	0.33	0.26	-	-	0.02	0.04	154.13
Malaysia	49.86	12.61	31.10	2,395	0.09	0.10	Yes	-	-	0.15	798.9
Mauritius	50.56	10.83	26.05	1,317	0.15	0.03	-	-	-	0.12	
Namibia	12.16	3.64	25.91	252	-	0.21	-	-	-	0.12	16.18
Tunisia	14.90	2.37	0.22	412	0.25	0.20	-	-	-	0.01	
South Africa	32.35	6.85	54.45	701	0.25	0.21	Testing	-		0.06	1063.96

93 World Bank www.infodev.org/projects/internet/375pyramid