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Information and Communication Technology in the Atolls: Maldives Case Study

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This report was prepared by Michael Minges and Vanessa Gray. Formatting and cover design was done by Nathalie Rollet. The report is based on research carried out from 28 May - 3 June 2003 as well as articles and reports noted in the document. The assistance of the Ministry of Communication, Science and Technology and Mohamed Amir and Zulaikha Ibrahim was indispensable. Equally, the report would not have been possible without the cooperation of Maldivian organizations. The list of organizations met is attached in the annex to this report. The assistance of Dhiraagu, particularly their comments on earlier versions of this report, is highly appreciated.

The report is one of series examining the Internet in developing nations. Additional information is available on the ITU's Internet Case Study web page at: http://www.itu.int/ITU-D/ict/cs.

The report may not necessarily reflect the opinions of the ITU, its members or the government of the Republic of Maldives.

The title refers to the unique geographical situation of the Maldives. The country consists of 1'190 islands in 26 atolls. The word atoll comes from the Maldivian language and refers to a circular reef or ring of coral islands surrounding a lagoon.

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1. Introduction

Information and communication technology (ICT) is a key issue for members of the International Telecommunication Union (ITU), the United Nations specialized agency for telecommunications. In that respect, the ITU has carried out a series of case studies researching ICT in different nations.[1] This study looks at ICT diffusion in the Republic of Maldives. It touches on specific problems such as isolation and undersized markets that small island developing states such as the Maldives face in adopting ICT.[2] The study also examines how the Maldives is evolving into an information society, particularly relevant in the context of the World Summit on the Information Society (WSIS), the first phase of which was held in Geneva, Switzerland in December 2003.[3]

The organization of this report is based on a framework developed by the Mosaic Group.[4] The scope has been widened to incorporate telecommunication networks such as the fixed-line and mobile telephone networks. Mosaic considers six factors as follows:

- **pervasiveness:** a measure based on users per capita.
- **geographic dispersion**: a measure of the concentration of ICT, from none or a single city to nationwide availability.
- **sector absorption**: a measure of the degree of utilization of ICT in the education, commercial, health care and public sectors.
- **connectivity infrastructure**: a measure based on international and domestic backbone bandwidth, exchange points, and user access methods.
- **organizational infrastructure**: a measure based on the state of the ICT industry and market conditions.
- **sophistication of use**: a measure characterizing usage from conventional to highly sophisticated and driving innovation.

The report also considers other factors not included in the above framework such as the evolution to an information society, pricing and government policies.

[1] Resolution 31, "Telecommunication infrastructure and information and communication technologies for socio-economic and cultural development" calls upon the ITU to "organize, conduct or sponsor necessary studies to bring out, in a different and changing context, the contribution of ICTs to overall development." ITU. 2003. *Final Acts of the Plenipotentiary Conference (Marrakesh, 2002)*.

[2] The ITU notes, "… small island nations and communities face particular problems in bridging the digital divide." See Resolution 129 (Marrakesh, 2002) in ITU. 2003. *Final Acts of the Plenipotentiary Conference (Marrakesh, 2002)*. Small island developing states (SIDS) form an official grouping in the UN system. For a list of the 46 SIDS see http://www.un.org/special-rep/ohrlls/sid/list.htm. [Accessed 4 February 2004].

[3] The WSIS Declaration of Principles makes special mention of the Small Island Developing States noting they have particular needs. For more on WSIS see the web site at: www.itu.int/wsis/index.html. [Accessed 4 February 2004].

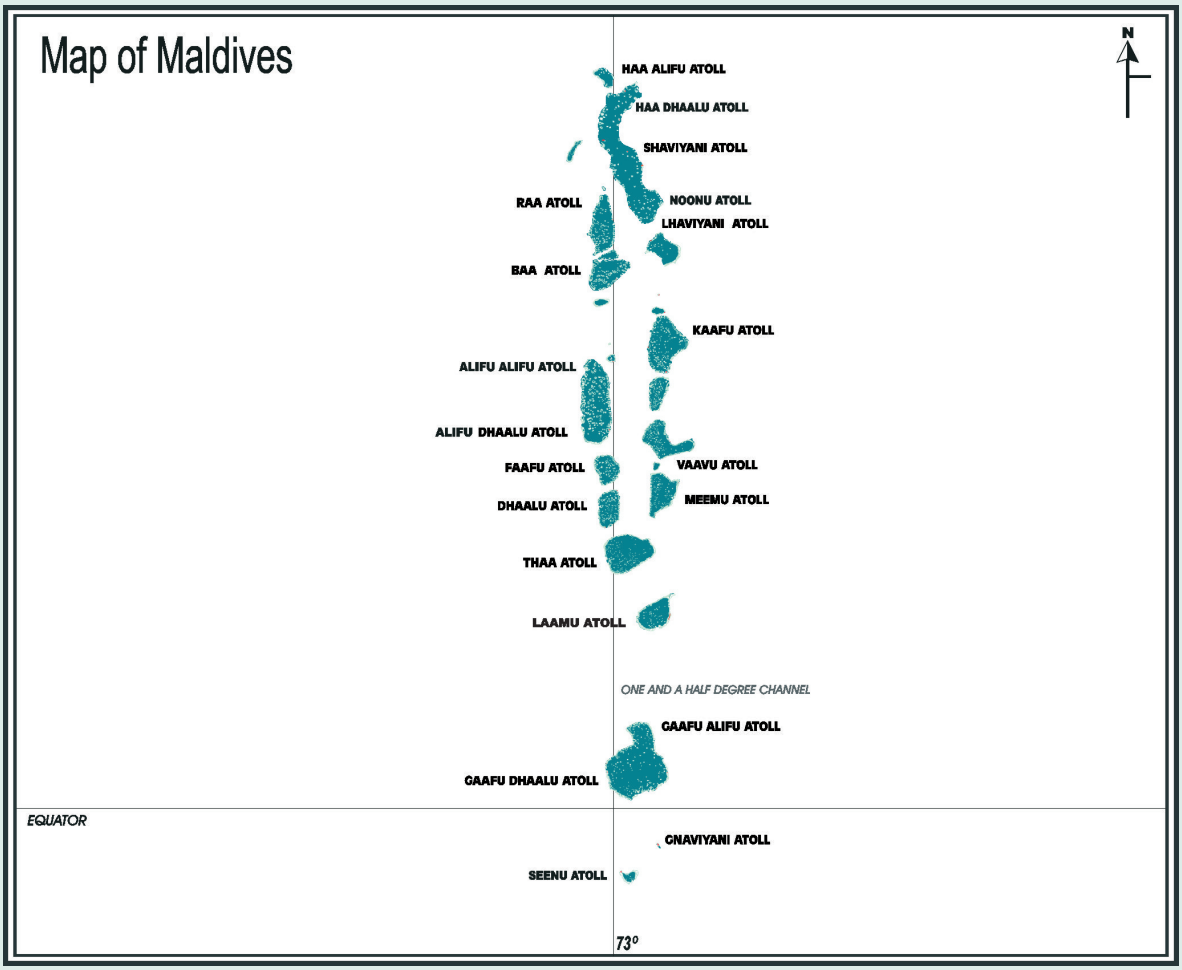
[4] Since the Global Diffusion of the Internet (GDI) project's inception in 1997, the Mosaic Group has studied the Internet in nearly 30 countries. See http://mosaic.unomaha.edu/gdi.html. [Accessed 4 February 2004].

2. Background

2.1 Geography[1]

The Republic of the Maldives consists of a chain of 1'190 coral islands spread over 100'000 square kilometers (820 kilometers from north to south) and 26 natural atolls[2], in the north central Indian Ocean (Figure 2.1). The northernmost atoll is located some 600 kilometers southwest of India and Male', the capital, is at a similar distance southwest of Sri Lanka. Only 199 islands are inhabited and almost 99 percent of the country's surface is ocean. Archeologists believe that the islands have been inhabited for over two thousand years. The name of the country is derived from the Sanskrit word, *Maladiv*, meaning a garland of islands. Administratively the Maldives is divided into 20 atolls.

Figure 2.1: Map of Maldives



Source: Dhiraagu.

2.2 Population[3]

According to the 2000 census, the population of the Maldives was 270'101, growing at two per cent a year during 1995-2000. The mid-year 2003 population was estimated at 285'066. The most populated island is Male', where almost 30 percent of the population live on some 1.77 square kilometres. This makes it one of the most densely populated capital cities in the world with over 41'000 people per square kilometre. The next most populated island has 9'500 inhabitants but most have less than 2'000 inhabitants (Figure 2.2). According to the national definition of *urban*, population residing outside of Male' is considered rural (72.6 percent). The 2000 Census reported 40'912 households with an average size of 6.6. The large household size is explained by the tradition of living with the extended family.

Ethnically Maldivians are Dravidian. While their origins go back to different groups, they are predominantly of Indian and Sri Lankan descendent. Maldivians are culturally homogeneous sharing one culture, one language and one religion. Everyone speaks Dhivehi, an Indo-Aryan language that is unique to the country. English is widely spoken by government officials and in the tourist industry and business sector. It is also the language of instruction in secondary school. The official religion is Islam, with the majority Sunni Muslims.

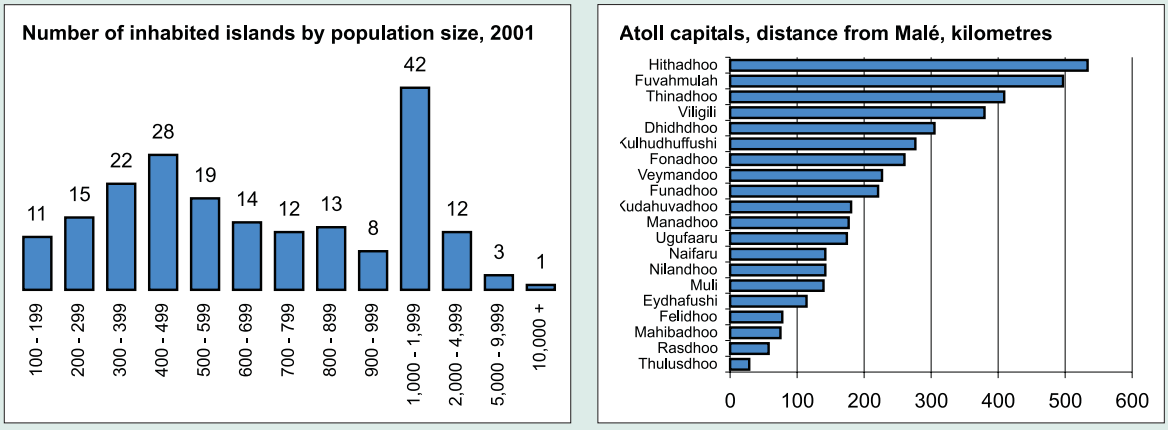
Table 2.1: Population indicators

Item	
Total population	270'101
Growth (1995-2000) (%)	2.00
Urban population (%)	27.4
Population Density (per/km2) - Male'	906 41'000
Age distribution (%): 0-14 15-64 65+	 40.7 55.1 3.7

Source: Ministry of Planning and National Development, Census 2000.

Figure 2.2: Geographic and demographic characteristics

Number of inhabited islands by population size, 2001 (left) and distance of atoll capitals from Male', kilometres (right)



Note: The total number of inhabited islands in the year 2000 was 200. In addition there were 111 non-administrative islands including tourist resorts, industrial islands and islands used for other purposes.
Source: ITU adapted from the Ministry of Planning and National Development.

2.3 Economy

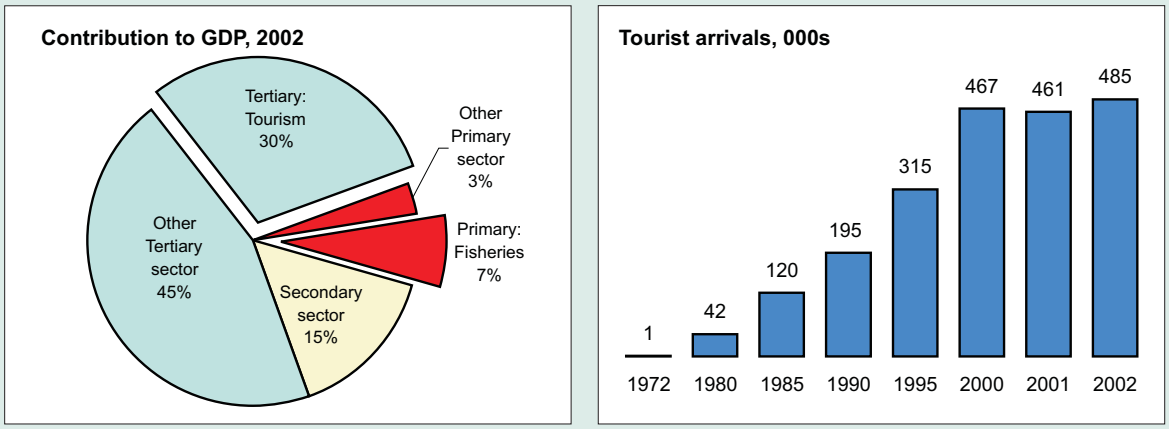
The Maldives, classified as a Least Developed Country (LDC), has few natural resources and scarce arable land. According to the Asian Development Bank, "*the combination of a small domestic market, remoteness, a dispersed population, and high internal transport costs poses formidable constraints to diversifying economic activity and delivering public services*."[4] Despite these limitations the country's economy has seen rapid growth, especially since the 1980s raising the Maldives from one of the 20 poorest countries in the 1970s to a middle-income country today. The two main engines of the economy are tourism and fishing, accounting for almost two fifths of Gross Domestic Product (GDP) (Figure 2,3, left). The tourism industry began around thirty years ago with two resorts and some 1'000 visitors. By 2002 tourism made up 30 percent of GDP and the number of tourists had grown to 485'000 (Figure 2.3, right). At the same time the country's limited resource base and reliance on export-oriented activities makes it vulnerable to external shocks. In the aftermath of the terrorist attacks of 11 September, the number of tourists dropped in 2001, the first ever annual decline.

The Maldives' development challenges are closely linked to its geographic and demographic situation. While the country's overall unemployment rate is low, a 1998 report found that 43 percent of the population, over 90 percent of which are outside Male', live on less than US$ 1.3 a day. Reducing this regional divide is a major government concern. One cause is the difficulty of providing services to small and dispersed locations. In that respect, the government has a programme encouraging inhabitants to move to more populated islands. However many people are reluctant to leave.

Besides vulnerability and regional inequity, the Maldives faces labour constraints. The population base is low and post-secondary training opportunities are limited. Consequently, the Maldives has to rely on expatriate workers (about one fourth of the labour force is foreign) and overseas educational institutions (to send students abroad for tertiary degrees).

Figure 2.3: Tourists welcome

Distribution of Gross Domestic Product, 2002 (left) and tourist arrivals, 000s, 1972-2002 (right)



Source: ITU adapted from the Ministry of Planning and National Development.

Table 2.2: Ranking Maldives human development

2001 data from UNDP 2003 Human Development Report

Maldives Human Development Indicators			*Ranking within groups*					
			South Asia		*Countries with similar income*		*Small Island States*	
Rank	*Indicator*	*Value*	*Rank*	*Country*	*Rank*	*Country (PPP)*	*Rank*	*Country*
86	Overall		**86**	**Maldives**	52	Cuba (5'259)	62	Mauritius
	Life expectancy	66.8	99	Sri Lanka	77	Suriname (4'599)	71	St. Lucia
	Literacy	97	127	India	**86**	**Maldives (4'798)**	81	Fiji
	School enrolment	79	143	Nepal	92	Guyana (4'690)	**86**	**Maldives**
	GDP per capita (US$, PPP)	4'798	144	Pakistan	105	El Salvador (5'260)	103	Cape Verde

Source: UNDP.

2.4 Quality of Life

Economic growth in the Maldives has gone hand in hand with gains in human welfare. The United Nations Development Programme (UNDP) ranked the Maldives 86th out of 176 countries in its 2003 *Human Development Report*. The ranking is based on a composite of four indicators: life expectancy, literacy, school enrolment and GDP per capita. The position of the Maldives, which places the country in the Medium Human Development group, is seven places higher than its GDP per capita rank, suggesting that it is doing better than average with regards to other indicators. For example the Maldives has a relatively high adult literacy rate compared to other countries with a similar income.

2.5 Government

Apart from brief interludes, the Maldives remained independent until 1887, when it became a British protectorate. It gained independence in 1965 and three years later it became a Republic. There are no structured political parties and candidates run on their personal qualifications. President Maumoon Abdul Gayoom is the second since independence and has been reelected every five years since 1978. The legislative assembly, the People's Majlis, is also elected every five years. The President appoints eight members while two members are elected from each of the twenty administrative atolls.

[1] Parts of this section have been adapted from the "Country Profile" page of the Ministry of Trade, Industries and Labour website at http://www.investmaldives.com/home.htm. [Accessed 4 February 2004].

[2] The word atoll comes from Dhivehi (the national language) and means a circular reef or ring of islands surrounding a lagoon.

[3] Parts of this section have been adapted from the Statistical Yearbook of Maldives and the Population and Housing Census of the Maldives 2000 available from the Ministry of Planning and National Development website at: http://www.planning.gov.mv. [Accessed 4 February 2004].

[4] Parts of this section have been adapted from the Maldives page on the Asian Development Bank website at http://www.adb.org/Maldives/default.asp. [Accessed 4 February 2004].

3. Pervaisveness

This chapter examines individual, household and community access to ICT (fixed and mobile telephones, computers and the Internet) as well as mass media (newspapers, radios and televisions) and compares the situation in the Maldives to other countries.

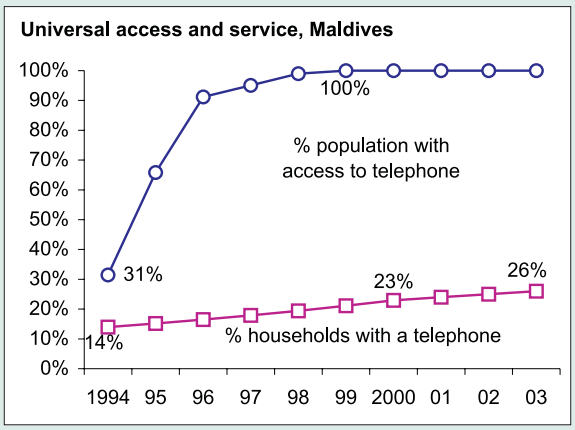
3.1 Telephony

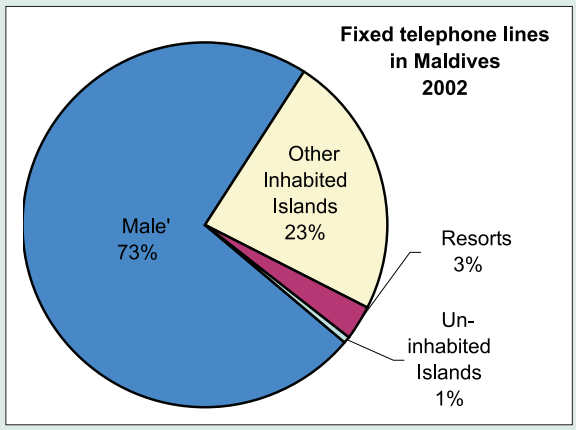
The Maldives has made tremendous progress in providing basic telephone access to its inhabitants. In 1999, it succeeded in providing telephone service to all 200 inhabited islands (Figure 3.1, left). Given the small size of most islands, this suggests that all inhabitants are within walking distance of a telephone. At least two payphones have been installed on each inhabited island, providing telecommunication access to 100 per cent of the population. Thus the Maldives has achieved *universal access to telephone service*. This is a remarkable accomplishment for a Least Developed Country (LDC). The five-year project to provide telephone service to all islands was fulfilled by the incumbent operator Dhiraagu as part of its license conditions. There were 30'056 fixed telephone lines at December 2003 for a telephone penetration of 10.5, the highest in the South Asia region and second highest among the LDCs.

Access to telecommunications is also being extended through the expansion of mobile cellular telephone services. Growth has been particularly high since the launch of pre-paid with the number of mobile subscribers surpassing fixed in April 2002 (Figure 3.2, left). Mobile is also well suited to the Maldivian environment of boat transport among the various

Figure 3.1: Universal telephone service and access

Percentage of population with access to fixed telephone and percentage of households with a fixed telephone, 1994-2003 (left) and distribution of fixed telephone lines by location, per cent, 2002 (right)

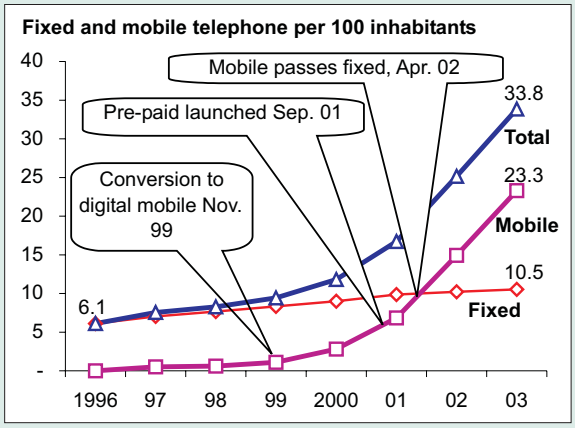


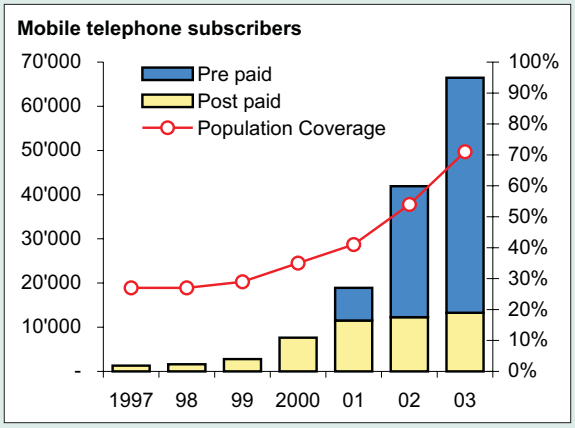


Note: In the left chart, data for 2000 for the percentage of households with a telephone is from the Census. Data for other years is calculated based on the number of residential lines adjusted for the estimated number of second telephone lines in households.
Source: ITU adapted from Dhiraagu and Ministry of Planning and National Development.

Figure 3.2: Mobile in Maldives

Fixed and mobile telephone subscribers per 100 inhabitants (left) and mobile telephone subscribers and population coverage (right)





Source: ITU adapted from Dhiraagu.

islands since cellular signals are available at sea in most atolls where there is mobile coverage. Mobile cellular coverage stood at 71 per cent in September 2003 with 82 islands and all resorts covered. At December 2003, there were 66'466 mobile subscribers (of which 80 per cent were pre-paid) for a density of 23.3 (32.8 if effective coverage is used). This is the highest in South Asia as well as among the LDCs.

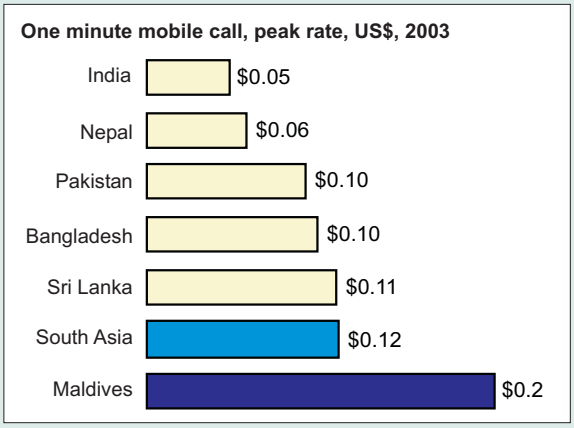
According to the 2000 Census, 23 per cent of homes in the Maldives had a fixed telephone line. This is up from an estimated 13 per cent in 1990. There is a large difference in *universal service* —defined as the number of households with a telephone— between Male' and the atolls. 71 per cent of household phones are in Male' which has a home fixed telephone penetration of 68.7 per cent compared to 8.7 in the atolls. One reason is that residential telephone service is only available on 12 islands. Male' also has a high second home telephone line ratio of 1.3. This is partly explained by the fact that many households have extended members residing in them (e.g., parents with grown children, relatives from the atolls, etc.). It could also partly be explained by usage of the second line for Internet access. There are no data on the number of households with a mobile telephone. Given the growth in cellular and the fact that residential fixed telephone service is not available on most islands, it is likely that universal service will most likely be accomplished through mobile. This is particularly important since the growth rate of fixed telephones in households has been stagnant over the last few years.

Universal telephone access policy has been based on subsidization of local fixed service. Tariffs for local telephone service have not changed since 1994. There is a nationwide connection charge of Rf 1'720 (US$ 134) and monthly subscription charge of Rf 30 (US$ 2.33) for fixed telephone service. Call charges are Rf 0.25 (US¢ 1.95) per minute (there is no off-peak rate) for fixed to fixed and Rf 2.00 (US¢ 16) for fixed to mobile. It would not appear that affordability is a major problem. The monthly subscription charge and 100 minutes of local calls would amount to 2.3 per cent of per capita income. The one time installation charge amounts to 5.9 per cent of per capita income. Technically there is no waiting list (it stood at 113 at the end

Figure 3.3: Mobile pricing

Comparison of monthly charges for mobile and fixed services in the Maldives, Rf, 2003 (left) and price of one minute mobile call, US$, 2003, South Asia nations (right)

	Mobile	*Fixed*	*Note*
Monthly charge	100 (US$ 7.78)	30 (US$ 2.33)	30 days validity for pre-paid; monthly rental for fixed telephone.
Call charge (per minute)	2.7 (US¢ 21)	0.25 (US¢ 1.95)	Peak. For fixed, refers to local call.
Usage charge	Included in voucher	9.26 (US$ 0.72) (37 minutes)	Mobile allows 37 minutes of peak time conversation with Rf 100 voucher.
Total charge	100 (US$ 7.78)	39.26 (US$ 3.06)	



Source: ITU adapted from Dhiraagu, World Telecommunication Development Report 2003.

of 2002) with service available on demand in the islands there are facilities.

The main problem to expanding *individual and household* access is a lack of service availability:

- Around sixteen per cent of households do not have electricity.
- At September 2003, 29 per cent of the population were not covered by the mobile cellular service.
- Residential fixed telephone service is available on twelve islands covering around forty per cent of households.

As mentioned, mobile service could be a solution for achieving higher levels of universal service in the Maldives. For that to happen, coverage needs to be expanded and pricing reduced. Coverage has steadily increased and is forecast to reach almost three quarters of the population by the end of 2003. This suggests that assuming the service were affordable, almost three quarters of households in the Maldives could have a mobile phone.

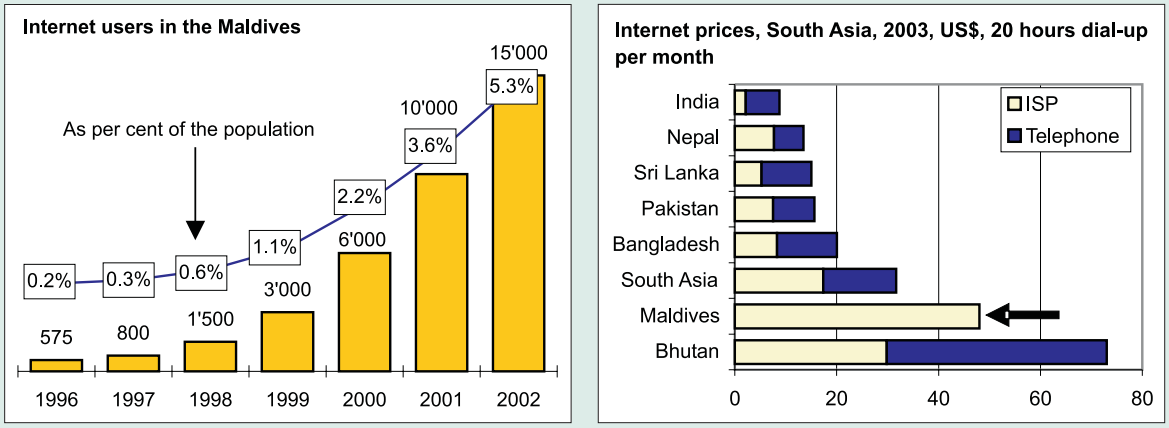
One way of analyzing the pentotial for mobile-fixed substitution is to compare the monthly costs of service. The cheapest pre-paid voucher is Rf 100 which allows 37 minutes of peak time conversation with an expiry of 30 days. This is more than twice as much as what it would cost a fixed line subscriber (Figure 3.3, left). This mobile premium is also reflected in regional comparisons. The Maldives has the highest per minute mobile call charges in the South Asia region (as well as the highest connection and SMS prices, Figure 3.3, right). Competition explains part of the difference with all South Asian nations except Maldives and Nepal having more than one mobile operator. However Nepal still has significantly lower mobile tariffs than Maldives.

3.2 Computers and Internet

There were an estimated 10'000 PCs in the country at the end of 2002. There is no local assembly and all PCs are imported. Import taxes on PCs are a moderate five per cent compared to an average of 21 per cent for other products. According to the *Population and Housing Census 2000*, the percentage of homes with a personal computer (PC) was 6.2. Like other ICT,

Figure 3.4: Internet users and pricing

Internet users and per 100 inhabitants, Maldives (left) and
Internet access prices for 20 hours of dial-up use per month, US$, 2003, South Asia (right)



Note: The right chart show the price of dial-up Internet use for 10 hours of peak and 10 hours of off-peak use per month. Telephone usage charges are included but not the line rental. In the case of the Maldives, there is no separate charge for telephone usage for Internet access.
Source: ITU World Telecommunication Indicators database.

the geographic distribution of PCs is uneven. Home PC penetration in Male' is 21.9 per cent compared to 1.3 per cent in the atolls.

It is estimated that approximately 14 per cent of homes in Male' had Internet access in October 2001 suggesting that more than half the home PCs have a connection.[1] Dhiraagu has had a program since 2000 with leading vendors to sell PCs already Internet ready.[2] Dhiraagu offers nationwide "pay as you go" dial-up Internet access, charging the same rate regardless of location. This means that dial-up Internet access is available anywhere in the Maldives where there is a telephone line. Around 500 users are also utilizing their mobile phones to access the Internet.

There are no official surveys on the number of Internet users in the country. Dhiraagu estimates that there were 15'000 users at the end of 2002 for a penetration of 5.3 per cent of the population. The estimated number of users is based on the following methodology:

- The number of telephone lines using the Dhiraagu "pay as you go" dial-up service is around 5'000 each month.[3] Dhiraagu estimates that on average two people use each line. That makes 10'000 users.

- Other customers with dedicated and broadband subscriptions such as government offices and large businesses many of which have LANs. This accounts for another estimated 5'000 users.

Internet penetration in the Maldives ranks it number one among South Asian nations, second among LDCs and 14th out of 38 small island states. The figure of 15'000 Internet users would not include people using Internet cafes. Thus, it is a conservative figure. A survey of the number of Internet users is critical to more accurately determine Internet usage in the country and to explore the digital divide in greater detail. It is estimated that 80 per cent of telephone lines used for Internet access are in Male'.

Dhiraagu offers several different Internet packages, all of which include telephone usage charges. Internet on demand—to a toll-free number—is Rf 0.55 (US¢ 0.4) per minute. This is the most popular option and used by the majority of dial-up users. Several monthly packages are available with per minute charges ranging from Rf 0.42 to Rf 0.33. These packages are used by less than 20 per cent of dial-up users. The entry-level package is Rf 100 (US$ 7.78) for four hours of usage. This amounts to 4.1 per cent of per capita income. Though not exorbitant, this package does not provide many hours of use inhibiting experimentation and the development of a vibrant Internet community. In terms of regional comparisons, Internet prices are high in the Maldives. The country has the second highest prices in South Asia, more than twice as much as what most other countries in the region charge (Figure 3.4, right).

There are a number of public Internet facilities. Dhiraagu has eight Internet cafes. Charges at its café in Male' are Rf 10 (US$ 0.78) for ten minutes. In addition, Dhiraagu provides a 75 per cent discount for educational institutions and encourages private companies to set up Internet cafes. There are 55 islands using dial-up Internet access, typically provided as a community centre type of operation. The monthly subscription is Rf 200 per month (normally 2'000 for non-residential islands) and Rf 1'720 for the installation. Dhiraagu also gives a twenty percent discount for calls.

3.3 Mass media

According to the 2000 Census, 56.7 per cent of homes had a television set. Of those, 85.7 per cent had a VCR/DVD player and nine per cent had a satellite dish. There are also between 5'000 - 7'000 cable television subscribers in Male'.

Broadcast media are government owned. The Voice of Maldives operates two radio channels one on the AM and the other on the FM band. It also provides audio streaming from its web site <www.vom.gov.mv>. Maldives Television operates one terrestrial channel. Limited terrestrial-based broadcasting explains the high demand for pre-recorded media and multi-channel television.

There are two daily newspapers with web sites, *Haveeru* and *Miadu*. They publish in Dhivehi with some English-language pages. The largest, Haveeru, reports a daily readership of 69.8 per cent of the population.[4]

[1] Ministry of Communication, Science and Technology. *e-Maldives: The Republic of Maldives National Information and Communications Technology Policy*. Draft. 2003.

[2] Dhiraagu. 19 September 2000. "Personal Computers Available "Dhivehinet-Ready" from Leading Maldives PC Vendors." *Press Release*. http://www.dhiraagu.com.mv/newsdesk/index.php?newsid=159. [Accessed 5 February 2004].

[3] This service requires no registration and is available from any telephone line in the country at the same rate. Speed is 56 kbps in Male' some other islands. The maximum speed outside Male' depends on the switch radio network interface.

[4] See the Haveeru web site at http://www.haveeru.com.mv/ads. [Accessed 5 February 2004].

4. Sector absorption

This chapter identifies the degree of utilization of Information and Communication Technology (ICT) in different sectors of the economy.

4.1 Education

The Ministry of Education (MOE, <www.moe.gov.mv>) is increasingly integrating ICT into its daily work. A 128 kbps leased line provides almost all staff at the ministry headquarters with access to the Internet. There are plans to expand the Ministry's Local Area Network (LAN) and to connect all educational institutions in the atolls to a Wide Area Network (WAN). The Ministry's web site offers statistics about the educational system, a directory providing links to web pages for four schools and information about studying abroad including scholarship application forms.

While every inhabited island in the Maldives has a primary school, secondary education is only provided at atoll capitals. Higher secondary schools exist in only three atolls outside Male' and of the 1'481 higher secondary school students, 84 per cent are studying in the capital. Primary and secondary schools in Male' have computer labs with access to the Internet. Some schools in the atolls are equipped with computers while a few have Internet access, typically restricted to staff.

The incumbent telecommunication operator Dhiraagu's *Internet for Schools* initiative provides discounted access.[1] Launched in November 2001, schools receive free installation, do not pay monthly subscription charges and get a 75 per cent discount on usage charges for dial-up access.[2] In July 2003 Dhiraagu introduced an Asymmetric Digital Subscriber Line (ADSL) 256 kbps package for educational institutions, which provides schools located in Male' unlimited usage for a fixed monthly rate of Rf 5'000 (US $389). Discounted Internet access is also available for private educational institutions that have been certified by the Maldives Accreditation Board.

Table 4.1: Maldives at school

March 2003

	Schools			*Students*			*Teachers*		
	Male'	*Atolls*	*Total*	*Male'*	*Atolls*	*Total*	*Male'*	*Atolls*	*Total*
Total	29	305	334	24'805	68'331	93'136	4'168	1'337	5'505
Primary (6-12 years)	16	213	229	13'763	52'406	66'169	2'951	693	3'644
Lower secondary (12-15 years)	11	89	100	9'803	15'683	25'486	1'194	566	1'760
Higher secondary (16-17 years)	2	3	5	1'239	242	1'481	23	78	101

Source: Ministry of Education.

The government contracts the private sector to install and maintain ICT equipment for schools that lack the expertise. In some schools that are poorly equipped, mainly in the atolls, parents have donated computers.[3]

The *Sixth National Development Plan* (NDP)[4], which defines government policies for the period 2001-2005, highlights the need to expand and promote ICT in education, including the reduction of Internet charges and improved connectivity. The NDP also emphasizes the use of ICT for management purposes. The MOE is drafting a strategy document that discusses ways of using ICT as a tool to improve educational institutions by making them more efficient und improving communication. Goals include establishing a school network to share educational resources and making use of distance education. The draft identifies a number of concrete goals such as providing all schools with a computer, providing all teachers with email and providing Internet access to all schools.

The *Maldives College of Higher Education* (MCHE, <www.mche.edu.mv>) established in 1998, provides post-secondary education. There are some 6'800 full and part-time students attending MCHE. Within the MCHE, the *Faculty of Management and Computing* has several computer laboratories. There are plans to expand facilities including establishing a network as well as additional computer laboratories in order to increase capacity to at least 100 students at any given time. Students enrolled in computer related programs have free Internet access. According to the results of a questionnaire filled out by students and academic staff, the main barriers for using ICT is the lack of available resources. Twenty percent, for example, said it was difficult or impossible to find a computer most of the time.

MCHE's 2002-2004 *Information Technology Strategic Plan* calls for the expansion of network infrastructure and coordination of ICT resources to enhance access to information and improve management and administration.[5]

Distance education is used to a limited extent. MCHE provides educational services to the atolls through the *Centre of Open Learning*. Students from over 100 islands meet in one of the 15 centres that are located across the country once a month for a period of two days. The MCHE provides the educational material. Some 50 percent of the exams are taken under supervision. ICT is primarily used for telephone and email contacts between students and tutors (assuming the services are available). The *Distance Education Project* has made available the programmes of India's Indira Gandhi National Open University (IGNOU) to Maldivian students for over a decade. The *Tertiary Institute of Open Learning* at MCHE coordinates the project. The Indian government provides scholarships for Maldivian students to pursue studies via the IGNOU distance mode.

4.2 Business

There are no formal statistics regarding ICT use in the business sector although one 2001 survey found that 86 per cent of businesses in Male' had Internet access.[6] Ancillary evidence suggests that most large companies and certain industries would have PCs and access to the Internet. This is particularly true in the tourism industry where most of the resorts have web sites or email.[7] There are five companies in the banking sector; they all have email and one has a web site.[8] The Maldives Customs reports that 85 per cent of declarations from substantial importers are transmitted electronically.

The extent of computerization and Internet access among smaller establishments is uncertain. The Ministry of National Planning and Development estimated that there were 4'565 small establishments in 1999 employing roughly 10'000 people.[9]

4.3 Government

The use of ICT within ministries is widespread and most government office workers have access to a PC and the Internet. The Internet is primarily

used for research and email. The majority of government agencies in Male' have Internet access through a leased line and are connected through a Local Area Network (LAN). At the regional level, only the atoll offices are equipped with Internet access and this is usually dial-up access and expensive.

Databases are among the most popular application and exist in almost every ministry. There is some duplication and a few ministries continue to keep written records of documents already in electronic format. The Ministry of Finance and Treasury is currently computerizing the national accounting and debt management systems and there are plans to expand the use of ICT in the financial area to other ministries. Most ministries also have web sites or web pages.

One of the most extensive users is the Maldives Airport Company, a government-owned enterprise under the Ministry of Transport and Civil Aviation. Its building is wired for 100 Mbps Ethernet and every employee has had individual Internet access and email since 2001.

Given the fact that the government sector is one of the country's major employers, providing government personnel with access to ICT is bringing the Maldives a major step torwards becoming e-ready. Almost 27'000 people, close to ten percent of the population, worked for the government in 2001.

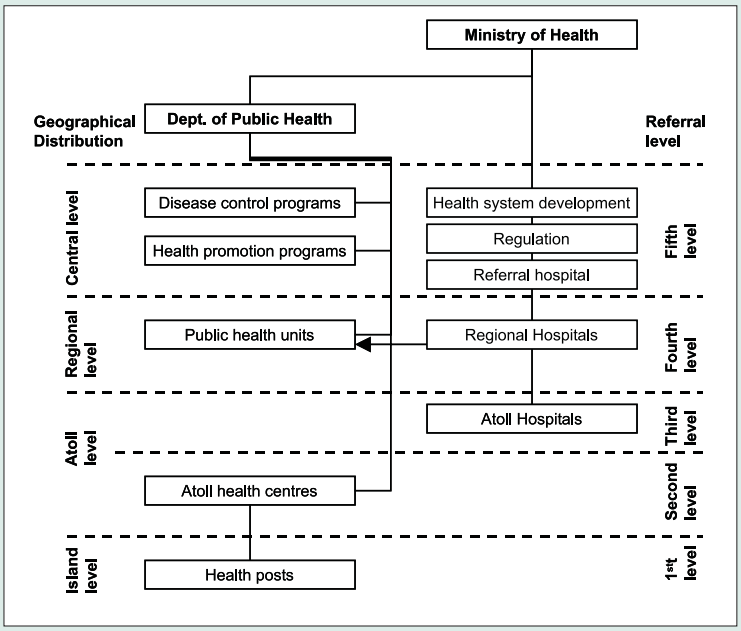
The Maldives recently launched a comprehensive e-government project. The Information Technology Development Project (ITDP) includes setting up a network to connect agencies in Male' and 20 atolls, developing a government portal and providing online services. The ITDP also aims to overcome the lack of coordination between ICT projects in the government. Currently, each government entity is in charge of its own ICT budget and there are no guidelines about how much should be spent on ICTs. This will change with ITDP, which will broadly define ICT expenditure and ensure that every agency has a minimum of ICT equipment.

One of ITDP's main objectives is to connect all government agencies — those in Male', in the atoll capitals, and eventually the island administrations — to a common network. This will allow the different government bodies to share databases and easily exchange information. The network in Male' will be high-speed, using fibre optic with the technology for the atoll backbone under discussion. The top level design of the project is near completion. It broadly defines the project's architecture and objectives, including the choice of online applications, which have been discussed with different government bodies. The implementation of the project, which is overseen by the Ministry of Communication, Science and Technology (MCST), is expected to begin early 2004.

4.4 Health

Medical services are provided at the Indira Gandhi Memorial Hospital in Male' (the country's main hospital), one private hospital in Male', six regional

Figure 4.1: Health system in the Maldives



Source: Ministry of Health.

hospitals, and four atoll hospitals. In addition, every atoll has at least one health centre. Medical services on other islands are provided through health posts (Figure 4.1).

The Ministry of Health is in charge of overall policy and delivering basic services to the atolls and islands. The main use of ICT in the health sector is within the Ministry. There are 70 computers connected to a LAN at headquarters in Male' for 124 employees. Although all terminals have high-speed Internet access, the most popular application is the exchange of information and email. Some work of the Ministry is computerized and a number of databases are used to manage and store information, for example on birth and death registrations. While all 12 hospitals have Internet access, there is no overall health network. Also, the use of the Internet as a research tool is limited. The Ministry website has information on the health system, including surveys, statistics, reports and conference papers. It also provides information on job vacancies in the health sector, links to news articles, and an interactive map with the main health indicators for each atoll. Users can also join a health discussion forum to post messages, search the site and ask questions via email. Besides the Ministry most other health related organizations have web sites (Table 4.2).

Telemedicine is carried out between two atoll hospitals and the Indira Gandhi Memorial Hospital in Male'. The transfer of images has helped improve health care but since the hospitals have dial-up connections with narrow bandwidth, the applications used are limited. The dial-up connection does not support advanced telemedicine applications, such as teleconferencing, which would need at least a 512 kbps connection. The lack of ICT skills among personnel is a further barrier to greater use of telemedicine. Discussions have been held with India regarding the use of telemedicine to link Maldivian health centres with hospitals in India.[10] The ITDP project calls for a Hospital Information System that would computerize patient records adding to time savings for medical staff (Chapter 7).

Table 4.2: Health online

Maldives health organizations with web sites

Ministry of Health	www.health.gov.mv
Department of Public Health	www.dph.gov.mv
Maldives Nursing Council	www.maldivesnursingcouncil.gov.mv
Maldives Medical Council	www.maldivesmedicalcouncil.gov.mv
Board of Health Sciences	www.health.gov.mv/hsb
Indira Gandhi Memorial Hospital	www.igmh.gov.mv

Source: Ministry of Health.

[1] Dhiraagu. "Internet for Schools." *Press Release*. 4 November 2001. http://www.dhiraagu.com.mv/newsdesk/index.php?newsid=106. [Accessed 4 February 2004].

[2] In Male, access is via a 64 kbps ISDN line while on the islands it is via analogue dial-up. Schools on islands without residential telephone service must pay an Rf 300 monthly subscription. See "Internet Access for Schools" on the Dhiraagu website at http://www.dhiraagu.com.mv/dhivehinet/accessforschools. [Accessed 5 February 2004].

[3] Analysis of Science & Technology Capacity and Needs. Republic of Maldives Science and Technology Master Plan. Prepared by the Ministry of Communication, Science and Technology, April 2001.

[4] Maldives Sixth National Development Plan (2001-2005), at: www.presidencymaldives.gov.mv/v3/pages/body.phtml?ID=12&Table=Head2&PTID=4. [Accessed 1 February 2004]

[5] Maldives College of Higher Education. *Information Technology Strategic Plan*. Draft.

[6] Ministry of Communication, Science and Technology. 2003. *Policy Framework for e-Maldives. The Republic of Maldives National Information and Communications Technology Policy*. Draft.

[7] The following web site has a directory with web site links of resorts in the Maldives: http://www.maldivesresorts.com. [Accessed 1 February 2004].

[8] See the "Financial Institutions" section on the Maldives Monetary Authority web site. http://www.mma.gov.mv/fi.php?itm=1. [Accessed 1 February 2004].

[9] See Ministry of National Planning and Development. *Small Establishment Survey 1999*. 11 June 2001. http://www.planning.gov.mv/stat/ses/ses.htm. [Accessed 1 February 2004].

[10] Speech by the Prime Minister of India Shri Atal Bihari Vajpayee At the Civic Reception in Male. 23 September 2002. http://www.meadev.nic.in/speeches/stmt-pm-civicreceptioninmale.htm. [Accessed 9 February 2004].

5. Connectivity

5.1 International and domestic backbone

Maldives first connected to the Internet on 14th October 1996 through a 64 kbps satellite connection. At June 2003, Maldives had 16 mega bits per second (Mbps) of asymmetrical (9 incoming and 7 outgoing) international Internet connectivity, all through satellite.[1] There are four routes: a symmetrical connection to the United Kingdom (terminated at Cable and Wireless), a connection to Hong Kong, China (terminated at Reach), a connection to Germany (terminated at the Deutsche Commercial Internet Exchange) and a connection to Singapore (terminated at the Singapore Telecom Internet exchange). The first three links are on the same satellite, Intelsat, and the latter on the Singapore Telecom satellite.

The Telecommunication Policy paper calls for the Maldives to examine the feasibility of a fibre optic connection to the Internet. One possibility would be to connect to one of the three undersea fibre routes passing nearby: the *Fibre optic Link Across the Globe* (FLAG), *South Asia Far East* (SAFE) and *South East Asia-Middle East-Western Europe* (SEA-ME-WE) (Figure 5.1). All have termination points in India or Sri Lanka. Another option is to connect to a new undersea fibre optic system such as a proposed

Figure 5.1: So close and yet so far

Undersea fibre optic systems passing near Maldives

Source: ITU adapted from Alcatel, FLAG Telecom, www.safe-sat3.co.za.

cable between Cochin, India and Mombassa, Kenya. The Maldives could either tap directly into an undersea cable or establish a fibre link to India or Sri Lanka and then leverage from those countries connections. Tentative inquires have been made with an estimated figure of US$15 million given for a fibre optic connection between Male' and Cochin, India, a distance of around 540 kilometres. This is around twice Dhiraagu's combined capital expenditure for the last two years and is felt to be too high.

Dhiraagu pays US$ 1.3 million a year for international Internet bandwidth. This works out to around US$ 12'000 per month per Mbps. In contrast, another small island state with undersea fibre connectivity Mauritius pays less than half that (US$ 5'000 per month). The higher cost thus seems to be partially due to higher prices for satellite connectivity and the relatively small bandwidth ordered.

Table 5.1: International connectivity

Maldives international Internet bandwidth indicators, 2001

	Value	*Rank*
Overall		10
Bit-Circuit Index	0.4	16
Bit-Minute Index	0.3	18
Bits per capita	16.4	13
Bits per subscriber	409	1

Note: Bandwidth used for calculations was based on incoming only (4.5 Mbps in 2001). Ranking carried out for 37 countries. *Bit-Circuit-Index* refers to international Internet bandwidth divided by the number of international telephone circuits (converted at 64 kbps per circuit). *Bit-Minute-Index* refers to international Internet bandwidth divided by the number of outgoing and incoming international telephone minutes. *Bits per capita* refer to international Internet bandwidth divided by the population. *Bits per subscriber* refer to international Internet bandwidth divided by the number of Internet subscribers.
Source: ITU *Asia-Pacific Telecommunication Indicators 2002*.

Maldives scored relatively well in a comparison of international Internet bandwidth for Asia-Pacific countries (using 2001 data). The ranking was based on three bandwidth indicators and the Maldives ranked 10th overall out of 37 economies (Table 5.1). The Maldives rank is pulled up because it scored first in the amount of bandwidth per subscriber. In retrospect this was calculated only on monthly subscriptions rather than pay as you go users. For other parameters, it appears that the Maldives does not have sufficient bandwidth and has not yet made the transition to an Internet economy (more Internet bandwidth capacity than equivalent voice telephone circuits).

Dhiraagu has a backbone connecting all inhabited islands. The network is microwave except for a domestic satellite link to the south because the distance is too far. No data protocols are used over the backbone.

5.2 Exchange points

The need for a national Internet exchange has thus far not been necessary. Since Dhiraagu controlled the international link, it performed the same function as long as it only routed overseas traffic abroad. In addition, most Maldives Internet traffic is to web sites abroad given the English proficiency of the population and the volume of content available in those languages overseas. With the introduction of a second ISP and the development of local content (e.g., e-government project, domestic e-mails), it is logical to create a national Internet exchange. Otherwise, locally destined traffic will be routed abroad, adding to expensive international Internet connectivity charges. Although the new ISP and Dhiraagu have had discussions, no decision has been reached.

5.3 User access methods

Dial-up is the prevalent Internet access method with some 5'000 subscribers.[2] Asynchronous Digital Subscriber Line (ADSL) was

launched in August 2002 and had 503 subscribers at December 2003. ADSL is only available in Male'. There were also 62 leased lines and 187 ISDN lines for Internet access at December 2003.

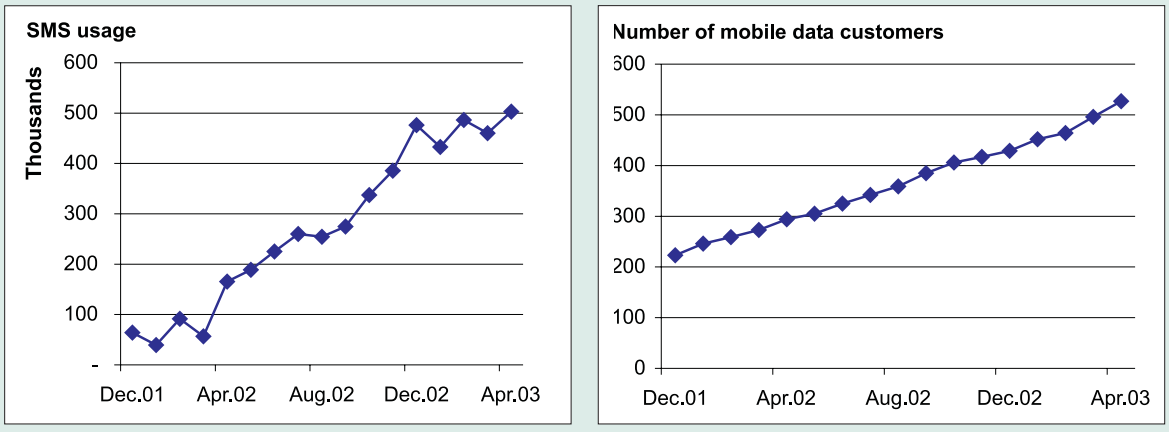
There are two cable television operators with around 7'000 subscribers. One has a network in Male' based on coaxial cable.[3] Another operates a Multipoint Microwave Distribution System (MMDS). Another company is in the process of installing a hybrid fibre-coaxial cable network in Male'. Although most cable TV subscribers are in Male', it is also available on some of the other islands. It would appear that the new cable network could support high-speed Internet access via cable modem.

Mobile Internet (e.g., Wireless Access Protocol (WAP)) and high-speed mobile (e.g., General Packet Radio Services (GPRS)) services are not currently available. Nevertheless, there is a growing market for mobile data services. Short Message Service (SMS) volume has been growing and reached around 11 per subscriber in December 2002 (Figure 5.2, left). A growing number of users are utilizing their mobile phones as modems (at speeds of 9.6 kbps) for Personal Digital Assistants (PDA) or notebook computers to access the Internet. There were 500 such users in April 2003, up from around 200 in December 2001, suggesting the potential (Figure 5.2, right). Dhiraagu plans to launch GPRS in 2004. The Telecommunications Policy calls for a feasibility study about the introduction of third generation mobile service (3G).

Wireless Local Area Networks (WLANs) using the popular IEEE 801.11b standard (i.e., Wi-Fi) are used by some organizations. There are not any publicly accessible hotspots in Internet cafes, coffee shops or other public locations. However some resorts have set up hotspots for their customers. The new ISP has been given exclusivity for the use of the 2.4 GHz band for Internet services for a year and half.

Figure 5.2: Mobile data

Number of SMS messages (left) and number of mobile data customers (right)



Source: ITU adapted from Dhiraagu.

[1] Dhiraagu adds incoming and outgoing bandwidth to calculate total international Internet bandwidth.

[2] There are some 1'100 subscribers to monthly Internet subscription packages with the remainder using Dhiraagu's pay as you go scheme.

[3] J-sat Communication Cable Vision service http://www.j-sat.com.mv. [Accessed 8 February 2004].

6. Market

6.1 Overview

The *Ministry of Communications, Science and Technology* (MCST, <www.mcst.gov.mv>) is responsible for ICT sector policy.[1] There is no telecommunication law with needed guidelines issued through specific regulations or decrees. The Information Technology Development Project (ITDP, see Chapter 7) calls for the creation of a telecommunication law. A Telecommunication Policy was published in 2001.[2] This document has six main goals (Table 6.2) backed by specific objectives and actions. A number of the objectives have been met since the policy was issued and some are to be addressed by the ITDP.

The *Telecommunications Authority of Maldives* (TAM) was established in late 2003 as industry regulator. The functions had previously been carried out by the Post and Telecommunication Section of the MCST. The TAM covers both the telecommunication and postal sectors. Its duties include licensing operators, tariff regulation and monitoring quality of service.

Although The Maldives is a member of the World Trade Organization (WTO), it did not participate in the negotiations on basic telecommunications services and therefore did not made a formal commitment to liberalization.

Dhivehi Raajjeyge Gulhun Private Limited (Dhiraagu, <www.dhiraagu.com.mv>) is the incumbent telecommunication provider. It began operation in October 1988 as a joint venture company, 55 per cent owned by the government and 45 per cent by Cable and Wireless of the United Kingdom. Dhiraagu provides fixed (including national and international long distance), mobile and Internet services with exclusivity for fixed services through 2008. Other services are open to competition although only one license, for Internet access service, has been issued thus far.

Table 6.1: Maldives telecommunications milestones

Maldives international Internet bandwidth indicators, 2001

1943	Wireless radio circuit established to Sri Lanka
1955	First telephone exchange installed in Male'
1967	Radiotelephone service begins to be introduced in atolls
1968	First public telephone exchange
1977	International satellite earth station established
1988	Dhiraagu created
1996	Commercial Internet services introduced
1997	Analogue mobile cellular service introduced
1999	All inhabited islands have telephone service
1999	GSM cellular mobile service introduced
2003	License issued for second ISP

Source: ITU adapted from Dhiraagu, other sources.

Table 6.2: Maldives Telecommunication Policy

Policy	Objective	Action
1. Reduce charges of all telecommunication services	1.1: Reduce the disparity in telecommunication charges between Male' and the rest of the country.	1.1.1 Abolish the differences in telecommunication charges among all inhabited islands, within a period of 3 years. In doing so, priority must be given to selected areas for economic activities, islands identified as growth centres, and densely populated islands.
	1.2: Lower Internet charges	1.2.1 Reduce charges for Internet dial-up service within the next three years. • Separate Internet charges from telephone usage charge. • Establish Internet 'access nodes' throughout the country. • Introduce flat rate usage packages for Internet use instead of charging per minute. 1.2.2 Reduce charges for Internet leased lines.
	1.3: Reduce International call charges	1.3.1 Reduce the international call charges to destinations where there is main traffic from the Maldives so that collection charges at both ends are similar. 1.3.2 Seek to reduce accounting rates. 1.3.3 Introduce cheaper means of making international telephone calls. 1.3.4 Allow Internet phone service for public use. Introduce services such as GMPCS and Inmarsat service.
	1.4: Reduce leased line charges	1.4.1 Reduce leased line charges. • Reduce leased line charges to a level comparable to that of other countries in the region. • Allow resale of leased line capacity. • Licence additional leased line service providers.
	1.5: Reduce chargeable unit	1.5.1 From 1st January 2002 chargeable unit shall be 6 seconds. 1.5.2 From 1st July 2002 chargeable unit shall be 1 second.
	1.6: Set a cost related tariff for service provision	1.6.1 With effect from 2002, telecommunication companies should implement accounting separation for each service they provide, in a manner required by the Government. 1.6.2 The Regulator shall determine the tariff. In determining the tariff, the Regulator will consider the tariff proposed by a service provider. The Regulator reserves the right to change a tariff if the existing tariff is deemed to be inappropriate. 1.6.3 The Regulator shall determine the need and level of subsidy required for the provision of a service. 1.6.4 Establish a 'Universal Services Fund'. All service providers must contribute to this fund. The Government will determine the amount of contribution.
2. Expand telecommunication services and to reduce the disparity in service provision between Male' and the other islands.	2.1: Provide country-wide telephone service on demand on an equal basis	2.1.1 Telecommunication service providers shall make arrangements, in accordance with a schedule laid down by the Government, to provide telephone service on demand and on an equal basis. 2.1.2 Islands within mobile coverage area and where there is no telephone network, provide residential telephones using fixed mobile phones at a rate cheaper than normal mobile service. 2.1.3 In islands where Dhiraagu has not provided telephone networks, Government should encourage local communities to install and operate their own telephone network. Arrangements shall be made to facilitate the availability of trunk lines at a cheaper rate. 2.1.4 Increase the number of public telephone booths in relation to the size and population of the islands. 2.1.5 Facilitate the resale of telephone, fax and Internet services at local shops / small businesses and community centres.
	2.2: Expand mobile telephone service to the whole country	2.2.1 Provide mobile telephone service to all tourist resorts. 2.2.2 Provide mobile telephone service to all inhabited islands of an atoll where there is a tourist resort. In doing so, the entire atoll and the sea between the atolls where service is provided must be covered. 2.2.3 Expand the mobile telephone service to all islands.
	2.3: Provide high speed Internet service throughout the country	2.3.1 Establish at least one access node in each atoll, and an additional access node in Male' Atoll on an island other than Male'. 2.3.2 Provide cheaper leased lines between users and access nodes and introduce modern technology such as wireless LAN / WAN. 2.3.3 Use broadband technology such as DSL to provide high-speed Internet services. 2.3.4 Enhance the existing telecommunication infrastructure and establish a wideband data network throughout the country.
	2.4: Increase capacity of international connections	2.4.1 Carry out a feasibility study within the next 3 years to connect Maldives to the worldwide optical fibre submarine cable network. If feasible, make plans to implement it.

Table 6.2: Maldives Telecommunication Policy (cont'd)

Policy	Objective	Action
3. Provide the necessary means and powers to the Regulator through an appropriate legislative framework to strengthen the telecommunication sector	3.1: Strengthen the legislative framework of the telecommunications sector	3.1.1 Formulate a telecommunication legislative framework. • This legislative framework should define the powers and responsibilities of the Regulator. It should also cover the rights and obligations of the consumers and the service providers as well as procedures for licensing, controlling and determining tariffs.
	3.2: Distance the Regulator from the management of the telecommunication company.	3.2.1 Government shareholding in a telecommunication company should be represented by an organisation other than the Regulator or the Ministry responsible for telecommunication policy. 3.2.2 No members of the Regulator or the Ministry responsible for telecommunication policy shall be on the Board of Directors of any telecommunication company.
	3.3: Enhance and strengthen the Regulator	3.3.1 Provide Regulator the freedom to discharge its regulatory functions. This would facilitate the implementation of international best practices in regulating the sector. 3.3.2 Enhance skills and resources of the Regulator in order to be effective in a competitive business environment.
Open the telecommunication sector and encourage competition	4.1: Open telecommunication services for competition	4.1.1 Open Internet service for competition. 4.1.2 Open mobile telephone service for competition. 4.1.3 Permit new licensees to build and operate their own national infrastructure and international connections to provide telecommunication services. 4.1.4 Carryout a feasibility study and work towards introduction of third generation mobile service (3G) in the Maldives. 4.1.5 Exclusivity will not be granted to any telecommunication service, after the expiry of the existing telecommunication operating licence and inform of this decision to stakeholders. 4.1.6 To open all telecommunication services for competition in accordance with the guidelines laid down by the Government.
	4.2: Make available resources required for the telecommunication operators	4.2.1 Formulate a new national numbering plan for telecommunication services. Such a numbering plan is required to allocate number blocks to various service providers in a fair and equitable manner. Frequent changes of the numbering plan would have a long-term detrimental effect to a large segment of the population. For these reasons, in other countries, the national numbering plan is managed by the regulators. 4.2.2 Assign the Regulator with the function of formulation and management of a long-term National Numbering Plan. 4.2.3 Assign and reserve the frequency band required for prospective mobile telephone operators. • Not to allocate full mobile band to any one operator. • If channels are used throughout the whole GSM mobile band, move the occupied channels to one end of the band and make room for a prospective mobile operators within a specified timeframe. 4.2.4 Establish a framework to facilitate interconnection among different networks and services. 4.2.5 Assign the Regulator with the function of registration and management of the Internet domain names of the Maldives.
5. Make Government revenue from the telecommunication sector less dependent on the profit of the sector.	5.1: Identify additional sources of revenue for the Government from the telecommunication sector	5.1.1 Set the Licence Fee for telecommunication companies to a level that is appropriate to the financial position of a company. 5.1.2 Introduce a tax regime for telecommunication companies. If such a tax is levied, the licence fee shall be a fixed amount. 5.1.3 Radio frequency spectrum being a limited natural resource, introduce appropriate charges for the utilisation of the spectrum. 5.1.4 Charge the operators for telephone number blocks allocated to them. 5.1.5 Charge for the registration of Internet domain names.
6. Facilitate the use of info-communication technology in all areas of development	6.1: Reduce the digital divide within the country	6.1.1 Conduct ICT awareness and training programmes to promote usage of infocommunication technology. 6.1.2 Establish community tele-centres throughout the country to provide affordable and easy Internet access. 6.1.3 Plan to establish a wideband data network connecting the entire country using the most appropriate technology. 6.1.4 Develop human resources required for info-communication needs of the country and retain them within the country.

6.2 Fixed

Maldives is a relative latecomer to telecommunications with the first telephone only being installed in 1955 and the first public exchange in 1968. Since then, the market has grown tremendously with the average annual increase in main lines between 1980-2000 standing at 16 per cent. The growth rate has declined to half of that over the last few years as the addressable market approaches saturation and mobile becomes more popular. At April 2003, there were 29'081 fixed lines in service for a penetration of 10.1

Network usage grew rapidly in the late 1990s as more islands became connected to the backbone network and the volume of telephone traffic grew rapidly. However domestic fixed line traffic has been in decline the last few years as users migrate to using their mobile phones more. Outgoing international traffic has also been stagnant the last few years, with the volume of incoming traffic growing. This is a result of asymmetrical international tariffs with it being more expensive to make international calls from the Maldives than the reverse. Increased mobile roaming has also impacted international outgoing calls.

6.3 Mobile

Dhiraagu is currently the only mobile operator. It launched an analogue Advanced Mobile Phone System (AMPS) in 1997. At the time, forecasts called for no more than 300 subscribers by the year 2003. This forecast was exceeded and by 1999, the system had already reached its capacity. The decision was taken to replace the AMPS system with a digital Global System for Mobile (GSM) network, launched in November 1999. Existing AMPS subscribers were provided incentives to switch to the new network and the AMPS network was closed down. Pre-paid was launched in September 2001, expanding the opportunity for mobile access. In less than a year there were more pre-paid than post-paid subscribers. In April 2002, the number of mobile subscribers surpassed fixed subscribers. At April 2003, the number of mobile subscribers was 48'204 for a penetration of 17.2 (31.8 when considering only the population covered by mobile service). The number of pre-paid subscribers was 35'765 or 74 per cent of the total.

Dhiraagu has steadily expanded coverage. Towards the end of 2003, population coverage stood at 71 per cent. The network covers 82 inhabited islands in 18 atolls and all 88 tourist resorts. Tourists are a lucrative market with roaming accounting for almost half of Dhiraagu's mobile revenue. Dhiraagu has roaming agreements with 99 mobile operators in 52 countries.

The Telecommunication Policy paper calls for opening the mobile market to competition. A tender for a second mobile operator should be issued in 2004.

6.4 Internet

Dhiraagu launched Internet service in October 1996. It brands the service as DhivehiNet. Dhiraagu offers dial-up, broadband (ADSL) and leased line access; web hosting; and also manages the .MV domain name. Regarding the latter, Dhiraagu is the administrative contact registered with Internet Assigned Numbers Authority (IANA) for the .MV domain name.[3] Registration information is available on the Dhiraagu web site.[4] Domain names are bundled with an email and cost a relatively high Rf 500 (US$ 38.91) to set up with a monthly subscription fee of Rf 100 per month (US$ 7.78 or US$ 93.39 per year).[5] Dhiraagu recognizes that the government should undertake domain name registration but it is waiting for the proper skills to be available before transferring responsibility. The Telecommunication Policy calls for transfer of domain management and administration to the regulator.

The first market segment where the telecommunication sector has been liberalized is Internet access. Following a tender, Focus InfoCom (majority-owned by a local company Focus Computers, www.focuscomp.com)

won the beauty contest for an Internet Service Provider (ISP) license. Despite the small market size, the tender for a second ISP attracted significant interest. There were initially six applicants of which two dropped out; the remaining ones included investors from Pakistan and Sri Lanka. The government selected the winner based on track record and plans for meeting universal service obligations (i.e., requirement to provide Internet services in the entire country within the next ten years). For three years, the market will remain a duopoly. Focus paid US$5'000 for the license and will pay annual fees amounting to five per cent of gross revenue.

Focus Computers was established in 1994. Business activities include integration services, distribution of PCs, and training courses. It has some 70 staff and three offices in the country. Focus Computers has an 83 per cent stake in Focus InfoCom. A local cable TV operator owns the other part but the shareholding might change, although Focus has to keep the majority (based on terms of license).

As part of the license award, Focus was granted the exclusive right to the 2.4 GHz frequency for the provision of Internet use for several years. This is the same frequency that the popular IEEE 802.1a standard (i.e., Wi-Fi) uses. The rationale was that this would offset the inherent advantage the incumbent has. It is logical to assume that Focus will be pursuing a wireless strategy in providing access to its customers.

[1] The Ministry of Broadcasting covers radio and television broadcasting.

[2] MCST. *Maldives Telecommunication Policy 2001-2005*. August 2001. http://www.mcst.gov.mv/Downloads/Documents/Telecom%20Policy-Public.pdf. [Accessed 1 February 2004].

[3] See the "Root-Zone Whois Information" for the Maldives on the IANA web site at http://www.iana.org/root-whois/mv.htm. [Accessed 7 February 2004].

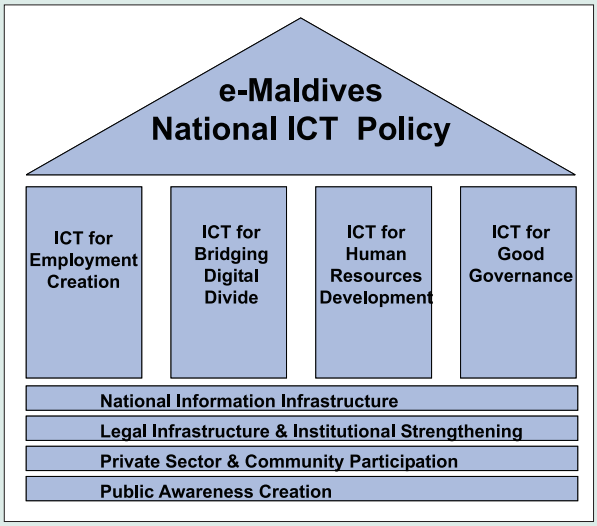
[4] Dhiraagu's Domain Name Service is available at http://www.dhiraagu.com.mv/dhivehinet/domainnames/. [Accessed 7 February 2004].

[5] In contrast, domain names using .COM as well as other suffixes are available from the registrar Network Solutions for US$ 34.99 per year with no set up costs. See http://www.networksolutions.com/en_US/name-it. [Accessed 7 February 2003].

7. Information Society

A number of different plans lead the Maldives on its path towards an information society.[1] The Maldives *Vision 2020*, introduced by the President in December 1999, guides the country's aspiration to be a top-ranked middle-income economy by the year 2020. Vision 2020 does not explicitly mention information society but notes, "*Modern technology will be widely used in the Maldives, facilitating progress and convenience in all spheres of life*."[2] The current National Development Plan (NDP) notes that ICT is important to both promote trade and business as well as an industry in its own right that could help diversify the economy and grow employment. The NDP calls for the ICT sector to be liberalized to "*create a knowledge based economy*."[3]

Figure: 7.1: Transforming the Maldives into an information society



Source: e-Maldives. National Information and Communications Technology Policy Draft. MCST and UNDP.

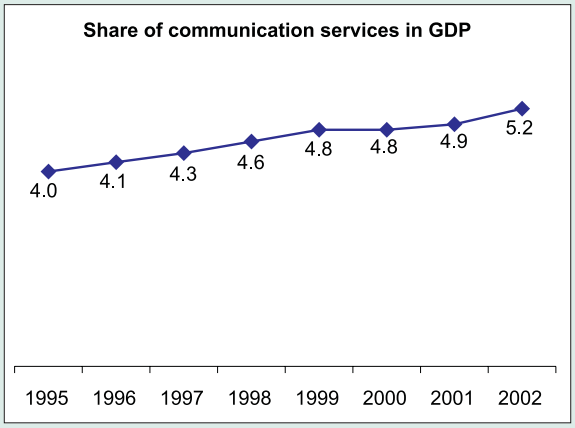
ICT-oriented documents include the 2001 *Science and Technology Master Plan* highlighting current and potential use of new technologies and the *Telecommunication Policy* 2001-2005. The latter, developed by the Ministry of Communication, Science and Technology (MCST), addresses policy related issues such as universal access and liberalization of the market. Currently the MCST, together with the UNDP, is working on a national ICT policy called *e-Maldives*, to develop an approach to move the Maldives towards becoming a "*knowledge-based society where ICT is the engine to propel economic growth and an effective bridge to digital divides and social development by the year 2010*".[4] Based on the country's main development challenges as well as its current ICT status, the framework has identified four key prerequisites that need to be established so that ICT can be a tool for development within four pillars (Figure 7.1, Box 7.1). Within this framework the document calls for a number of initiatives and goals that should be carried out and reviewed by the year 2010.

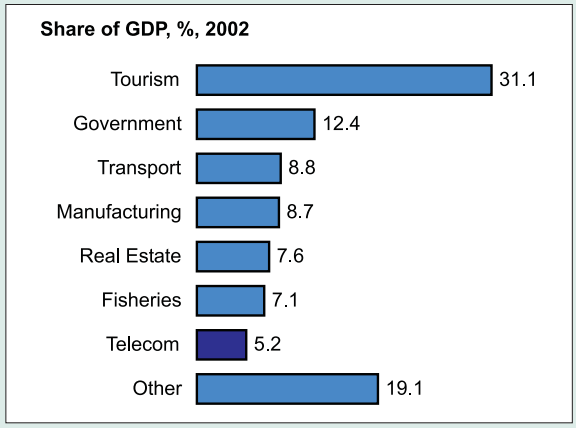
7.1 Economic impact

There are no official statistics on the size of the overall ICT sector in the Maldives, although telecommunications would contribute the largest amount. The communications sector share of GDP was 5.2 per cent in 2002, up from four per cent in 1995 (Figure 7.1, left). A number of factors have contributed to this increase including completion of the nationwide backbone in 1999, increases in fixed and mobile telephone subscribers, launching of the Internet and growing tourism (and subsequent demand for international communications). Communications is the seventh largest direct contributor to the economy. In 2002, communications had the third highest sector growth rate after fishing and

Figure 7.2: Telecom economic impact

Share of communications in GDP, per cent, 1995-2002 (left) and share of various sectors in GDP, per cent, 2002 (right)





Source: ITU adapted from MPND.

Box 7.1: e-Maldives

The Ministry of Communication, Science and Technology has drafted an Information and Communication Technology (ICT) policy document with the support of the United Nations Development Programme. Subtitled *e-Maldives* the draft policy document lays out ICT benefits in four areas or what it calls *pillars*: 1) Employment creation; 2) Bridging the digital divide; 3) Human resource development; and 4) Good governance. The pillars in turn are dependent on four *foundations* to ensure success: 1) National information infrastructure; 2) Legal framework and institutional strengthening; 3) Private sector and community participation; and 4) Public awareness creation.

The draft policy envisions the following strategies for each of the pillars:

Employment creation: using ICT to achieve efficiency and productivity in existing activities and to create new ICT-based employment. In the case of the latter, this includes the development of new services in the Maldives traditional economic sectors, fisheries and tourism such as portals and information systems. It also calls for the creation of a Software Park with incentives to attract investors.

Bridging the digital divide: ICT is seen as a tool to reduce gaps between the capital and atolls through enhanced access to information and the delivery of electronic government, education and health services. In this regard, the policy calls for universal access to the Internet from the atolls at affordable prices.

Human resource development: ICT is important for delivering education as well as a subject in its own right. The policy identifies the use of ICT for training both those in the formal educational system as well as those outside it. Strategies include incorporating greater use of ICT in school curriculum, creating an ICT-based institute of higher education and expanding the use of distance education.

Good governance: ICT can improve government efficiency and transparency. The policy calls for the creation of a government network linking all agencies, access points for the public and the delivery of online services.

The policy mentions a number of areas for strengthening the foundations for successful implementation of ICT. In the area of national infrastructure, it advocates an integrated network with multiple uses in order to reduce duplication. Regarding the legal framework and institutional strengthening, the draft policy calls for the passage of necessary laws such as an electronic transaction act and the creation of new ICT agencies and chief information officers. The draft policy notes that in the area of private sector and community participation the involvement of business and those living in atolls are critical. The policy also calls for high-level initiatives to raise awareness such as a National ICT Year.

The draft policy has a timetable of 2010 for achieving its objectives and includes a number of indicators for measuring goals. The latter include indicators such as the percentage of new economy generated by ICT, percentage of knowledge workers and ICT indices.

Box 7.2: Tourism and telecommunications: A marriage made in heaven

There is a symbiotic relationship between two of the largest sectors of the Maldivian economy, tourism and telecommunications. They both depend on each other and neither could be as successful alone. It is unlikely that the tourist industry could have blossomed as much as it has without an effective telecommunication network. The start of international telephone service in the Maldives can be traced to the beginning of tourism in 1972.[6] It is also unlikely that Dhiraagu, the national operator, could have expanded the telecommunication network without revenues from tourism. A common myth is that most phone lines are in tourist hotel rooms. In fact, only three per cent of telephone lines are in resorts in the Maldives. Nonetheless, all of Maldives 87 resorts have telephone service and are an important user of Dhiraagu's services. An analysis of Supply and Use Tables of the Maldivian economy reveal that the biggest user of telecommunication services is tourism, consuming 26 per cent of telecommunication sector output.[7]

The Maldives' relatively high level of international telephone traffic is also a result of tourism. Five of its top ten calling countries are those from which the Maldives receives the largest number of tourists (UK, Italy, Germany, Japan and Switzerland). International mobile roaming has also been a boon to Dhiraagu. Although roaming was only launched in 2000, it already accounts for the majority of mobile revenue. This is not surprising given high roaming charges; a roamer can pay up to six times more than a local subscriber for telephone calls. One factor that helps is that almost 80 per cent of Maldives tourists hail from Europe where GSM, the system used in the Maldives, is the de facto standard. Dhiraagu has roaming agreements with 80 operators in 44 countries.[8]

Understanding the link between telecommunications and tourism is important for other small island states, many of which are keen to promote tourism. Good telecommunications is important for attracting and developing the tourism industry. Tourists make a high level of international calls and seem willing to pay a high price. They can be an important source of revenue helping to keep prices lower for local services and thus helping to expand national access. The tourism industry need for telecommunication is evolving beyond just international calls to include e-mail, web sites and international roaming. Support for these services can help boost local employment.

manufacturing. Dhiraagu dividend payments to the government account for 6.5 per cent of government non-tax revenue. Telecommunications also accounts for the third highest (non-tourist) stock of foreign direct investment valued at US$ 16.3 million at March 2002. There have also been foreign investments by India and Sri Lanka in the computer software sector.

Though the precise impact of ICT on the economy is difficult to measure, there is anecdotal evidence to suggest it is significant. For example, tourism, one of the pillars of the Maldives economy, is highly dependent on ICTs for marketing (web sites) and communications (telephone, fax and email reservations and communications by tourists, Box 7.2).[5] The government, which accounts for 12 per cent of the economy, is engaged in an US$ 12 million e-government project that will utilize ICT to enhance administration.

7.2 Employment impact

Another aspect of a country's evolution to an information society is the need for ICT workers, which can help reduce unemployment. This is particularly important in the Maldives that has a growing pool of educated young people. Figures on overall employment in the ICT sector are not available. Dhiraagu directly employs 520 people as well as having an indirect impact on employment through areas such as vendors of mobile phones and pre-paid cards.

7.3 Social impact

Another perspective on the information society is how the use of electronic information is transforming citizen's lives. Access to ICT is increasing. In the year 2000, 57 per cent of homes had a television while 23 per cent had a telephone line and six per cent had a PC.

One limitation in gauging the social impact of ICT is a lack of data and surveys to understand how people are using it. There are certain proxies. One is a growing willingness to use electronic transactions. For example there are some 20'000 debit card

holders in Male' using their cards at over 250 restaurants and shops as well five Automated Teller Machines (ATM).[9] The volume of Internet traffic is rising with some 51 million minutes of dial-up use in 2002, an increase of 17 per cent over the previous year. However usage is still low at about one hour per year per user, suggesting limited experimentation on the Internet. Text messages sent over mobile phones is rising with an average of 11 per subscriber in December 2002, up from three at the end of 2001.

Many are still not aware of the benefits of ICT and there is a significant digital divide between Male' and the rest of the country (Box 7.3). There are a number of institutional issues that need to be resolved to expand the Maldivian information society such as the enactment of digital laws and the acceptance of free online government forms. There are several projects in the pipeline to make ICT more relevant for the population. One is an e-government project that would bring public services on-line. Another effort is to extend ICT access in the

Box 7.3: ICT in the Atolls

The main digital divide in the Maldives is between the capital Male' and the atolls. According to the 2000 Census, overall household telephone penetration was 22.9 per cent but that ranged from 68.9 in Male' to 8.7 in the atolls. The divide for computers is also wide with an overall national rate of 6.2 per cent of households possessing one compared to 21.9 per cent in Male' and 1.3 per cent in the atolls. In November 2001, the UNDP, along with the ITU, carried out a fact finding mission to 21 islands to assess the level of ICT and get feedback from islanders about ICT requirements. While virtually all islands had computers, the penetration ranged from over three per 100 inhabitants to less than one, reflecting an island digital divide. The input obtained from the mission will be useful for a UNDP project to create an atoll portal with content reflecting the needs of those living on the islands.

	Island	*Population*	*ICT Status*
SHAVIYANI (North Miladhunmadulu)	Feevah	845	3 computers in total (1 at school, 1 office, and 1 private). 12 PCs will be installed in 2002 with parents' support 5 telephones in total (2 public telephone booths, 1 in office, 1 in school and 1 in court) 150 TV sets, which means every household has at least one set
	Maakadoodhoo	1400	10 computers in computer lab at the school 3 telephones in total (2 public telephone booths, 1 in office) 226 households have sets, which means in every home there is a set
	Lhaimagu	684	3 computers in total (1 in school, 1 in island office and 1 private) 3 telephones in total (2 public telephone booths, 1 in office) There is a high demand for telephones
	Funadhoo	1297	42 computers in total. (1 in island office, 11 in island office, 1 in health centre, 1 in youth centre, 2 in project office, 1 in pharmacy and 12 private). There is a computer lab at the school with 13 computers 10 telephones in total (3 public telephone booths, 1 in island office, 1 in health center, 3 in island office, 1 in project office and 1 in NSS). Plans to have more public telephone booths in 2002. 200 households have TV set
	Komandoo	1536	46 computers in total (42 PCs and 4 laptops). There is computer lab in the school and computer course is part of the curriculum. For outside, private computer course is being run. 6 telephones in total (3 public telephone booths, 1 in island office, 1 in school, 1 in health centre). 300 households have TV sets
	Maaugoodhoo	915	6 computers in total (1 in island office, 2 in school and 3 private) 3 telephones in total (2 public telephone booths, 1 in island office). Telephones are very much in demand. The public phones are used to communicate with family members outside the island and for business matter (eg. What cargo to bring from Male' to the island) 110 households have TV sets
NOONU ATOLL	Kedhikulhudhoo	1500	9 computers in total. In one part of the island, there is a total of 4 computers (1 in island office, 2 in school and 1 private). In the other part of the island, there is a total of 5 computers (1 in school, 1 in island office and 3 private). 5 telephones in total. In one part of the island, there are 2 telephones (1 public telephone booth and 1 in island office). In the other part of the island, there are 3 telephones (1 public telephone booth, 1 in island office and 1 in health centre. The public phones are used to communicate with family members outside the island, business matter and for advice/information on medical treatment. 174 households in total have TV sets. In one part of the island, there are 84 households. In the other part of the island, there are 90 households.
	Landhoo	837	2 computers in total (1 in island office and 1 in school). There is no computer lab in school 3 telephones in total (2 public telephone booths, 1 in island office). The public phones are used to contact students studying outside the island and to contact husbands who are working in resorts 73 out of 130 households have TV sets

Box 7.3: ICT in the Atolls (cont'd)

NOONU ATOLL	Lhohi	707	2 computers in total (1 in island office and 1 in school) There is no computer lab in school 3 telephones in total. (2 public telephone booths, 1 in island office). 50 out of 90 households have TV sets
	Manadhoo	1500	23 computers in total (1 in island office, 3 in school, 5 in island office, 1 in health centre, 2 in project office and 3 private). There is computer lab with 8 computers, run by Pioneer company 11 telephones in total (2 public telephone booths, 1 in island office, 1 in school, 1 in health centre, 1 in the court, 4 in the island office and 1 in NSS). There is a high demand for public phones. Long queues are seen often. The phones are used to call family members, business and official matters 80 out of 216 households have TV
	Holhudhoo	1945	30 computers in total (1 in island office, 4 in school, 4 in private centre and 6 private). There is a private computer training centre in the school run by Cyryx company (Pentium 3 model used) with 15 computers 6 telephones in total (3 public telephone booths, 1 in island office, 1 in school and 1 in the court) 201 out of 256 households have TV sets
	Velidhoo	2067	38 computers in total (1 in island office, 3 in power house, 2 in staff room, 1 in administrative office, 1 in library and 15 private). There is a computer training centre in the school run by Computer Career Centre with 15 computers. Computer density is 1.5% 20 telephones in total (5 public telephone booths, 1 in island office, 1 in school, 1 in the court, 1 in power house, 1 bureau fax and 10 lines on cordless phones). Telephone density is 1% 220 out of 397 households have TV sets
LAAMU ATOLL	Maabaidhoo	823	There are 4 computers in the school, 5 in homes and no computer in the island office. There are also an additional 7 computers at the Island Computers Training Centre in the island. 4 telephones (2 public telephone booths, 1 in office, 1 in school). Most of the houses have a TV (about 110).
	Kalhaidhoo	626	There are no computers in this island. However, the school is planning to buy a computer next year. 3 telephones (2 public telephone booths, 1 in office). Many of the households have TV. However, the programmes and the hours of broadcast is not satisfactory. (about 95).
	Mathimaradhoo ward (Gamu)	650	There are 2 computers at Qatar Ameer School, and a number of computers in other places like, the island office, the atoll hospital, and individual homes.(a rough estimate of 10) There is 1 telephone in the island office, 1 in the atoll hospital, 1 in the school and some telephone booths.(about 7) Many of the households have TV.(about 85)
	Mukurimagu ward (Gamu)	880	Computer literacy: Many children from this ward who attend Qatar Ameer School in Mathimaradhoo have had some understanding of computers. Students of grade 10 have done a basic computer course at school. There is a cyber café run by Dhiraagu in this island (in Mathimaradhoo ward). The cyber café provides internet service from 7:30 to 5:00 for 5 days a week. The rate of service is almost the same as Male'.
	Fonadhoo	1654	There is no computer lab in the island/school, however there are about 15-20 computers in the island (school, atoll office, island office, health centre, bank, and some private homes.) There are about 10 telephone lines in this island which are mostly in various government offices (atoll office, island office, school, dhanal, bank, health centre, etc) and telephone booths. Most house holds have TVs. (about 450)
	Kunahandhoo	974	There is one computer at school which is the only one in the island, in the island. This computer was financed and purchased by the students and the computer has been non-functional from the very beginning There is one telephone in the island office and two booths. There is a very high demand for telephones and the two booths are not enough.
	Maamendhoo	1047	There are 3 computers in the island (1 in school, 1 in the island office and 1 in a private home). There are three telephones in the island, (1 in the island office and two telephone booths).
VAAVU ATOLL	Fulidhoo	367	6 computers in total. (2 in school, 2 public computers by committee and 2 private. There is no computer lab. 2% density 4 telephones in total (2 public telephone booths, 1 in island office, 1 in school) Public telephones are high in demand. The phones are used for personal matters such as contacting students outside the island and for business matters. 1% density 52 TV sets in every household, which means 100% density. There is only one channel.

Source: ITU Mission Report: Maldives UNDP Project, November 2001.

atolls and develop locally relevant content.

7.4 E-Government

Most ministries are online and can be accessed from the presidential web site that serves as a sort of informal portal <http://www.presidencymaldives.gov.mv/v3/pages/LinksList.php3>. Web sites provide information about the respective ministry, including public announcements, documents, speeches, and vacancies as well as contact details. Several web sites allow users to download forms, the main e-citizen application that is currently provided.[10] The availability of government forms online has been limited due to the tradition requiring citizens to pay for them. This has prevented some government agencies from providing online forms because they do not have payment systems to charge for the forms and if provided for free, it could be a violation of the rule.

7.4.1 Big plans

The Maldives recently launched a comprehensive e-government project. Financed by a US$ 12 million loan from the Asian Development Bank (ADB), the wide-ranging *Information Technology Development Project* (ITDP) covers infrastructure and access, services and content and ICT policies.[11] Specifically it includes setting up a network and connecting government agencies in Male' and 20 atolls; developing a portal and providing online services; establishing the National Computer Center (NCC) to coordinate ICT development, as well as implementing sector reform.

The government portal will centralize individual ministerial efforts to provide online services by providing integration and consistency. It will support electronic transactions between ministries and the delivery of government services to the public. To ensure that e-services will not be limited to the population in Male', the project envisions a public access scheme to equip every atoll with an Internet kiosk. Installed at the atoll office, the kiosk will be staffed by assistants trained to help citizens' access and use the applications.

The initial applications slated for delivery under the e-government project include:

- *National Citizens Identification*. This envisages the creation of a single database containing citizen identification records to be accessed by all ministries. This will result in efficiency from accessing one central database rather than maintaining local records. The average time saved has been estimated at 15 minutes per record; with an estimated 1.4 million accesses per year, this amounts to considerable efficiency. It is envisaged that the application would be extended to citizens allowing them to update their records and obtain relevant information remotely.

- *Hospital Information System*. This component forsees the creation of a medical records database with real-time access by health staff. It is estimated that productivity will be raised by 25 per cent for doctors and up to 90 per cent for other staff by having patient information available online.

- *Vessel, Vehicle, and Aircraft Registration*. This service will allow property owners to register or renew their applications online. This will cut down substantially on trips to carry out these activities with an estimated savings in the number of trips of 15 per cent in the initial phase of the project and rising to 70 per cent.

The conceptual phase of the e-government project has been completed and the government invited bids in November 2003 for development of the two main components: Government Network of Maldives and the Information Technology Architecture. The network

component involves linking ministries in Male' and 23 islands using fibre optic in the capital and a satellite system for the islands. The Information Technology Architecture deals with the software aspects including the development of initial e-citizen applications.

7.4.2 Atoll portal

Apart from the ITDP, there is also a UNDP project "Digitally Empowered Development in the Island Communities of Maldives."[12] This project envisions the creation of a community portal that would provide relevant information to and about islands in both Dhivehi and English. The idea is that local communities would provide content such as island profiles, travel information, discussion boards and employment and business opportunities.

7.5 Education

7.5.1 Enrolment and attainment

A significant determinant of a country's ability to transition to an information society is its knowledge base. Indicators such as school enrolment and educational attainment help determine the potential for ICT use.

Primary and secondary school enrolment are high and reflect government efforts to provide basic education, at least until the age of 15. Government spending on education amounted to 18 per cent of all expenditures in 2002. The Maldives ranks well when compared to other developing countries with 96 per cent of youth between the ages of 6-15 attending school. There is also very little gender disparity in education (Box 7.4).

There is almost universal literacy (97 per cent) in a population dispersed over 200 islands. Literacy was increased through a government project providing basic reading and writing courses to adults across the country.

In terms of educational attainment, there is a gap between secondary school attainment and the post-secondary level reflecting limited tertiary opportunities. While around 45 percent of the population has attended middle school, less than one percent of the population has a tertiary degree. The 2000 Census further reveals the difference in educational attainment between Male' and the atolls. While 37 percent of those living in Male' have at least a secondary education, the number stands at 15 percent for those living in the atolls. Two percent of the population in Male' has a tertiary degree, compared to 0.2 percent residing outside Male'.

There is a strong link between education and Internet access. This is drawn out in numerous surveys that show that those in school or with high levels of education have more elevated Internet usage rates than others. In the case of the Maldives, it would appear that there is a large untapped Internet market. According to Dhiraagu estimates there were some 15'000 Internet users at the end of 2002. This figure is less than the number of people aged 15-19 attending school (21'101 according to the 2000 Census). In addition, there are another 32'625 people aged 15-59 who have at least a secondary education. These two groups, prime Internet users, equal 53'726 people. Thus there is a gap of 38'726 between those currently using the Internet and those who probably have the skills or can be taught fairly quickly how to use it. There is also often a close relation between newspaper circulation and Internet users. The country's leading newspaper claims a daily circulation of 86'000. The difference between this group and the existing number of Internet users is 71'100. Thus the potential Internet market is between three to five times larger than current estimates of the number of users (Figure 7.3). On the other hand, the number of Internet users may be underestimated.

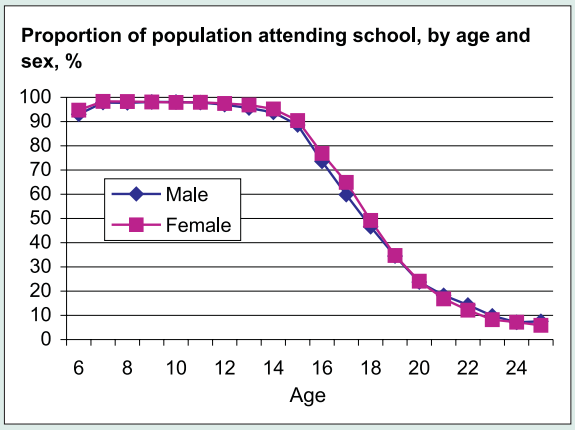
Box 7.4: ICT potential for women

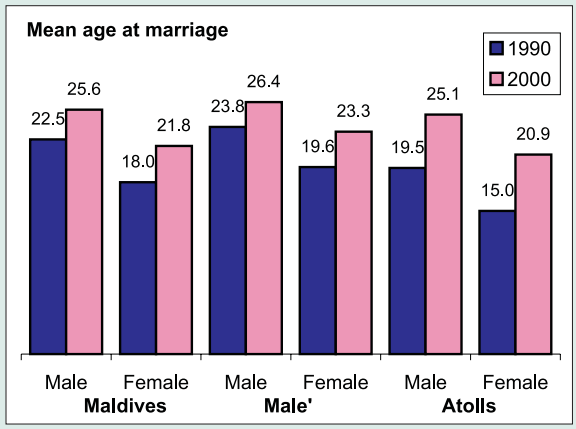
The Maldives is progressive in gender issues. The rights of women are constitutionally protected and there is a Ministry of Women's Affairs. The country scores high compared to peer countries on indicators measuring female participation in education. Educational enrolment and attainment figures for the Maldives show slight gender-related differences. However after the age of 20, there is a small drop off in female school attendance. One issue is that most post-secondary educational opportunities are in Male'. Families in the atolls are more reluctant to send females off to study in the capital. Females also tend to get married earlier than men. Household duties and the arrival of babies make it more difficult for women to purse educational opportunities.[13] A positive trend is that the age of marriage has been rising, giving women more opportunity for education (Box Figure 7.4, right).

The participation of women in the formal labour market is much lower than men. While 72 per cent of men over the age of 15 works, the corresponding figure for women is only 37 per cent. Similar to post-secondary education, marriage and children affect the ability of women to work. The diffusion of Information and Communication Technology (ICT) could have a big impact on female labour participation in the Maldives. If ICT access can be provided in homes, then it would give more women the ability to participate in new economy activities. Since the younger generation of women almost all complete mandatory schooling they have a good starting background for using ICT. The availability of online government applications can also make women less dependent on men for obtaining public services, enhancing their empowerment. [14] There is also scope for women to operate atoll Internet kiosks as part of the Women Community Associations. In a report on gender in the Maldives, the Asian Development Bank has also emphasized the potential of information technology for boosting female employment.[15]

Box Figure 7.4: Gender in the Maldives

Percentage of population attending school, by age and sex (left) and mean age at marriage, by location and sex (right)

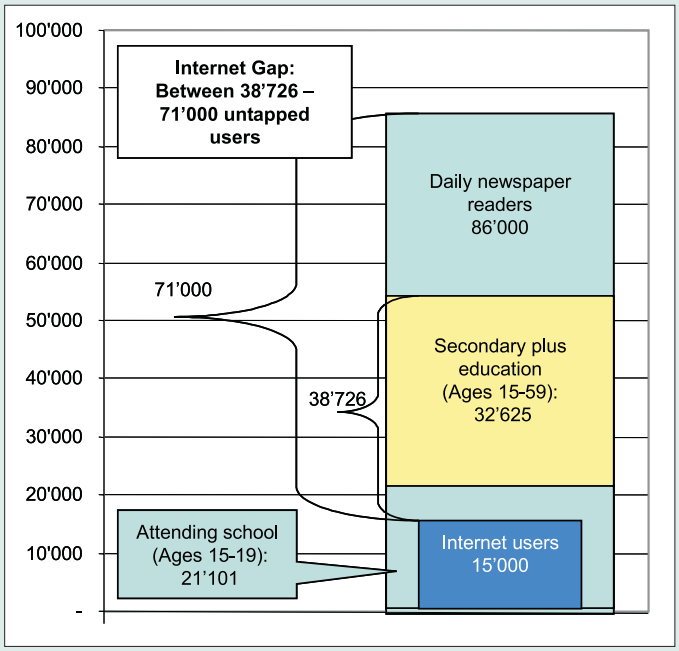




Source: ITU adapted from Ministry of Planning and National Development.

Figure 7.3: Maldives untapped Internet market

Difference between potential and actual Internet users



Note: The chart shows the gap between the estimated number of Internet users in 2002 and those believed to have the ability to use the Internet (age 15+ attending school, those with at least a secondary school education and those who read a newspaper). For example the difference between estimated Internet users (15'000) and those who read a newspaper every day (86'000) is 71'000.
Source: ITU adapted from Dhiraagu Internet user estimate, Ministry of Planning and National Development and Haveruu newspaper.

7.5.2 ICT education in schools

The Sixth National Development Plan[16], which defines government policies for the period 2001-2005, highlights the need to expand and promote ICT in education, including computer literacy.

The Ministry of Education's draft *Information Technology and Education, Policy and Strategies*, recognizes "*the promise of IT for education for all*" and the need to move from "*natural-resource-based primary products, towards knowledge-based and human-resource intensive goods and services*".[17] The draft discusses ways of teaching IT in schools and tertiary institutions as well as using IT as a tool to improve educational institutions by making them more efficient und improving communication. A number of goals are aimed at turning the Maldives into a knowledge-based economy. These include making all secondary school leavers computer literate, expanding computer studies to the lower secondary level, training a cadre of specialist IT teachers, establishing a school network to share educational resources and making greater use of distance education. The draft sets a number of objectives for the years 2001-2005, such as providing all schools with a computer, providing all teachers with email, teaching students IT two hours per week and providing Internet access to all schools. A shortage of funding and skilled teachers has been the main problems in realizing the objectives.

ICT courses were introduced in secondary schools as early as 1986, but limited to a small number of students. Today ICT classes are provided in all higher secondary schools. The importance that policy makers attach to ICT is demonstrated through a presidential decree, stipulating that from 2004 every secondary school graduate must be computer literate. There are plans to integrate ICT into the primary school curriculum but a lack of trained teachers is a barrier. One way around this has been outsourcing training to the private sector.

An Internet culture has spread among students, particularly in the capital. Most teenagers in Male' have basic computer skills and know how to use the Internet, although schools may not be their main access location. Some attend classes at one of the some dozen private computer training centres. Others learn at local Internet cafés. Dhiraagu also offers free Internet courses to school classes (Box 7.3). In the atolls, parents have purchased computers for some schools and in a few cases paid for private companies to provide training.[18]

Box 7.5: Increasing awareness and attracting new customers

Dhiraagu has been utilizing off-peak times at its Internet café to increase awareness among the young. Since 2002, it has provided free Internet courses to school classes. In October 2003 the initiative was extended to five classes per week at its Male' cyber café[19], the largest in the capital. Students between the ages of 10-14 are invited during so-called 'happy hours', times when there are relatively few other customers. The Internet café staff use the one-hour course to show students how to access web sites and find educational material.

In addition to access to Internet cafes, another advantage students in Male' have is that their language of instruction is English, both in primary and in secondary schools. Although this is officially the case nation-wide, primary students in the atolls are most often taught in Dhivehi, the local language. English is taught simply as a subject, and students from the atolls often find it difficult to switch to English when they commence secondary school.

7.5.3 ICT workforce

Post-secondary education is provided by the Maldives College of Higher Education (MCHE, <www.mche.edu.mv>), established in 1998 through an Asian Development Bank project. The MCHE was created as an umbrella organization to consolidate and manage seven existing and largely independent post-secondary educational institutions.

The Sixth National Development Plan foresees the eventual transformation of the Maldives College of Higher Education into a university. The College has six faculties and two Centres. While the fields of tourism, health, education and engineering provide the greatest number of courses, most are one-year or less certificate courses. A bachelor's degree is offered in tourism, management and education while the Faculty of Tourism offers a Master's degree. The degrees are offered in cooperation with foreign universities and include study abroad. Over 6'800 students are currently enrolled at the MCHE, of which some 4'000 are part-time.

Every student enrolled in the college has to take a course to become *computer literate*. Precise skills are outlined covering hardware, data processing, operating systems, word processing and spreadsheets. The estimated teaching time to become computer literate is 16.5 hours. Apart from these skills, a computer literate student is also expected to have a certain attitude towards using the knowledge. This attitude includes having "*a desire for self-learning, a willingness to seek information and use that information, and a positive inclination towards fast desirable changes, reskilling and technology*."

According to the results of a questionnaire filled out by students and academic staff, the main barriers for using ICT is the lack of available resources. Twenty percent, for example, said it was difficult or impossible to find a computer most of the time. The main reason students and staff do not use the Internet is not because of the lack of skills but because of non-availability. While most staff said they had basic ICT skills, they lacked more advanced training. Seventy-seven percent further noted that they had no help desk to turn to for assistance and many depended on a 'learning by doing' method.

The Faculty of Management and Computing (FMC) offers diploma and certificate programmes in Information Technology as well as a bachelor degree in Business Information Systems in conjunction with a UK university.[20] FMC will host a CISCO Networking Academy Program under the ITU / CISCO Internet Training Centres Initiative for Developing Countries.[21] Two MCHE staff attended CISCO instructors training at MCHE's

parent academy in Hyderabad, India in September 2003. The parent academy trains the instructors of local academies and gives them technical support.

The College, which has over 300 staff, is under the Office of the President, rather than the Ministry of Education. Its 2002-2004 Information Technology Strategic Plan outlines the current ICT situation and defines the college's objectives for the coming years. The goals laid out in the Strategic Plan include the integration of technology into all aspects of teaching, learning, and research; the improvement of the network infrastructure and the coordination of IT resources; the use of technology to improve access to information and user support services; and the enhancement of management and administration through the use of ICT. Each goal has specific strategies, including concrete actions and quantitative targets.

Dhiraagu, the telecommunication operator, has an in-house training programme, providing its employees with required ICT skills. Dhiraagu's part owner, Cable & Wireless of the UK, has played an important role and many employees have been sent abroad to receive specialized training. Dhiraagu has been discussing the possibility of jointly establishing a two-year course in telecommunication engineering with MCHE. One bottleneck is the cost of equipment for the course that Dhiraagu would have to purchase.

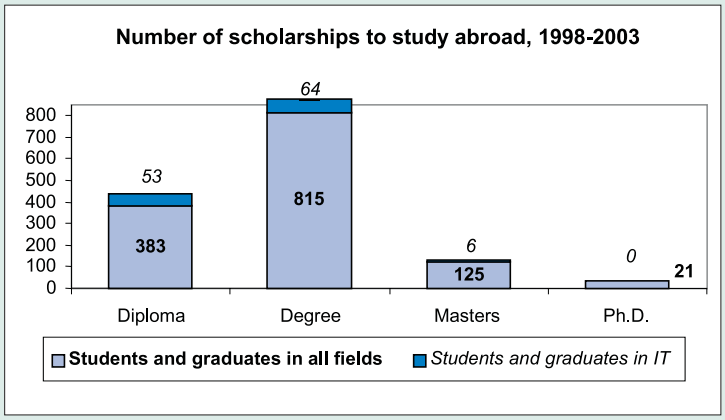
Since tertiary education options in the Maldives are limited, the nation relies on foreign education institutions. Between 1998 and 2003, the government sent some 1'500 students abroad on scholarships. Top destinations include Malaysia, India, Sri Lanka, Australia and the United Kingdom. Most scholarships are funded by development assistance. The majority of students studying IT abroad obtained diplomas or bachelor degrees with only a few doing post-graduate work (Figure 7.4). In addition many more Maldivians study abroad without government funding. In 2003 some 500 students were registered with the Ministry of Education as studying abroad but since students are not obliged to register, the number is estimated to be at least twice this high.

The Maldives is not as affected by brain drain as other developing countries. Despite the fact that students are free to chose where to work after their scholarship ends, and do not have to pay back grants, it is estimated that 99 percent return home. One of the reasons might be that few students obtain post-graduate degrees, which are particularly high in demand on the international job market. It also means that the amount of time spent abroad is limited and students have less time to become accustomed to a new country and culture.

ICT training by the private sector is widely available in the capital, and provided by some 15 centres. Participants can obtain certificates and diplomas. These take between one and three years respectively. To ensure quality the Maldives Accreditation Board certifies IT courses provided by the private sector. At November 2003, it had approved some thirty ICT courses from five training centres (Table 7.1).

Figure 7.4: Going abroad for higher education

Difference between potential and actual Internet users



Source: Maldives Ministry of Human Resources, Employment and Labour.

Table 7.1: Private sector ICT courses

Maldives Accreditation Board approved ICT courses, November 2003

Comtronics Training Centre	
Advanced Course in Architectural Drawing with Auto Cad	Advanced Certificate
Basic Course in Computer Application	Cert 1
Certificate Course in Computer Application	Cert 2
Advanced Computer Course in Office Management	Cert 3
Certificate Course in Web Designing and Hosting	Cert 3
Cyryx Computer Training Centre	
Advanced Certificate in Information Technology	Advanced Certificate
Certificate 1 in Information Technology	Cert 1
Certificate 2 in Information Technology	Cert 2
Certificate 3 in Information Technology	Cert 3
Diploma in Information Technology	Diploma
Focus Education Centre	
Certificate in Office Application	Cert 1
Certificate in Basic Office Management	Cert 1
Foundation Course in Computing	Cert 1
Certificate of Secretariat Skills	Cert 2
Certificate in PC Competence	Cert 2
Certificate 2 in Microsoft Office Management	Cert 2
Advanced Certificate in Computer Studies	Advanced Certificate
Diploma in ICT System Support	Diploma
International Business Systems Overseas (IBS)	
PC networking using Microsoft Windows 2000	Cert 1
Graphic Specialist Course	Cert 1
PC Troubleshooting and Configuration	Cert 1
Certificate 2 in Microsoft Office	Cert 2
Mandhu Learning Centre (MLC)	
First Certificate in Information Technology	Cert 1
Advanced Certificate in Information Technology	Advanced Certificate
Diploma in Mathematics and Information Technology	Diploma
Diploma in Information Technology	Diploma
Win Information Technology Training Centre	
Certificate 1 in Computer Application	Cert 1
Certificate 2 in Microsoft Office	Cert 2
Certificate 3 in Microsoft Office management	Cert 3

Source: Maldives Accreditation Board.

Given the shortage of local labour, the Maldivian economy is dependent on expatriate workers. In May 2003 there were a total of 32'241 foreigners working in the Maldives. This represents more than 30 percent of the total workforce, which stood at about 88'000 according to the 2000 census. The greatest number of expatriates was found in business (3'987), education (2'642), and hotels and restaurants (2'074).

A breakdown of the type of work foreigners are performing, such as ICT, is not available. This is also not available for the economy as whole. The entire area of ICT workforce statistics and their relation to training is lacking. This makes it difficult to plan ICT training and evaluate the impact of ICT on employment. In that respect it would be extremely useful to compile a database of the existing ICT workforce, those receiving training in ICT and carry out an analysis of future needs.

7.5.4 The public at large

The draft Information Technology report by the Ministry of Education calls for ICT courses for the general public since there have not yet been significant government initiatives in this area. Dhiraagu has several initiatives to promote the Internet to the public at large. It organizes Internet fairs where free introductory Internet courses are provided. Local companies use these fairs to present and demonstrate new hardware and software products. Dhiraagu also organizes web design competitions with the winners receiving prizes such as PCs or mobile phones.[22] The winning sites were hosted for free for one year. Dhiraagu also organizes seminars for the government as well as the private sector. These sessions feature representatives from Dhiraagu who make presentations on how people can use the Internet. The presentations, which are given for free, have been provided to almost ten ministries.

Those with a secondary education have a relatively good grasp of English since it is the language of instruction in secondary schools. People with only primary education, on the other hand, will most likely have limited English language skills and thus find it difficult to use the Internet.[23] The official language of the Maldives, Dhivehi, uses a unique, Arabic influenced script called Thaana. The Maldives Internet Task Force (MITF, at www.mitf.net) and others have been promoting the use of Dhivehi and Thaana in electronic format. Thaana has now been added to the Unicode Standard, used for representation of text for computer processing. Maldivians are now able to type and read documents in Dhivehi, as well as create and use websites based on Thaana.

[1] The World Summit of the Information Society describes the information society as an environment "…where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life." See WSIS Declaration of Principles at http://www.itu.int/dms_pub/itu-s/md/03/wsis/doc/S03-WSIS-DOC-0004!!MSW-E.doc. [Accessed 8 February 2004].

[2] President Maumoon Abdul Gayoom. "Address on the Occasion of the 34th Anniversary of Independence Day." 26 July 1999. http://www.presidencymaldives.gov.mv/v3/pages/body.phtml?ID=30&Table=Head3&PTID=30.

[3] Ministry of Planning and National Development. *Sixth National Development Plan 2001-2005*. 2002.

[4] Ministry of Communication, Science and Technology. *e-Maldives: The Republic of Maldives National Information and Communications Technology Policy*. Draft. 2003.

[5] Searches on the phrases "Maldives tourism" and "Maldives hotels" using the Google search engine returned 112'000 and 398'000 hits respectively. [Search executed on 12 June 2003].

[6] "The tourism industry of the Maldives was introduced in 1972 and this boosted the demand for more sophisticated international telecommunication services. As a result of rapidly-growing demand for both local and international telephone services, the first automatic exchange with the capacity of 300 lines was installed in the capital Male' in 1976. In the following year, the first Earth Station (NEC Standard B) came into operation allowing the general public to have access to International Telecommunications services for the first time." See "History" on the Dhiraagu web site at www.dhiraagu.com.mv/about_us/history.php.

[7] This is based on the 1997 Supply and Use tables, the latest year for which data is available. Total use of post and telecommunications services was Rf 579.99 million of which resorts consumed Rf 151.45 million. See the Supply and Use Tables included in the 2003 Maldives Statistical Yearbook at http://www.planning.gov.mv/yrb2003/YearBook/allFrames.htm. [Accessed 8 February 2004].

[8] One issue that Dhiraagu hopes to address is roaming for Japanese and Republic of Korea visitors. These two countries account for over ten per cent of tourists but do not use the GSM system so their mobiles will not work in the Maldives.

[9] Information on credit card holders, point of sale outlets and the number of ATMs is from the Bank of Maldives http://www.bankofmaldives.com.mv [Accessed 8 February 2004].

[10] At the Ministry of Transport and Civil Aviation web site http://www.transport.gov.mv, for example, users can download the vehicle and vessel registration form. At the Ministry of Youth and Sports web site http://www.youthsports.gov.mv/application/application1a.htm applications for joining a Youth Centre can be submitted online and the Department of Immigration and Emigration http://www.immigration.gov.mv/forms/index.htm has made different forms available online, including the application for a passport.

[11] Asian Development Bank. "Helping Islanders Access Public Services Through The Internet In Maldives." *News Release*. 17 December 2001. http://www.adb.org/Documents/News/2001/nr2001197.asp.

[12] UNDP. "Digitally Empowered Development in the Island Communities of Maldives."

[13] "But perhaps the more compelling reason for the lower educational status of women is the cultural expectation for women to marry at a young age…Having done so, it becomes difficult for them to continue their studies and more so when they start having babies…" Ministry of Planning and National Development. 2002. *Analytical Report. Population and Housing Census of the Maldives 2000*.

[14] "Further, their traditional dependence and reliance on men to help them obtain public services will give way to independence and self-reliance as they can directly access public services…In this way it is highly likely that the provision of public services through the Internet, and the overall improvement in communications will provide greater incentives for women to participate in economic activities and enhance their social position." Asian Development Bank. November 2001. *Report and Recommendation of the President to the Board of Directors on a proposed loan to the Republic of Maldives for the Information Technology Development Project*.

[15] Asian Development Bank. April 2001. *Women in the Republic of Maldives. Country Briefing Paper*. http://www.adb.org/Documents/Books/Country_Briefing_Papers/Women_in_Maldives/default.asp?p=gender.

[16] Ministry of Planning and National Development. *Sixth National Development Plan 2001-2005*. http://www.mv.undp.org/docs/6NHDR/index.htm.

[17] Ministry of Education. March 2001. *Information Technology and Education, Policy and Strategies*. Draft. Is this the latest version? Has it been published yet?

[18] Ministry of Communication, Science and Technology. April 2001. *Republic of Maldives Science and Technology Master Plan*. http://www.mcst.gov.mv/Documents/mplan.htm. [Accessed 4 February 2004].

[19] The Dhiraagu Cyber Café was the first in the Maldives when it began operations in mid-1998. It has a 256 kbps dedicated leased line and 24 recent model PCs. Trained assistants are available to assist users to set up an email account or help out with other questions. See the website at http://www.cybercafe.com.mv. [Accessed 4 February 2004].

[20] For information on program, see the description at the Middlesex University web site: http://www.mdx.ac.uk/subjects/cit/bis.htm. [Accessed 4 February 2004].

[21] CISCO. 2 December 2002. "Cisco and ITU Narrow Gap in Internet and New Economy Skills Worldwide: Internet Training Centers Initiative for Developing Countries helps bridge digital and gender divides." *Press Release*. http://newsroom.cisco.com/dlls/ts_120202.html. [Accessed 4 February 2004].

[22] http://www.dhiraagu.com.mv/newsdesk/index.php?newsid=108.

[23] Apart from the primary schools in the capital, the dominant language of instruction in primary schools is Dhivehi.

8. Conclusions

8.1 A successful SIDS

The Maldives faces greater constraints that even most small islands: it is a Least Developed Country (LDC), has a small population of less than 300'000 and consists of 199 inhabited islands spanning 820 kilometres from north to south. Despite these economic, demographic and geographic challenges, the Maldives was able to provide access to telephone service to all of its inhabitants by the year 1999. This was accomplished through a compact between the government and the private telecommunication operator.[1]

Despite this impressive achievement the Maldives cannot afford to rest on its laurels. It needs to evolve to a new stage that fully seizes the benefits of Information and Communication Technology (ICT) for development. This includes moving from universal access to universal service and widely diffusing newer ICT such as the Internet, particularly in underserved areas.

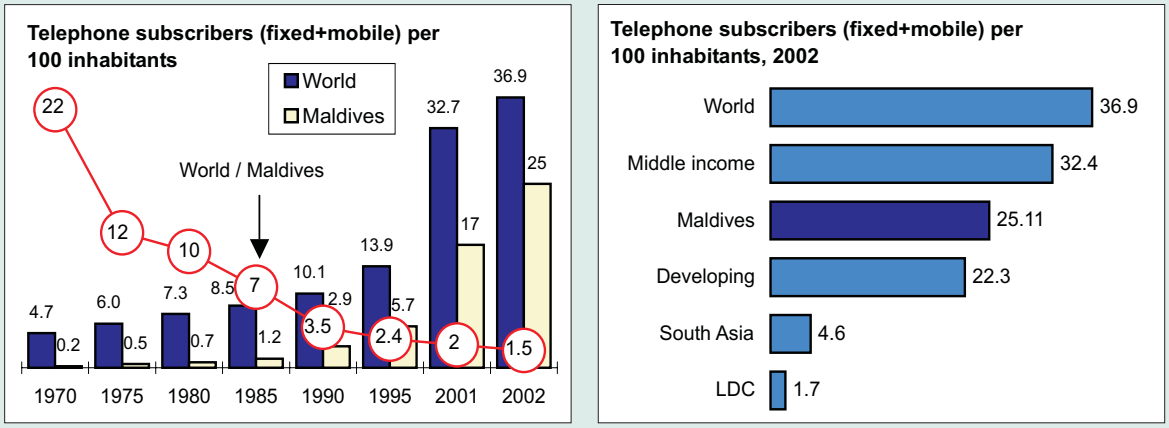
One concern is that the Maldives is not fully exploiting the potential of ICT for delivering services to remote, dispersed locations. While there is a telemedicine project, benefits have not thus far been widespread. Distance education, beset by concerns about the quality of learning, has not been fully exploited.

The issue of injecting additional liberalization in the telecommunication sector is complex. Dhiraagu has served the nation well. It installed the backbone network under difficult geographical conditions allowing the nation to achieve universal access. The fixed, mobile and Internet networks are reliable. Fixed telephone tariffs for most consumers are reasonable. Though mobile tariffs are relatively high, they do not seem to have been a deterrent to uptake. Internet pricing is partly a result of high international connectivity costs that the Maldives pays and should drop with the newly licensed ISP. Further liberalization raises questions about feasibility given the population dispersion of the country. Without adequate regulation, the digital divide could widen as investors focus on the more populated islands. For liberalization to work, regulatory skills will need to be deepened to deal with a multi-operator market. Additional competition may also lead to a rebalancing of tariffs. Local telephone service prices would rise and possibly create concerns about affordability.

Another challenge is the need for greater broadband use to bring the Maldives more fully into the information age. The existing national backbone—mainly microwave links—was not designed with high-speed data transmission in mind. The network needs to be upgraded or an overlay needs to be installed. Options would include fibre optic cable and Very Small Aperture Terminal (VSAT) satellite technology. On the one hand fibre is an obvious solution at least for compact Male' and possibly for connecting atolls by using festooning to interlink islands. There is no need for the construction of towers but the ocean depths between atolls, the large spread of the country and price of fibre itself could be costly. Alternatively VSAT technology solutions could be explored. The option of connecting to an undersea fibre optic cable for international connectivity should also be more deeply investigated. Though initial inquires have been made, and the costs appear high, this should be re-examined in the context of wider benefits. Options for sharing the cost of the connection and possibly obtaining financing assistance should

Figure 8.1: Catching up

Telephone subscribers per 100 inhabitants, 1970-2002, world average and Maldives (left) and telephone subscribers per 100 inhabitants, 2002, Maldives and various regional and economic group averages (right)



Source: ITU World Telecommunication Indicator database.

be explored. The government should fully leverage various options and encourage different parties to collaborate and not duplicate infrastructure unless absolutely necessary.

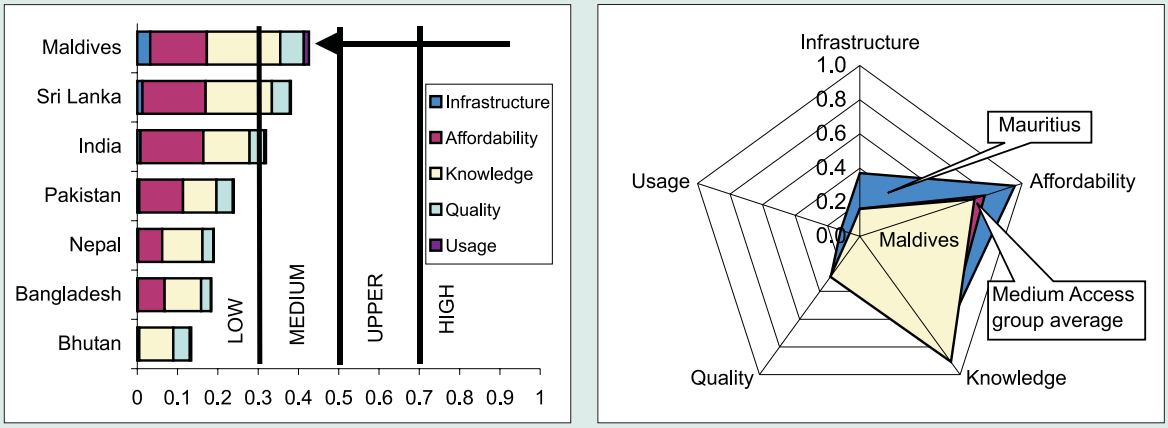
8.2 Assessing the Maldives

As noted throughout this report, the Maldives has made exemplary progress in expanding telecommunication access to its citizens. How does the Maldives compare internationally and how ready is it to make use of the benefits from ICT? In terms of overall infrastructure—fixed and mobile telephones—the Maldives' rank has risen by 30 positions (from 133 to 93) over the last quarter century. While the country's telephone density was 22 times less than the world average in 1970, this gap had been reduced to just one and half times by 2002 (Figure 8.1, left). The Maldives has the highest telephone subscribers per capita in South Asia as well as among the LDCs (Figure 8.1, right). It is on target to catch up with middle-income countries in terms of telephone penetration fulfilling one aspect of its aspiration of Vision 2020 to become a middle-income developing nation.

The ITU launched the *Digital Access Index* (DAI) in November 2003 as a new way of measuring the ability of nations to provide access to ICT.[2] The DAI is based on four factors that have an impact on access: infrastructure (fixed and mobile telephone subscribers), affordability (Internet access costs), knowledge (literacy and school enrolment) and quality (international Internet bandwidth and broadband subscribers). A fifth factor, Internet user penetration, matches the theory of the index with actual usage. The Maldives ranked 92nd out of 178 countries and was the highest-ranking LDC and South Asian nation (Figure 8.2, left).[3] Its overall score of 0.43 places Maldives in the medium access category. It is useful to compare how Maldives fares in the various factors to see its strengths and weaknesses. In terms of infrastructure it matches the medium access category average while knowledge, quality and usage are above the average. The area it does less well is in affordability (Figure 8.2, right). When compared to the top-ranking medium access countries, the Maldives needs to raise its level of infrastructure and lower its costs. The country should aim for the goal of moving into the next category, high access (DAI value above 0.49).

Figure 8.2: Maldives in the DAI

Maldives Digital Access Index values compared to South Asia (left) and Medium access category average (right)



Source: ITU.

The ITU has been using a framework developed by the Mosaic Group to gauge the e-readiness of nations.[4] That framework has been applied to the Maldives (Box 8.1). Maldives ranks in the mid-range of countries that have been studied. It performs well in terms of overall penetration and absorption of ICT in different sectors of the economy. It does less well in spread of ICT—particularly to the atolls—and organizational infrastructure—with a relatively closed telecommunication market. These are areas that the nation needs to work on to improve its e-readiness ability.

It is also useful to carry out a *Strengths, Weakness, Opportunities and Threats* (SWOT) analysis particularly as they relate to the development of the ICT sector. The Maldives has a number of strengths. Widespread use of English gives it an advantage in the ICT area where so much content and software is in that language. Another positive attribute is the Maldives sense of unity simplifying consensus on national goals and strategies. Good governance is another plus with the public administration scoring well in terms of transparency and efficiency compared to other developing nations.[5] Universal access to telecommunications is also a strong point. The Maldives location can be a plus particularly in attracting ICT businesses that are looking for security and distance from the world's problems.

The country also has several weaknesses. While the Maldives' small size and geography can be strengths they are also the source of most of its weaknesses. For example the country's small population base works against the establishment of a university, constraining higher educational opportunities. This is particularly important since the development of an ICT industry requires advanced skills. Another weakness is the lack of broadband capability in the national backbone. This inhibits the atolls from fully participating in the information society by restricting the functionality of applications such as telemedicine and distance education. The lack of a fibre optic connection for international Internet bandwidth is also a limitation since the quality and pricing of satellite connection is less favourable.

It is important to be realistic about e-opportunities particularly

Box 8.1: State of the Internet in Maldives

The International Telecommunication Union (ITU) has been using a framework to analyze the development of the Internet in different nations. Developed by the Mosaic group, the framework consists of values for six different elements that have an impact on Internet take-up.[8] Values range from 0 to 4; the higher the value, the better.

Pervasiveness measures the overall access rate to the Internet. Maldives is rated *common*, 3, as the estimated penetration rate is 5.3 per cent of the population (above the one per cent to reach the common level).

Dispersion measures the geographical spread of Internet access. All inhabited islands in the Maldives have telephone service. Although Internet access is theoretically available wherever there is a telephone line at a standard nationwide fee, in reality the line would need a PC. On some of the islands, there are only payphones with no PC attached. Public Internet access is available on some 55 islands. Dispersion in the Maldives is rated 2, *moderate*, with Internet access available from approximately 25 – 33 per cent of inhabited islands.

Absorption measures the extent to which different sectors of the economy are using the Internet. Maldives is rated 3, *common.* Virtually all government agencies have Internet access, as do secondary schools. Large companies and sectors such as tourism and banking have Internet access. The Ministry of Health has a Local Area Network and two hospitals are involved in telemedicine project.

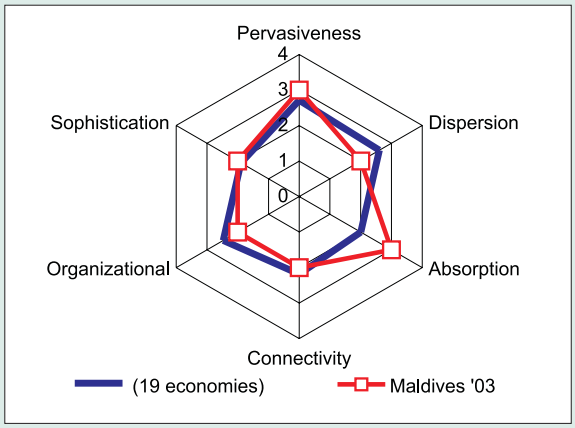
Infrastructure measures the extent and speeds of backbone and local access networks. Maldives is rated 2, *expanded*. Maldives has a well-developed telephone network and has introduced broadband access. However, the predominant method of access to the Internet is still via low-speed, dial-up; there is no national data backbone and international Internet connectivity is via satellite rather than fibre.

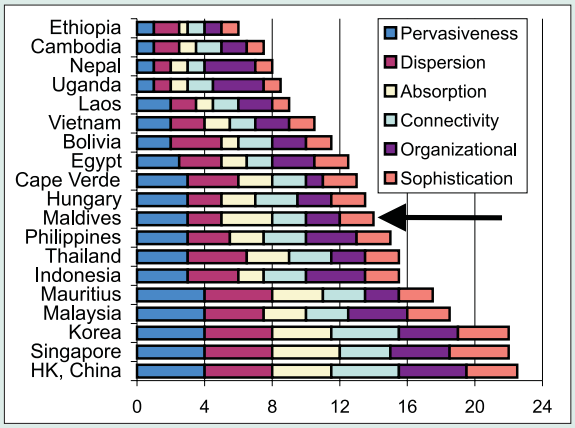
Organization measures market conditions. Maldives is rated 2, *controlled*. The Internet market has been a monopoly. A second ISP license was issued in 2003.

Sophistication measures how usage ranges from conventional to highly sophisticated. Maldives is rated 2, *conventional*. The most popular Internet applications appear to be surfing and e-mail The usage of more advanced applications such as media streaming, online banking, e-commerce transactions and government interaction are still developing.

The ITU has carried out evaluations for 19 economies since January 2000. One way of comparing economies is to sum the scores of each element. The highest ranked economy thus far is Hong Kong, China with an overall score of 22.5 (out of a possible maximum of 24). The Maldives ranks eighth out of the 19 economies with a score of 15. One benefit of the Mosaic framework is that it highlights which areas a country need to improve to enhance its Internet diffusion. In the case of Maldives, this would be dispersion and organizational, areas where it is below the average of the 19 countries evaluated. In the case of dispersion, there is a need to expand Internet access in the atolls. In the case of organizational, Maldives has recently awarded a second ISP license and it is too soon to see the impact.

Figure 8.2: State of Internet in the Maldives





Note: The higher the value, the better (0=lowest, 4=highest).
Source: ITU.

considering the Maldives' constraints in terms of small population and limited post-secondary training facilities. However there are certain niche areas worth exploring. One is e-tourism or the application of ICT to tourist services. The country already has a significant tourism industry. Tourism is an information intensive business with the need to provide details to consumers as well as process reservation requests. The Maldives could leverage its large tourism industry to become a leader in e-tourism applications.[6] Another opportunity is India given the Maldives historical relations, business ties and geographical proximity. India has the developing world's largest export-oriented software development industry and hence much expertise in ICT. India has been sharing its expertise with the Maldives and is willing to extend it further. The Indian Prime Minister notes, "*Our cooperation in human resource development spans an entire range - from defence to hospitality, from medicine to information technology. We will further widen and intensify this range. We have also discussed some new ideas - for an IT village, for the ecological preservation of Hulhumale, for digital mapping of your islands, for a telemedicine link and for a remote sensing centre. These lay down markers for our future endeavours*."[7]

The Maldives is moving in the right direction and has a number of ICT plans and projects. One danger is they could stall due to a lack of commitment or resources. The loss of LDC status is a serious threat since many of the nation's projects in ICT have been with the assistance of the international development community. This is in some ways tied to another threat, that of marginalization. The Maldives is a small country and at times may seem irrelevant to the global community. This can have a negative impact in terms of raising support and awareness for issues that are important to the Maldives. This all the more reason to embrace ICT as a development enabler particularly since it also ties in with the current emphasis of the international community. In any case, the Maldives has few other alternatives for

Table 8.1: Maldives SWOT

Strengths, Weaknesses, Opportunities and Threats

Strengths	**Weaknesses**
Widespread English	Lack of tertiary institutions
Widespread access to basic telecom	Shortage of ICT professionals
Current government commitment to ICT	ICT regulatory inexperience
Good governance	Geographic isolation & small size
Geographic isolation & small size	Lack of fibre-optic bandwidth
High literacy	
Sense of national unity	
Opportunities	**Threats**
Niche in areas such as e-tourism	ICT goals become side tracked
Leverage on India's software development expertise	Loss of LDC status
Telemedicine and distance education	Marginalization
	Brain drain

Source: ITU.

diversifying its economy. With few natural resources, limited labour supply and a need to promote an environmentally clean image for the benefit of tourism, agricultural and manufacturing diversification of the economy is not a viable option.

8.3 Recommendations

- *Accelerate enactment of e-laws*. The Ministry of Commerce drafted an e-commerce law that legally recognizes electronic transactions. The draft was sent to the Attorney General's office two years ago but has yet to be approved because of heavy workload and other priorities. Another delay is that all legal documents need to be translated into the national language, Dhivehi. The lack of the necessary laws and online transaction processing is a significant hindrance to the development of e-commerce and e-government applications.

- *Telemedicine*. While there are a number of efforts to use ICT to make the health care system more efficient, these are largely limited to the collection and dissemination of information. The Health Master Plan, for example, stipulates the use of information, education and communication to empower people to lead healthy lifestyles. It also emphasizes the need to set up a database to collect essential health indicators and information on ICT-related projects. The Master Plan does not mention the use of telemedicine, despite the fact that it is already used, albeit in a limited way. The geographic particularities of the Maldives suggest that telemedicine should be an attractive application. Even basic telemedicine services, such as the exchange of images, could improve health care services in the islands.

- *Wireless and broadband push*. There has been a delay in the adoption of key wireless technologies such as high speed mobile and Wireless Local Area Networks (WLAN or Wi-Fi). This will change as the new ISP has been granted the exclusive use of the 2.4 GHz spectrum for Internet use for the next few years. This is the same frequency that Wi-Fi uses and it is expected that the ISP will quickly rollout services. Dhiraagu is examining the introduction of high-speed mobile service using General Packet Radio Service (GPRS). Given the rapid growth of mobile and the growing number of users that are utilizing their mobiles for data, GPRS looks promising. It could also be an appropriate technology in the atolls for accessing the Internet particularly where fixed lines are limited or slow. The government should encourage these initiatives by facilitating administrative procedures.

- *Test bed*. The Maldives should leverage its unique geographical characteristics and experience from tourism by becoming a development and expertise centre for ICT in these areas. For example, most islands are small. Thus they are ideally suited to wireless LAN technology such as Wi-Fi.[9] This would be attractive in resorts for tourists who bring portable computers with them as well as to spread Internet access on inhabited islands for the local community. Another area would be the new Multimedia Messaging Service (MMS) for mobile phones. International roaming already generates considerable revenues and this could be increased given MMS ability to transmit "digital postcards".[10]

- *Local content development*. One of the barriers to getting more people online is that they may not be aware of the benefits or there may not be much content available that interests them. In the Maldives many Internet users surf abroad because there are still not many compelling national

sites and applications. In order to get additional people using ICT, more locally relevant content will have to be developed. The government can take the lead by developing e-citizen applications. This has particular relevance in the Maldives where distances are great. The ability to complete and process government forms online could save citizens and business transport costs and time spent travelling. The UNDP atoll portal project could also potentially help drive more Maldivians to use the Internet. Another area of content development is tourism. Resorts are in the Maldives and it is logical that content should be developed and hosted in the country.

- *Statistics*. The Maldives has good administrative records for telecommunication services. In addition, the national statistical agency asked about the availability of certain ICT products and services in the 2000 Census (i.e., fixed telephone, PC, television). Policy makers are also monitoring appropriate accessibility indicators such as islands with telephone service and mobile cellular population coverage. There is a need to extend the analysis to other information society areas. For example, it would be useful to know how many households have mobile phones. In particular, there is an urgent requirement for an Internet user survey. This would provide information on the number of Internet users and their characteristics such as location, educational attainment, and gender. This could be carried out by the national statistical agency on a regular basis based on existing international models. In addition, there is a need for information about household expenditure patterns for communication services in order to have a deeper understanding of how affordability affects ICT take-up. There is also a need to measure the ICT sector in the national accounts, the take-up of ICT in different sectors (i.e., business, government and education) and ICT employment.

- *Distance education.* Several development agencies have noted that distance education could have a meaningful impact in the Maldives where "bricks and mortar" educational facilities are limited because of small market size and where two thirds of the population is widely dispersed across two hundred islands.[11] While the Maldives seems like an ideal place to employ online education, neither the facilities in Male' nor the atolls, are adequately equipped to support it. In addition, there seems to be misgivings about distance education particularly its ability to ensure quality. These issues need to be resolved and a meaningful distance education policy and projects implemented.

- *Universal access*. The Maldives has accomplished universal access to basic telephone service. It now needs to go further. The Telecommunication Policy states: "*A majority of the population is deprived of the Internet service due to unavailability of residential telephone lines as well as public Internet access centres, such as cyber cafés, in most of the islands. Hence, priority must be given to expand the telecommunication services and reduce the existing disparity in service provision between Male' and other islands*." In order to do this, a coordinated and concrete policy is needed. Projects and proposals should be coordinated and existing facilities leveraged to minimize duplication and maximize the resources available. Specifically the relationship between 1) existing private and community Internet cafes, 2) public kiosks as envisaged by the e-government plan and the 3) UNDP atoll ICT project need to be clarified. An

ideal solution would be to identify one location in each atoll capital (and eventually every island) where affordable high-speed Internet access to government and other Internet services will be available. By combining initiatives it would be possible to achieve a more attractive solution such as high-speed fibre optic, Wi-Fi or VSAT rather than just dial-up access. Pricing and training issues also need to be clarified.

- *Education.* The government needs to enhance university-level ICT training. One way is to provide support for ICT activities of the Maldives College of Higher Education. The government should further support the creation of an IT degree. The shortage of IT manpower affects all sectors across the economy, including the government, and the Maldives needs to make sure that it creates its own pool of IT professionals. While it would seem reasonable to rely on foreign universities for specialized training, Maldivians should have the possibility to receive basic IT training in such areas as database management, support, and networking.

  There is also a need to promote computer literacy and awareness among the public at large. This includes providing training in basic computer skills, particularly for those outside the workforce and academic environment. This could be modelled on the country's successful adult literacy programme.

- *Liberalization*. There is no doubt that additional liberalization of the telecommunication sector will result in lower pricing for Internet and mobile services. This is the experience of other countries that have introduced competition. However the Maldives is unusual in that the compact between the government and the incumbent telecommunication operator has been very successful. Dhiraagu has provided telephone service to all inhabited islands, a challenging accomplishment considering the geographical layout of the country. Given the unique circumstances of the Maldives—many small relatively sparsely inhabited islands—liberalization may be difficult. Though there is growing evidence that investors can be interested in small markets, the dispersion of population in the Maldives will make it a more difficult proposition. Furthermore, the government has been able to extract concessions from Dhiraagu that will be less likely in a more competitive environment. Thus liberalization should not be pursued as an end in itself, but rather as one way to achieve a modern telecommunication network with a high level of access. Liberalization will require greater resources devoted to regulatory issues such as interconnection and universal service if it is to be successful. A telecommunication act is also a necessary precursor for liberalization to be successful.

- *Fibre optic*. The Maldives reliance on satellite technology for its international Internet connection has drawbacks. The price of Internet connections via fibre tends to be cheaper than satellite, quantity is more abundant and the quality better. The latter is an important point, for if the Maldives is to develop a vibrant software sector—particularly in the area of data hosting—fibre is a must for reliability and speed. Though the cost of an undersea fibre connection will be steep, it should not be measured in purely financial terms. There are wide-ranging spill over benefits that need to be quantified to form part of the equation.

- *ICT and the economy*. There is widespread belief that ICT can

play a pivotal role in the Maldivian economy. Indeed, with limited resources and a small manufacturing sector, the Maldives has few options for diversifying its economy and ICT seems one of the brightest. This is acknowledged in the various sector and national development plans and the draft ICT strategy which sees employment creation as one of the pillars of ICT mentioning areas such e-tourism, e-fisheries and software parks. What is now needed is more specificity about the exact impacts, layout and evolution of the ICT sector. This would include an inventory of existing ICT businesses, their output and employment and future evolution. It would also include a detailed description about the types of future ICT businesses that the country would like to establish, employment requirements and linkages to existing and planned training. A macro-economic model showing the relationship between ICT and the economy would be useful for planning. The government should also pick a few strategic ICT businesses it wants to develop and assign resources to attract them.

[1] Essentially this could be summarized as the operator meeting specific goals, particularly the completion of a nationwide transmission network in exchange for retaining market exclusivity. Part government ownership of the operator no doubt assisted in ensuring that the operator's goals were in line with national development priorities.

[2] "ITU Digital Access Index: World's First Global ICT Ranking." *Press Release*. 19 November 2003. http://www.itu.int/newsarchive/press_releases/2003/30.html. [Accessed 9 November 2004].

[3] A Bangladesh newspaper commented on the South Asian rankings. See "Bangladesh crawls in the ICT race." *The Daily Star*. 24 November 2003. http://www.thedailystar.net/2003/11/24/d31124050248.htm. [Accessed 9 February 2004].

[4] See "The Global Diffusion of the Internet Project" at http://mosaic.unomaha.edu/gdi.html. [Accessed 9 February 2004].

[5] See the World Bank Governance Research Indicator Country Snapshot (GRICS): 1996-2002 at http://info.worldbank.org/governance/kkz2002/sc_chart.asp. [Accessed 9 February 2004].

6 For more on e-tourism and developing countries see the web page of the UNCTAD Expert Meeting on Electronic Commerce and Tourism held in September 2000: http://www.unctad.org/Templates/meeting.asp?intItemID=1942&lang=1&m=4338. [Accessed 4 February 2004].

[7] Statement by Prime Minister Shri Atal Bihari Vajpayee at State Luncheon by President Maumoon Abdul Gayoom of the Republic of Maldives. 23 September 2002. http://meadev.nic.in/speeches/stmt-pm-stateluncheon.htm. [Accessed 9 February 2004].

[8] For definitions of the elements and how values are assigned see "Questionnaire: Global Diffusion of the Internet" at http://som.csudh.edu/fac/lpress/gdiff/quest.htm. [Accessed 9 February 2004].

[9] For example the Mirihi Island Resort, the first to obtain a satellite Internet connection, has installed a W-Fi network noting "It would be very good for the islands in terms of tourism and attracting people to the island." Alfred Hermida. 31 July 2003. "Paradise island gets wireless web." BBC News. http://newsvote.bbc.co.uk/mpapps/pagetools/print/news.bbc.co.uk/2/hi/technology/3107027.stm. [Accessed 4 February 2004]. The resort's website notes the availability of wireless Internet access for those "who need to keep in touch with work or want to send emails to family." http://www.mirihi.com/internet.html. [Accessed 4 February 2004].

[10] Data are not available on the number of postcards sent from the Maldives but can be inferred from international letter-post items which include postcards. There were 1.5 million international letter-post items sent in 2001 compared to around one million received. Assuming that the difference is accounted for by postcards sent by tourists, this suggests that around 500'000 post cards were sent from the Maldives in 2001.

[11] The World Bank calls for distance education to train O level graduates noting that computers are widely available in the atolls. http://lnweb18.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewForJavaSearch/A2B5EB7F276345B385256C860071A654/$file/Maldives_PPAR.pdf. The Asian Development Bank also had planned for university level distance training as part of an education project. http://www.adb.org/Documents/Profiles/LOAN/28161013.ASP. The following paper also makes the case for promoting distance education at the secondary level: Ali Fawaz Shareet and Kinshuk. 2003. "Distance Education Model for Secondary Schools in Maldives." Proceedings of the International Conference on Information Technology: Research and Education.

Annex 1: Meeting schedule

Date	*Organization*	*Persons met*
28 May	Dhiraagu	Mr. Mohamed Maumoon, Head of Services
	Ministry of Communication, Science & Technology	Mr. Hussain Shareef, Director General Mr. Mohamed Amir, Director, Telecom Ms. Zulaikha Ibrahim, Telecom Analyst
29 May	Dhiraagu	Mr. Ismail Rasheed, Head of Networks Mr. Umayr Shafeeu, Manager Switching Mr. Ahmed Shaafiu, Marketing Manager Ms. Lina Atkinson, Manager Sales Outlets
	Ministry of Planning and Development, Statistical Office	Ms. Aishath Shahuda, Assistant Director
1 June	Ministry of Communication, Science & Technology	Mr. Midhath Hilmy, Minister Mr. Faig Umar, Assistant Director Ms. Malika Ibrahim, Assistant Director
	Ministry of Trade and Industries	Mr. Fazeel Najeeb, Director International Co-operation
	Ministry of Education	Mr. Ahmed Adeem, Senior System Programmer
2 June	Ministry of Communication, Science & Technology	Mr. Hussain Shareef, Director General Mr. Mohamed Amir, Director, Telecom
	Enviroweb (Consultants for e-government project)	Mr. Michel Boulanger, Consultant in Information Systems Mr. Jesus Garcia, Consultant in Information Systems
	Asia-Pacific Telecommunity (APT)	Mr. Amarendra Narayan, Secretary General Mr. G. Hugh Railton, Deputy Secretary General
	Dhiraagu	Mr. Ismail Waheed, Chief Executive Officer
3 June	Opening APT Study Group Meeting	
	College of Higher Education	Mr. Hassan Hameed, Rector
	Ministry of Health	Mr. Ahmed Afaal, Assistant Director
	United Nations Development Programme (UNDP)	Mr. Jan Thomas Hiemstra, Deputy Resident Rep. Ms. Nashida Sattar, Programme Officer
	Focus Computers (2nd ISP)	Mr. Sobah Rasheed, Director

Annex 2: Acronyms

ADB	Asian Development Bank
COL	Center for Open Learning
FHTS	Faculty of Hospitality and Tourism Studies
FMC	Faculty of Management and Computing
ICT	Information and Communication Technology
ISP	Internet Service Provider
ITDB	Information Technology Development Project (ITDP)
Kbps	Kilo bits per second
LDC	Least Developed Countries
Mbps	Mega bits per second
MCHE	Maldives College of Higher Education
MMS	Multimedia Messaging Service
MOE	Ministry of Education
MPND	Ministry of Planning and National Development
NDP	National Development Plan
PC	Personal computer
Rf	Maldivian Rufiya. The 2002 annual average rate of Rf 12.85 per one United States dollar is used to make conversions in the report.
SAARC	South Asian Association for Regional Cooperation
SIDS	Small Island Developing States
SMS	Short Messaging Service
UNDP	United Nations Development Programme
VSAT	Very Small Aperture Terminal

Annex 3: ICT statistics

	Note	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003
DEMOGRAPHY, ECONOMY											
Population	1	10x3	245	250	254	259	265	270	275	281	285
Households	2	10x3	35	36	37	38	40	41	42	43	44
Gross domestic product	3	10x6	4'696	5'301	5'982	6'357	6'935	7'348	7'651	8'186	...
Average annual exchange rate per US$	4		11.77	11.77	11.77	11.77	11.77	11.77	12.24	12.80	...
Consumer price index	4		100	106	114	113	116	115	115	116	...
TELEPHONE NETWORK											
Main telephone lines			13'869	15'268	17'967	19'985	22'179	24'432	27'242	28'651	30'056
Main lines per 100 inh.			5.67	6.12	7.07	7.72	8.37	9.05	9.9	10.2	10.5
% residential main lines		%	61.9	68.3	69.4	65.1	63.4	63	62.6	63.9	...
% main lines in urban areas		%	89	...	...	...	...	...	74	73	73
Public payphones			181	285	397	521	596	629	723	773	918
Waiting list for main lines			261	244	326	315	514	153	265	113	44
MOBILE SERVICES											
GSM mobile subscribers			-	20	1'290	1'606	2'926	7'638	18'894	41'899	66'466
- Cellular prepaid subscribers			-	-	-	-	-	-	7'360	29'625	53'189
Coverage of population		%	-	...	...	...	35	40	40	54	71
Cellular subscribers per 100 inh.			-	0.01	0.51	0.62	1.10	2.83	6.86	14.91	23.3
TRAFFIC (minutes)											
Local telephone		10x3	105'539	107'650	113'813	129'203	137'118	144'229	142'170	112'936	...
National trunk telephone		10x3	29'645	33'773	54'558	62'537	76'841	81'661	80'169	64'544	...
Dial-up Internet		10x3	-	...	...	10'613	20'020	35'947	43'893	51'358	...
Fixed-mobile		10x3	-	...	...	3'000	3'601	19'320	32'097	47'407	...
International out. telephone		10x3	3'086	3'976	4'384	5'067	5'682	5'562	6'900	7'016	...
International inc. telephone		10x3	3'612	4'239	5'057	5'903	6'655	7'212	8'335	10'266	...
Mobile		10x3	-	-	1'376	6'927	8'330	35'603	53'054	81'580	...
STAFF											
Full-time telecommunication			384	445	399	497	550	532	523	519	...
- of which female			...	...	...	124	137	131	127	140	...
QUALITY OF SERVICE											
% Telephone faults cleared by next day		%	...	52	57	45	46	...	...	90	...
Faults per 100 main lines per year		%	36	87.9	76.9	69.6	55.9	55.7	52.3	46.4	...
TARIFFS											
Telephone connection			1'720	1'720	1'720	1'720	1'720	1'720	1'720	1'720	1'720
Telephone monthly subscription			30	30	30	30	30	30	30	30	30
Local call (per minute)			0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Cellular connection			-	1'000	1'000	1'000	1'000	1'000	500	500	500
Cellular monthly subscription			-	300	300	300	300	300	150	150	150
Cellular - 3-min. local call (peak)			-	7.5	7.5	7.5	7.5	7.5	6.75	6.75	6.75
Cellular - 3-min. local call (economy)			-	6.75	6.75	6.75	6.75	6.75	5.70	5.70	5.40
REVENUE											
Total telecom services		10x6	220	316	399	460	529	624	720	835	...
- Mobile communication		10x6	-	...	...	29	30	100	201	360	...
CAPITAL EXPENDITURE											
Annual telecom investment		10x6	110	176	173	131	100	135	88	102	...
BROADCASTING											
Television equipped households	5		12'000	13'800	15'800	18'100	20'700	23'204	26'010	29'100	...
Home satellite antennas	5		113	280	450	750	1'300	2'094	3'500	5'800	...
INFORMATION TECHNOLOGY											
Personal computers			3'000	4'000	5'000	6'000	7'500	10'000	15'000	20'000	...
Internet subscribers	6		-	-	...	763	939	1'060	1'100	1'067	1'147
- DSL Internet subscribers			-	-	-	-	-	-	-	190	490
Estimated Internet users			-	575	800	1'500	3'000	6'000	10'000	15'000	...
International Internet Bandwidth (Mbps)			-	-	0.64	0.64	2	3	5	9	...

Note: (1) Source: Ministry of Planning and National Development (MPND) mid-year estimates. (2) Source: MPND (1995, 2000); ITU estimates (other years). (3) At market prices. Source: MPND. (4) Source: IMF. (5) 2000 = Census. Other years, ITU estimate. 1995-96: Dhiraagu, 2000: Census, other years: ITU estimate. (6) Not including "pay as you go" users.
Source: Dhiraagu, Ministry of Communications, Science and Technology.

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