

Khmer Internet: Cambodia Case Study



International Telecommunication Union



March 2002

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**INTERNATIONAL TELECOMMUNICATION UNION
GENEVA, SWITZERLAND**

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The views expressed are those of the authors and may not necessarily reflect the opinions of the International Telecommunication Union (ITU), its members or the Government of the Kingdom of Cambodia. This report is one of a series of Internet Case Studies being carried out in the South East Asia region. Additional information is available on the Internet Case Studies web site <www.itu.int/ITU-D/ict/cs>.

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1. Country background

1.1 Overview

The Kingdom of Cambodia, with an area of 181'035 square kilometres, is located in South East Asia, on the south-western part of the Indochina Peninsula. It is bordered by Thailand on the west and north-west, by Lao PDR on the north, and by Vietnam on the east and south-east. Cambodia is bounded by the Gulf of Thailand on the south-west with a coastline that is 435 kilometres long.

Cambodia is known for its cultural heritage and the impressive Angkor temples represent the country's major tourist attraction, with some one million visitors expected in 2002.

The temples were built between the 9th and the 13th century in the religious and administrative centre of the Khmer Kingdom.

Situated between the Tropic of Cancer and the Equator, Cambodia has a tropical climate with two distinct seasons: the dry monsoon season from November to May and the humid, rainy monsoon season from June to October. Annual average temperature varies between 21 to 35 degrees Celsius, often reaching over 40 degrees in April, the hottest month. The landscape is dominated by the large Tonle Sap (Great Lake), as well as the Mekong and Bassac rivers that run through the country's Central Plain. While some 75 percent of the country is flat, the more densely forested and sparsely populated highlands comprise the Cardamom Mountains in the southwest, including the country's highest mountain (Phnom Aural, at 1'771 meters) and

Figure 1.1: Map of Cambodia



Source: World Factbook, 2001.

the Dangrek Mountains in the north, along the Thai border.

Administratively, the country is divided into 20 provinces, four municipalities and 12'738 villages.

1.2 Demography¹

The national census in 1998 counted a population of 11.4 million. The majority of the population is rural, with only 16 percent residing in urban areas. Cambodia's capital is Phnom Penh, with a population of about one million. With an estimated annual growth rate of 2.4 percent, the population is expected to double within less than 30 years. Fifty five percent of the population is under the age of 20 and 71 percent of the male population is under 30. With relatively fewer adult men, about a quarter of Cambodia's households are headed by women. The population is predominantly Khmer (around 90 percent),

Table 1.1: Population indicators

Item	Year 1998
Total Population (million)	11.4
Population Growth Rate	2.4
Average life expectancy at birth (years)	
• Male	50
• Female	53
Urban population (%)	16
<u>Age Distribution:</u>	
Below 15 years (%)	42.8
15-29 years (%)	26.1
30 years and older (%)	31.1

Source: National Institute of Statistics, Cambodia.

some five percent are Chinese and five percent Vietnamese. The official language, spoken by 95 percent of the population, is Khmer. There is some use of French and English. French tends to be understood mainly by older people while English is more commonly understood by the younger generation. Theravada Buddhism is the religion of virtually all of the ethnic Khmer and of about 95 percent of the population.

1.3 Economy²

Cambodia is one of the poorest countries in the world. In 1999 its GNP was US\$ 3.1 billion and its GNP per capita US\$ 260, compared to an average GNP per capita of US\$ 1'000 in the East Asia and Pacific Region. Thirty six percent of the population lives below the poverty line and 90 percent of the poor are in rural areas. The Cambodian economy is largely based on the primary sector (fishing, farming, and forestry), which employs 82 percent of the workforce. The industrial infrastructure of the country is poorly developed and the sector accounts for only three percent of employment. Services account for the remaining 15 percent of the labour force. In 1999 the primary sector represented 50 percent of the total GDP, services amounted to 35 percent and industry accounted for 21 percent. The industrial sector is

likely to have a growing impact on the economy since its annual average growth has been some ten percent since 1990, compared to two percent for the agricultural sector and eight percent for the service sector.

After many years of war and internal conflict, a stabilizing political environment has led to an improved economic performance and the economy has been growing slowly but steadily in the last few years. Economic growth was five percent in

1999, four percent in 2000 (despite that year's devastating floods) and is projected to be 5.5 percent in 2001. Cambodia's most important exports include garments, processed wood, natural rubber, tobacco, and rice. Its main markets are Thailand, USA, Singapore, and China.³ Forestry could be a major income for the government but illegal logging is estimated to have cost the government US\$ 60 million in 1997 (two percent of GDP). Deforestation is also a threat to the environment, and efforts are being made to balance the country's natural resources as well as the revenues they could generate.

Average annual inflation dropped to four percent in 1999, compared to almost 15 percent in 1998. At 74 percent of GNP (US\$ 2.3 billion) in 1999, total external debt was down from 79 percent in 1998, and 160 percent in 1989. Foreign aid of US\$ 24 per capita in 1999 remains a major source of foreign currency in Cambodia. A major problem the country faces is the lack of a private sector. One of the biggest barriers to private investment is an often unpredictable and unstable regulatory framework. The government sector is thus a major target for reform in Cambodia. The country suffers from corruption and the lack of tax and customs enforcement. Tax revenues represent only six percent of the

country's GDP. The government has started to implement different measures to fight corruption, improve the transparency of the public sector and strengthen the legal and judicial system and reforms. Entry to the Association of South East Asian Nations (ASEAN) is likely to have a positive influence on the political as well as economic situation. According to the Asian Development Bank, "Cambodia has made considerable progress in implementing liberalization measures and structural reform in the past few years".

1.4 Human development⁴

Cambodia ranks 121st out of 174 on the United Nations Development Programme's Human Development Index (HDI), placing the country at the end of the medium human development category. Although one of the lowest ranked South East Asian countries (only above Laos), Cambodia is about where it should be in terms of human development given its per capita income. The HDI is composed of a basket of indicators including life expectancy at birth, adult literacy, school enrolment and GDP per

capita. Table 1.2 shows that the HDI varies greatly in the ASEAN region and that Cambodia, together with Laos, has the region's lowest HDI. Cambodia's history of war and internal conflict have had a detrimental impact on the country's social and economic structure.

1.5 Government

Cambodia has a long history, and its culture goes back at least to the South-East Asian Hindu state of Funan in the first century. It is known for the Kingdom of Angkor, which has its origin in the eighth century. Weakened by wars and dynastic rivalries, Cambodia became a French protectorate in 1863 and a virtual colony by 1884. While French control over the country was temporarily suspended during the Second World War, French rule returned to Indochina once the Japanese had surrendered. The quest for independence, however, increased and in 1954, Cambodia gained full independence under King Norodom Sihanouk. Although Sihanouk emphasized Cambodia's neutrality, the country was eventually drawn into the US-Vietnam war and

Table 1.2: Human Development Indicators

Cambodia compared to selected Asia-Pacific economies, 1999

HDI Rank	Country	Life expectancy at birth (years)	Adult literacy rate (%)	Combined school gross enrolment ratio (%)	GDP Per Capita (PPP US\$)
26	Singapore	77.4	92.1	75	20'767
56	Malaysia	72.2	87.0	66	8'209
66	Thailand	69.9	95.3	60	6'132
70	Philippines	69.0	95.1	82	3'805
101	Vietnam	67.8	93.1	67	1'860
102	Indonesia	65.8	86.3	65	2'857
118	Myanmar	56.0	84.4	55	1'027
121	Cambodia	56.4	68.2	62	1'361
131	Lao PDR	53.1	47.3	58	1'471

Source: United Nations Development Programme.

in 1969 the United States, suspecting communist enemies in Cambodia, heavily bombed the country. Internal conflicts led to the overthrow of Sihanouk in 1970 and the establishment of the pro-military regime under General Lon Nol.

Sihanouk formed an alliance with his former enemies, the Cambodian communists, called the Khmer Rouge, against the government of Lon Nol. Despite US support for Lon Nol, the government was overthrown and the Khmer Rouge gained power in 1975. In the next four years the Khmer Rouge, under the leadership of Pol Pot, tried to convert Cambodia into a self-sufficient, agrarian country. This social and economic experiment established state control through terror, turned citizens into slave workers, and killed an estimated 1.7 million people, some 20 percent of the population at the time.⁵

Border disputes, ideological differences, and the wish to restore order in the region, led Vietnam to invade Cambodia in 1979. The Khmer Rouge were pushed westwards, toward the border with Thailand, from where they fought a guerrilla war against the Vietnamese-backed government. Other groups, beside the Khmer Rouge, began to fight for Vietnamese withdrawal. In 1989 the last Vietnamese troops left the country and four political groups, including a faction led by former King Sihanouk, started their struggle over power.

A framework for a settlement between the opposing forces within Cambodia was agreed upon in 1990 and a year



later the UN was given authority to supervise a ceasefire and organize elections that took place in 1993. Over four million Cambodians - around 90 percent of eligible voters - participated in the elections, which established the Royal Government of Cambodia. Within a framework of parliamentary democracy King Sihanouk was proclaimed Head of State. Two Prime Ministers, Prince Ranariddh and Hun Sen, were appointed to represent the two major parties that won the elections. The Khmer Rouge, who boycotted the election, were promised amnesty. This led to the defection of some of its members and in 1994 the group was officially outlawed.

After internal struggles within the coalition government in 1997, the Cambodian People's Party assumed leadership. Hun Sen was elected sole Prime Minister in 1998 in a new coalition government, with Prince Ranariddh as President of the National Assembly.

¹ Unless otherwise indicated, the information in this section is adapted from the Ministry of Education, Youth, and Sport, The Kingdom of Cambodia: Country Background, at http://www.moeys.gov.kh/profile/edu_in_cambodia/country_background.htm#not2.

² Unless otherwise indicated, the information in this section is adapted from the Asian Development Bank, at <http://www.adb.org/Cambodia/default.asp> and the World Bank, Regions and Countries: Cambodia.

³ Cambodia Ministry of Commerce, at <http://www.moc.gov.kh/main/stats.htm>.

⁴ The Information in this section has been adapted from the UNDP's Human Development Report, 2000.

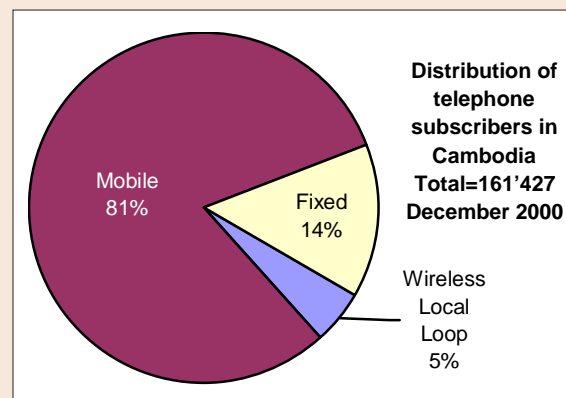
⁵ Financial Times, Khmer Rouge tribunal moves closer, August 28, 2001, p. 6.

2. Telecommunications: Made for Mobile

2.1 Mobile record setter

Cambodia is a textbook example of wireless technology boosting telecommunications development. It was the first country in the world where mobile telephone subscribers passed fixed ones—way back in 1993. Cambodia began the millennium with more than four out of five telephone subscribers using a wireless phone (see Figure 2.1), the highest ratio in the world. Thanks to mobile, Cambodia's tele-density—telephone subscribers per 100 inhabitants—reached one in 2000, a significant achievement for a Least Developed Country (LDC). While mobile has contributed to the bulk of Cambodia's telecommunication progress over the last decade, wireless fixed lines have also helped and accounted for five percent of all telephone subscribers at the beginning of 2001.

Figure 2.1: The world's most wireless place



Source: MPTC.

Perhaps the biggest factor contributing to wireless success is that there just never were many fixed lines to begin with. Years of civil war both destroyed most of the existing fixed network and prevented the construction of new lines. At the end of 1992, the year mobile cellular was introduced in Cambodia, there were only a little over 4'000 fixed lines for a population of some 9.3 million. A year later, mobile had already surpassed fixed. Another contributing factor to mobile success was that the government liberalized the market early on, allowing both private investment and competition.

Today, Mobitel, a GSM mobile operator, is the largest telecom network operator in the country with almost 95'000 subscribers at the beginning of 2001. There are three digital and two analogue mobile operators, all with foreign investors. Two additional digital mobile licenses have been awarded but have not yet started operating. Another success factor has



been prepaid, with over 90 percent of mobile subscribers opting for this payment method. With a per capita GDP of only US\$ 260, most Cambodians either could not afford or would not qualify for a subscription telecommunication service. Prepaid cards with denominations as low as US\$ five, and a used handset available for as little as US\$ 20 make mobile telecommunications much more accessible. Prepaid is also attractive from an operator's perspective because it eliminates the risk of subscriber default. Another contributing factor to mobile growth is billing in US dollars (use of the US dollar is widespread in Cambodia), which reduces the investor's exchange rate risk.

While wireless communications have helped Cambodia achieve a minimal level of communications, it has also created its fair share of problems. This includes a confusing mix of government shareholdings and agreements; an interconnection maze; and an over-reliance on mobile network service provision to the detriment of the fixed line network.

2.2 Mighty MPTC

The Ministry of Posts and Telecommunications of Cambodia (**MPTC**) <www.mptc.gov.kh> is the industry policy-maker and regulator. In addition, it is involved in some way in every telecommunication network in the country either as a provider or joint venture partner. It has managed this feat without investing much of its own money. Most of the fixed network has been provided through bi-lateral assistance, while the mobile network has been constructed with foreign investment. According to the Council for the Development of Cambodia, private capital totalling US\$ 131 million was invested in the telecommunication sector during the period 1994-1999.⁶

The only network the MPTC owns outright is the local exchange in Phnom Penh. The Japanese Government largely funded extensions during the 1990s to the Phnom Penh network (US\$ 40 million

in two projects, US\$ two million contributed by Cambodia). The first extension began in December 1996 and was completed in March 1997 providing 6'800 line capacity. Capacity is now 16'800 lines and is to be expanded to 50'000 lines by 2007. In the year 2000, the MPTC also began installing fixed lines outside Phnom Penh by putting local exchanges in eight provinces. One side effect of practically starting from scratch is that all local telephone lines are connected to digital exchanges.

The MPTC has a staff of just over 2'000 of which roughly one third work in telecommunications. The Ministry of Finance allocates its yearly budget. One of the biggest problems within the



MPTC are constraints on its ability to operate as a commercial entity. Although over the years consultants have presented several proposals advocating the corporatization of the telecommunication arm of the Ministry and the creation of a "Telecom Cambodia", no action has been taken. Instead, MPTC's revenues continue to be reported as a part of overall government revenues, and its profits absorbed by the government for use elsewhere. This has adversely affected the MPTC's ability to expand the fixed network. As a result, there is a de facto policy of allowing private investment in partnership with the MPTC to expand telecommunications. Most of this investment has flowed

Table 2.1: Cambodian telecom service operators

Service	Number of operators	Name of operator	Note
Fixed lines	3	MPTC	In Phnom Penh and since 2000, 8 provinces
		Camintel	Provinces+1'112 WLL in Phnom Penh
		Camshin	WLL in Phnom Penh
GSM cellular	3	Camshin	GSM 1800
		Mobitel	GSM 900
		Casacom	GSM 900
Analogue cellular	2	Casacom	NMT-900
		Camtel	AMPS-800 network in Phnom Penh
International gateway	2	MPTC	International gateway built by Telstra, passed to government in 2000
		Tele2	Launched gateway in November 2000

Source: ITU.

into the mobile sector but has also included Wireless Local Loop (WLL), fixed lines in the provinces and international gateways. While this policy has contributed to telecommunication development, it is marked by a lack of transparency. For example, there is no clear picture of licensing or policy and timetable for telecommunication liberalization. Rather, restrictions on market entry are generally a function of various contracts signed between the MPTC and the operators. For example, in the contract established with Telstra for the establishment of an international gateway (since expired), it was stipulated that no new gateways would be built.

The magnitude of the various joint ventures is evident from revenue generated in the telecom sector. For example, in 2000, the MPTC itself had US\$ 23 million in revenue (including postal services). On the other hand, the other telecom operators generated twice as much, or some US\$ 52 million of which over US\$ ten million was paid to the MPTC as revenue sharing. There appears to be considerable confusion about whether the MPTC is actually

receiving the full amount due from revenue sharing.⁷

2.3 ASEAN investing

In addition to the MPTC, there are five private companies providing telecom services in Cambodia (see Table 2.1). All have strategic foreign investors, primarily from South East Asian nations (Thailand, Indonesia and Malaysia).

Cambodia Indosat Telecommunication (**Camintel**) <www.camintel.com>, a joint venture of PT Indosat of Indonesia (49 percent) and the Kingdom of Cambodia, was established in 1995 to take over the United Nations Transitional Authority in Cambodia (UNTAC) network in the provinces. Since the network already used the Indosat satellite, it seems logical that the Indonesian company would become involved as a joint venture partner. Camintel has fixed lines in all the provinces but two. In addition it operates 1'112 WLL lines in Phnom Penh as well as 156 card phones. Camintel also has a license to provide Internet services to provincial users. Camintel has around 200 employees.

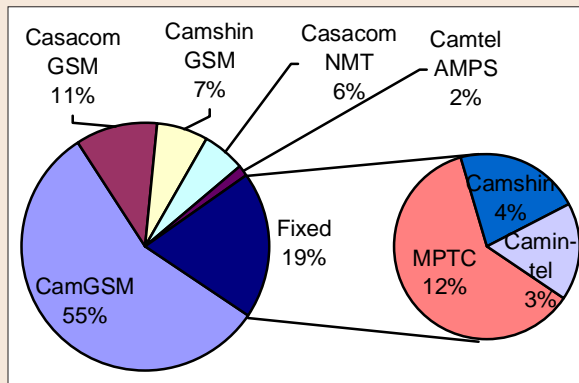
CamGSM Co., Ltd (**CamGSM**) <www.mobitel.com.kh> has been the country's largest telecom operator since 1998, just one year after launching its MobiTel GSM network (in March 1997) (see Figure 2.2). Today CamGSM has a 70 percent market share of the mobile market. Although its mobile network is present in almost all provinces and it claims it will have coverage in all provinces by the end of the year, the majority of its customers are in Phnom Penh. The MobiTel network uses Alcatel equipment with which it has signed contracts for over US\$ 80 million for infrastructure.⁸ CamGSM is a joint venture between the international Luxembourg-based cellular company Millicom (58.4 percent) and the Royal Group of Cambodia. CamGSM shares its revenue with the MPTC. The percentage varies annually according to the contract. In 2001 it was ten percent. A sister company, **Tele2**, obtained a license for an international gateway, which it launched in November 2000. In addition, Tele2 launched a broadband fixed wireless access service in March 2001.

Cambodia Samart Communications Company Ltd. (**Casacom**) provides analogue and GSM mobile services. It is a joint venture of the Samart Group of Thailand, Telkom Malaysia and the government of Cambodia (30 percent). It launched its analogue NMT-900 network in November 1992 and its GSM network in April 1999. Casacom's GSM network uses Ericsson equipment. The initial investment was US\$ 7.5 million.

Cambodia Shinawatra (**Camshin**) was originally a joint venture with the government established to provide a WLL network. In March 1997, Camshin was converted to a fully owned subsidiary of the Shinawatra Group of Thailand. It was granted a GSM license until 2032 and the 1800 frequency network was launched in April 1998. As at December 2000, Camshin had 6'778 subscribers to its WLL network, of which some 90 percent were in Phnom Penh. It had 10'552 subscribers to its GSM network.

Figure 2.2: Cambodia telecom market

Market shares based on December 2000 subscribers



Source: ITU adapted from MPTC.

Cambodia Mobile Telephone Company (**CamTel**) launched Cambodia's first mobile network, an analogue AMPS system in October 1992. CamTel is owned by the CP Group of Thailand. Its subscribers, all in Phnom Penh, have dwindled since the launch of GSM due to limited functionality and a lack of analogue handsets. CamTel has been awarded a GSM license and intends to launch services sometime in 2002.

Though no longer in operation, Tricelcam provided an analogue ETACS mobile network, which it launched in October 1993, and which at one point had around 6'000 subscribers (1996). Tricelcam was a joint venture between TRI of Malaysia and the Cambodian government. Tricelcam was a victim of GSM's rapid success as well as of the inability of TRI to invest in the network following the Asian financial crisis in 1997.

It is believed that SK Telecom of the Republic of Korea has been granted a mobile cellular license using CDMA technology. No further information is available.

2.4 Prefix city

For a country of its size and income, Cambodia has one of the most crowded telecom markets in the world

with six operators running a total of eight fixed and mobile networks. Different prefixes have been assigned to the networks that are often referred to by these numbers rather than their names (see Table 2.2). There is no number portability, for either fixed or mobile. Cambodia has a Calling Party Pays system. All networks are required to interconnect and there is a central

interconnection point at the MPTC in Phnom Penh. The current interconnection charge, established by the MPTC, is seven US cents per minute. While the MPTC had authorized negotiations between operators to establish cost-based interconnection charges the Ministry abruptly changed its mind in mid-2001. It announced that it would adopt Sender Keeps All (SKA) and thus no longer make interconnection payments. This reversal was, no doubt, triggered by a traffic imbalance from fixed to mobile calls of between 14-20:1. Mobile operators,

who receive more fixed calls than they send out, will be adversely affected by this change. Some operators have suggested that if SKA were fully implemented, they would have to reconsider their investment strategy due to the end of revenues from incoming calls.

2.5 International cash cow

Telstra of Australia opened Cambodia to the world when it installed the first international gateway in 1990. This was done as a so-called ten-year Business Cooperation Contract (BCC) with the MPTC. Telstra received 51 percent of the revenue, and the MPTC the remainder. The BCC expired in 2000 and the gateway is now fully owned by the MPTC.

Table 2.2: Prefix soup

Network prefixes in Cambodia	
011	Camshin
012	CamGSM
015	Casacom (NMT)
016	Casacom (GSM)
018	Camtel
023	Fixed

Table 2.3: Cambodia's international call tariffs

US\$ per minute, At 1 March 2001

	Work days	Weekends
To Lao, Vietnam, Thailand	US\$ 1.50	US\$ 1.35
To other Asian countries	US\$ 1.60	US\$ 1.44
To countries on other continents	US\$ 1.80	US\$ 1.63

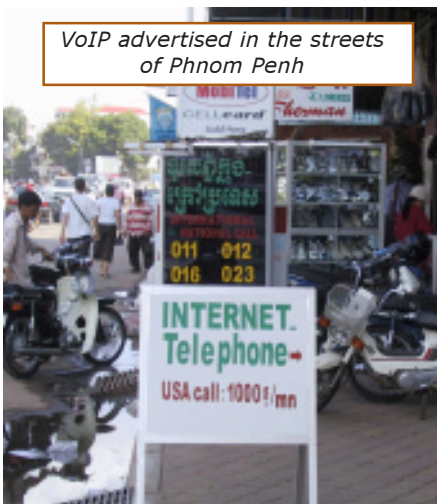
Source: MPTC.

Millicom launched the country's second international gateway in November 2000 through its Tele2 subsidiary.⁹ This arrangement is structured as a joint venture between the MPTC, Millicom and the Royal Group. The license is valid for 25 years. It is not believed that any additional international gateways will be awarded in the near future.

The MPTC earns 85 percent of its revenue from international phone calls. This is not surprising considering that Cambodia has some of the highest international tariffs in the world and the fixed network is so limited. The international tariff structure is straightforward. There are three bands and a weekday and weekend rate (see Table 2.3). Mobile operators charge the MPTC rate in addition to the mobile per minute call charge. Access to direct international calling from fixed lines requires the payment of a deposit of currently US\$ 150 for the MPTC network and US\$ 200 for Camintel's network.

Because of the high cost of international calls, users are turning to other methods for communicating abroad. First, many people rely on incoming international calls with the ratio of incoming to outgoing 3:1 (29 million minutes of incoming international calls in 2000 compared

VoIP advertised in the streets of Phnom Penh



to 9.6 million outgoing). Second, despite its illegality, there appears to be growing use of Voice over Internet Protocol (VoIP) with a number of Internet cafés openly advertising it. In a few cases, stolen foreign mobile phones have also been used to make international calls.

2.6 All phones lead to Phnom Penh

According to the last government survey on household telephone penetration, less than one percent of Cambodian households had a telephone in 1996. When this figure is broken down, some five percent of households in Phnom Penh had a telephone, 1.1 percent in other urban areas had one, while for the rest of the country, household penetration of telephones was negligible. Though this figure is five years old, the figure for fixed lines, and the urban/rural distribution have not changed much. Less than 20'000 fixed lines were added between 1996-2000. Just over 100'000 mobile phones have been added but the majority have been in Phnom Penh. The situation is such, that by the end of the year 2000, 85 percent of the country's fixed telephone lines were in Phnom Penh

even though it accounted for less than ten percent of the country's population. Overall fixed density stood at 0.25 telephones per 100 people. The density in Phnom Penh, 2.44, was some 60 times greater than that of the provinces (0.04).

Despite this low teledensity and the large disparity between Phnom Penh and the provinces, there is no formal government policy for universal telephone access in Cambodia. Instead, micro-business schemes are helping to spread telephone access. One example are the privately operated telephone booths that are omnipresent in Phnom Penh and other large cities. These booths typically have one worker and may be operated in conjunction with an adjacent shop or market stall. Equipped with a collection of mobile phones, each subscribed to a different network, the business model is that the booth's customer uses the phone with a subscription to the number being called, thus avoiding the network interconnection fees. The booths charge R500 (12.8 US cents) per minute to make a call (to fixed or mobile), compared to regular charges of anywhere between US 15-28 cents (depending on whether the call is fixed to mobile, mobile to fixed or mobile to another mobile network).¹⁰ These booths supplement the 339 card phones operated by Telstra and Camintel—there are no coin-operated phones in the country because there are no coins. Estimates of the number of telephone booths range widely. A general consensus is that there are at least 500 in Phnom Penh.

The mobile boom has also contributed to universal access. Indeed if high coverage could be achieved, most Cambodians would be in reach of a telephone signal—a major accomplishment. Efforts could then be focused on affordability. Surprisingly, mobile operators were unclear about their exact population coverage. The networks are concentrated along



One of the privately operated telephone booths in Phnom Penh

Table 2.4: Fixed telephone tariffs

September 2001

	MPTC		Camintel	
	Phnom Penh	Provinces	Phnom Penh	Provinces
Installation	US\$ 70	US\$ 40	US\$ 100	US\$ 100 / US\$ 40*
Monthly subscription	US\$ 8	US\$ 6	US\$ 10	US\$ 10
Local call	1 US cent	1 US cent	2 US cents	2 US cents
Fixed to mobile call	15 US cents	15 US cents	15 US cents	15 US cents
Long distance call	15 US cents	15 US cents	15 US cents	15 US cents

Note: * Cheaper rate for some provinces. Including taxes. A deposit is required for international direct dialling (MPTC: US\$ 150 in Phnom Penh and US\$ 100 in provinces; Camintel: US\$ 100).
Source: ITU adapted from MPTC, Camintel.

the main roads and have been slowly filtering into the provinces. Several mobile operators vowed that they would service the largest towns in all provinces before the end of 2001. This can be partly attributed to the fact that coverage has become an important selling point.

2.7 How much does it cost

Telephone tariffs are established by the MPTC. For fixed lines, there is a choice of three operators. In Phnom Penh, users can choose between the MPTC or the WLL networks of CamShin or Camintel.

In the provinces, the main provider is Camintel although the MPTC has recently begun installing lines. Fixed line tariffs are reproduced in Table 2.4. Fixed charges are high relative to Cambodia's low per capita income. This may be partly to offset the fairly low usage charges.

For mobile pricing, the GSM operators offer post-paid and pre-paid subscriptions while CAMTEL offers only post-paid subscriptions. Most Cambodian mobile

subscribers use the pre-paid system. Post-paid subscriptions also have a number of extra deposits and charges that are not applicable with pre-paid. On the other hand post-paid call charges are cheaper than pre-paid. Pre-paid cards are available in denominations ranging from US\$ five to 50. In general, higher denominated cards have a lower price per call. Some operators charge a daily fee for pre-paid. The validity of pre-paid cards ranges from 14 – 180 days, again depending on the denomination. Incoming calls usually have a longer validity period.

Table 2.5: Mobile pricing

July 2001, US cents except connection charge

Pre-paid	Camshin	Mobitel
Connection	\$30	\$22
To same mobile peak	25.2	31
To same mobile off-peak	15.2	20
To fixed peak	25.2	33
To fixed off-peak	15.2	20
To another mobile peak	28	33
To another mobile off-peak	16	20

Note: Including taxes. For Mobitel, refers to US\$ 5 denomination card.
Source: ITU adapted from operators' tariffs.

2.8 Mobile data

Despite the rapid growth of mobile and growing interest in the Internet, there is not much activity in Cambodia's mobile data market. Two of the mobile operators have launched Short Messaging Service (SMS). However take-up has been affected by the unavailability of Khmer font on mobile handsets. Operators also indicate that they will not introduce WAP or GPRS soon, let alone third generation mobile. Some indicate that they are waiting for instructions from investors'

home markets before proceeding in Cambodia.

This lack of interest in mobile data is surprising considering the market opportunity due to a lack of fixed lines. Though using a conventional GSM network to dial-up the Internet is not speedy (9.6 kbps), it is better than nothing. Indeed some mobile subscribers in the country are using their mobile phones for sending and receiving e-mails. If the mobile operators upgraded to GPRS, they might find a suppressed demand.

⁶ US Department of State. *2000 Cambodia Country Commercial Guide*. <http://usembassy.state.gov/cambodia/wwwf0002.pdf>

⁷ According to one report private telecom operators own the government over US\$ 8 million. The government has threatened to revoke their licenses. See "Cambodge Nouveau", du 1 - 16 juillet 2001, n°158.

⁸ "Alcatel Wins a New GSM Network Contract in Cambodia Valued at US\$ 63 Million." June 5 2000. *Press Release*. <http://www.home.alcatel.com/vpr/archive.nsf/AllDocuments/4D586A95DC03DCB0C1256A53006058F4?openDocument#>

⁹ "Millicom International Cellular SA Announces the Launch of an International Gateway in Cambodia." *Press Release*. 1 November 2000. <http://micc.client.shareholder.com/News/20001101-36232.cfm>

¹⁰ For example, it costs 15 US cents to call from fixed to mobile, 25.2 cents to call from mobile to fixed peak and 15.2 cents mobile to fixed off-peak and 28 cents mobile to another mobile network peak, 16.5 cents off peak and even 25.2 to the same mobile network (peak).

3. The Internet: The state of being underdeveloped

3.1 Internet for Development

Cambodia is a latecomer to the Internet with commercial services only launched in 1997. It has the dubious distinction of having the lowest Internet penetration in South East Asia as well as the highest prices. The question is does Cambodia have high Internet prices because it has a small market or is the market small because the prices are high? One is related to the other, since, without a larger market, Cambodia cannot benefit from economies of scale to reduce costs.

Apart from the obvious barrier of poverty, exasperated by exceptionally high Internet prices, the Kingdom faces a combination of distinct factors that inhibit the expansion of the Internet. These include the lack of a vibrant academic community that could help nurture and sustain networking; the complexity of computerizing the written Khmer language, which hinders local application development (see Box 3.2); an extreme shortage of dial-up telephone lines needed to access the Internet; and government policies that have restricted Internet supply.

The international community has played a key role in launching, providing and nurturing the Internet in the Kingdom (see Box 3.1). The Internet was introduced thanks to Canadian assistance; the leading Internet access provider started its business with Australian foreign investment; and almost all initiatives to provide affordable Internet access to the public have been launched by non-governmental organizations. What is lacking is what could be called "*Internet for Development*": a large-scale, visible initiative that binds the power of the Internet to Cambodia's urgent development needs.

3.2 Better late than never

The use of e-mail in Cambodia dates back to 1993 (see Box 3.1) but it was not until May 1997 that Cambodia obtained full connectivity to the Internet via a link to Singapore.¹¹ That connection was made possible with assistance from the Canadian International Development Research Centre (IDRC). The Ministry of Posts and Telecommunications (MPTC) created an Internet Service Provider (ISP), Camnet, and launched commercial services after a free three-month trial period. In the meantime, an additional ISP license was granted to Telstra of Australia to launch its BigPond Cambodia service, the first commercial ISP in the country, in June 1997.¹²

In June 2001 the estimated number of Internet users in Cambodia was 8'000. Although Cambodia's Internet penetration of 0.07 percent is very low (the lowest in South East Asia apart from Myanmar), it has made steady growth. When the Internet was launched in 1997, there was roughly one user among every 6'000 Cambodians. By mid 2001, this had increased to one user for every 1'200.

At the end of 2000, Cambodia had 22'990 fixed telephone lines.¹³ The potential of dial-up Internet access is consequently very limited because only 0.26 percent of the population have a fixed telephone line. With just over 4'000 Internet subscribers, around one in four telephone lines is already used to access the Internet. This ratio is relatively high and suggests that the lack of fixed lines is one of the reasons for the low Internet penetration.

3.3 The market players

The MPTC functions as policy maker, regulator, and operator on the

Box 3.1: The international development community, Cambodia and the Internet

As with so much else in Cambodia, the international development community—bi-lateral and multilateral assistance agencies and non-governmental organizations (NGOs)—have played a critical role in introducing and nurturing the Internet in the Kingdom. For example, Norbert Klein of the Open Forum <www.forum.org.kh> was instrumental in introducing e-mail to the country. This came about in 1994 when a Cambodian student wanted to study in Sweden and found his application rejected because he did not have an e-mail account. Klein arranged for a UUCP account with the Institute for Global Communications in San Francisco. Despite call charges of US\$ five per minute at that time, e-mail was exchanged with the Institute once a day, allowing Cambodians to communicate electronically with the outside world. The first e-mail with a Khmer text attachment was sent between the student in Sweden and his wife back in Phnom Penh. Today the Open Forum provides e-mail for around 500 subscribers as well as an Internet café at its office in Phnom Penh. The Forum has also been instrumental in promoting the usage and standardization of the Khmer font.



Another networking pioneer was Bill Herod. Working with Canada's International Development Research Centre (IDRC), Herod was involved in establishing Cambodia's first direct Internet connection, a 64 kbps link to Singapore in 1997. IDRC provided financial support to the MPTC's ISP Camnet, in

exchange for Camnet offering subsidized services to government and education organizations. Herod went on to open a public Internet centre at Lidee Khmer, an association of Cambodians who studied abroad. He then moved on to help a group of Cambodian women launch the Khmer Internet Development

Services (KIDS) <www.bigpond.com.kh/users/kids>, a dot-com company that develops web sites, provides training, and runs an Internet café in Phnom Penh.

One sign of the success of these initiatives is that more Cambodians are using the Internet. Both the Open Forum and KIDS note that there has been a marked up turn over the last year of Cambodians using their facilities. The

downside is that since Cambodians pay less, the organizations are earning less money to expand their activities. This is unfortunate since they have been important in developing a Cambodian civil society as it makes a fragile transition to democracy. They have opened up the outside world to Cambodians as well as Cambodia to the outside world. These low profile organizations have done as much if not more than anyone else to launch Cambodia into cyberspace. They illustrate the constructive role that the international community can play in reducing the Digital Divide but also suggest that small, grass-roots initiatives are more effective than the larger aid organizations that tend to hog the headlines.

Cambodian Internet market. Until mid-2001, the number of ISPs in Cambodia was limited to two—the government-owned **Camnet** <www.camnet.com.kh> and the commercial ISP BigPond. Legally, Camnet is part of the MPTC but is supposed to be run as a commercial entity. In reality, Camnet faces constraints linked to its government ownership. The ISP is often slow to react to market needs because changes must run through the regular decision-making process within the government. This gives Camnet a strategic disadvantage vis-à-vis its competitor. The government-owned ISP is also

obliged to employ people from within the MPTC who are telecommunication rather than information technology experts. There are plans to separate the ISP from the ministry but no date has been fixed so far.

In March 2001, Camnet had 1'796 dial-up subscribers, 65 percent of which were private customers, 28 percent commercial, three percent from the educational sector and four percent from the government sector. It had only one leased line customer, a reflection of high leased line prices and the underdevelopment of the Cambodian Internet market.

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BigPond <www.bigpond.com.kh>, with 2'008 dial-up subscribers at March 2001, is Cambodia's largest ISP. It launched services in 1997, when the MPTC and Telstra agreed on a duopoly until 2002, protecting BigPond from competing Internet service providers entering the market. It was equally agreed that, as long as there was no joint venture between the ISP and the MPTC—as is the case with other telecommunication operators—BigPond would share an increasing percentage of its revenues with the government. By 2001 this share had reached 40 percent. It dropped to 20 percent, though, when BigPond agreed to an early end to duopoly and an opening of the market in June 2001.

Ninety percent of BigPond's clients are in Phnom Penh with the remainder in Siem Reap. All twelve employees work in Phnom Penh; services in Siem Reap are remotely controlled. BigPond's seven leased line customers include the World Health Organization, MobiTel, and

some NGOs. The ISP also hosts 16 web sites plus some personal web pages, which BigPond offers free of charge. Over 40 percent of the ISP's clients are



BigPond offices in Phnom Penh

private customers, some 20 percent are commercial and another ten percent are international and non-governmental organizations. Clients also include Internet cafés, government officials and ministries.

Although the exclusivity of the two ISPs officially only ended in July 2001, two other companies have been

Table 3.1: Cambodia's Internet players

December 2000

Provider	Subscribers			Note
	1999	2000	Change	
Camnet	1'033	1'630	58%	Government-owned ISP. Provides Internet access in Phnom Penh.
BigPond	1'225	1'852	51%	Private ISP owned by Telstra of Australia. Provides Internet access in Phnom Penh and Siem Reap.
Camintel	52	289	456%	Telecom operator in the provinces. Partly owned by PT Indosat of Indonesia. Provides Internet access in 14 provinces.
Open Forum	460	453	-2%	Non-governmental organization. Provides e-mail service and access to information hosted in Cambodia.
TOTAL	2'770	4'224	52%	

Source: ITU adapted from data submitted by the providers.

providing Internet access in Cambodia. One is **Camintel** <www.camintel.com>, the telecommunication operator who inherited the UN's telephone network in the provinces. It is not quite clear whether Camintel operates under a so-called provincial license that allows the operator to provide Internet access in the provinces or whether Camintel is simply sub-renting ISP services from Camnet. The latter provides Camintel with a 128 kbps leased line, which, according to Camintel staff, occasionally suffers from technical problems. Camintel hopes to eventually become a fully independent ISP, with its own network and infrastructure. Camintel's Point-of-Presences (POPs) are in Phnom Penh, mainly because it would be difficult to maintain POPs in the provinces. The ISP's provincial users, however, are only charged for a local phone call and Internet access prices are comparable to those in the capital. Three provinces are not covered by Camintel's ISP services. The telephone switches in these provinces run on VSAT and are not equipped to transport data. This makes Internet access very expensive for users in those provinces because they have to make a long-distance dial-up connection to a POP in the capital.

The **Open Forum of Cambodia** <www.forum.org.kh> has been providing e-mail access since 1994. It had 453 subscribers in December 2000, with more than twice as many users. In addition, the Forum maintains a number of locally relevant information on its web site including newspapers and newsgroups. It also hosts a number of other organizations' web pages. The Forum also has an Internet café at their Phnom Penh offices for those without access to a PC or the Internet.

3.4 Mobile operator goes Internet

In anticipation of market liberalization, mobile cellular operator **MobiTel**, the largest telecommunication operator in the country, has recently become active on the Internet market. It launched a



broadband wireless service dubbed **Telesurf** <www.telesurf.com.kh> in March 2001. Based on 3.4 gigahertz microwave technology, Telesurf covers an area of 14 kilometres in Phnom Penh. At December 2001 it had some 800 subscribers, mainly Small and Medium Enterprises (SME), as well as some large corporations and individuals. It presently offers speeds of up to one Mbps and is a badly needed high speed service considering the lack of leased line or ISDN connections or for that matter, basic dial-up telephone lines. One draw back is that customers must be in line of sight and it is only available in Phnom Penh though there are plans to expand it to other provinces. Telesurf's international gateway is through satellite, via Tele2 that provides it with two Mbps downstream and one Mbps upstream. When launched, Telesurf was advertised as a radio connection to the Internet since MobiTel did not have an ISP license. Thus typical ISP services such as a web page and e-mail were not included.

But then MobiTel launched a bilingual (English/Khmer) portal <www.everyday.com.kh> in August 2001, after receiving the country's third ISP license.¹⁴ It now provides users with a free e-mail account and allows them to send and receive free e-mail in Khmer. MobiTel also launched prepaid Internet cards, available at its headquarters, some of its phone shops and convenience stores located at gasoline stations.

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3.5 How can anyone afford it?

Cambodia has some of the highest Internet prices in the world and by far the highest tariffs in the South East Asia region (see Table 3.2). An entry-level plan in Cambodia would cost a user US\$ 3.99 per hour (including telephone charges), more than eleven times what a much wealthier Singaporean would pay. Tariffs in Cambodia are usage-based. There are a number of plans with pricing varying according to the number of free hours included. Tariffs are roughly the same between the two main ISPs; when one makes a price change, the other quickly adopts it. Pricing is in United States dollars. In addition, local call charges also need to be paid for dial-up access (one US cent per minute). Although the only POPs are in Phnom Penh and Siem Reap, as discussed earlier, Camintel only charges local phone calls for Internet access in all but two provinces and Internet access prices are comparable to those in the capital. Although prices are high, they have nonetheless declined. When the Internet was first introduced in Cambodia in 1997,

Camnet charged as much as eight dollars an hour for Internet access. Although Camnet would like to offer a flat rate plan, the MPTC fears that this could reduce its revenues. Prepaid cards have recently appeared on the market, with both BigPond and MobiTel offering them. However the denominations are not very low, effectively pricing them out of reach of most Cambodians. MobiTel offers the lowest denomination card at US\$ 20 for six hours of use or US\$ 3.33 per hour. A US\$ 20 Internet prepaid card is roughly ten percent of the average Cambodian's per capita annual income.

Camnet was established with the help of the IDRC and in exchange was obliged to provide subsidized services to schools, universities and NGOs until 1999. Ministries may also benefit from these services. Camnet continues to provide preferential conditions that exempt the beneficiary from the monthly fee of US\$ 30 and include eight hours free Internet access per month. Additional usage then only costs 20 percent, around US\$ 0.5 an hour, of the regular Internet access charge. A major problem with this

Table 3.2: Dial-up Internet pricing

September 2001, US\$

ISP	Plan	Entry Fee/ Deposit	Monthly Fee	Free Hours	Extra hour
Camnet	Option 1	\$40	\$18	3	\$3.40
Camnet	Option 2	\$40	\$30	8	\$2.70
Camnet	Option 3	\$40	\$90	30	\$2.45
Camnet	Option 4	\$40	\$300	120	\$2.25
Camnet	Option 5	\$40	\$600	260	\$2.10
Camnet	Option 6	\$40	\$1000	500	\$1.50
Big Pond	Casual	\$50-\$100	\$15	3	\$3.50
Big Pond	Standard	\$100	\$50	13	\$2.80
Big Pond	Frequent	\$200	\$110	35	\$2.50
Big Pond	Premier	\$400	\$240	100	\$2.00
Camintel		\$30	\$20	3	\$3.00

Country	Telephone	ISP
Cambodia	\$0.60	\$3.33
Vietnam	\$0.48	\$0.66
Indonesia	\$0.84	
Philippines	\$0.75	
Thailand	\$0.40	
Malaysia	\$0.39	
Singapore	\$0.36	

Note: Prices are based on typical entry-level plans. In Cambodia and Thailand, they are based on prepaid Internet cards. In Singapore, only dial-up telephone charges are applicable. In Indonesia and Malaysia, a nationwide Internet call is bundled with the telephone charge. In the Philippines, there are no usage charges for local telephone calls. In Thailand, local calls are flat rate.

Source: ITU adapted from ISPs.

system is that it opens the door to misuse and manipulation. Camnet is aware that some users within the ministries and other subsidized agencies resell their accounts, especially to Internet cafés. By giving out the user name and password of a 'cheap' account, a beneficiary can grant low-priced Internet access to anyone in Phnom Penh. Technically, it would not be difficult to identify these stolen accounts because they usually have a very high access rate (for example through frequent usage in Internet cafés). Camnet also registers the telephone number from which the subsidized account is accessed and can tell whether it is legal user or not. For several reasons, though, one of which is that it would cost Camnet time and resources to uncover and to block stolen accounts, little is done to prevent this misuse. BigPond does not face the 'stolen account problem' since it does not provide special rates to organizations or government entities.

Although Internet cafés can make use of special high volume plans, which give them cheaper access for a greater number of hours, prices remain high. In order to be profitable, they have to charge clients a minimum of US\$ two per hour. Some Internet cafés offer Internet access below this price. There are two possible explanations for this. One is that the café could be using a stolen account. Or it could have installed a Local Area Network (LAN), allowing it to connect multiple PCs to a single dial-up account. In this case, several users share relatively small bandwidth and will consequently get slower speed.

To put Internet pricing in perspective, the average salary for a government employed teacher or policeman is around US\$ 20 per month. This salary would barely allow them to regularly use Internet café services. Some Internet cafés now offer a flat rate of US\$ ten for unlimited use, which is advantageous for regulars but still limits services to the better off.

Cambodian ISPs have very few leased line subscribers, which is not surprising, given the high prices. Camnet charges a flat US\$ 3'500 / month for a 64 kbps

leased line. BigPond's monthly subscription for a 64 kbps leased line is US\$ 250. On top of that, usage fees of between US\$ 1'850 - \$ 4'150 need to be added depending on the utilization of the line. A one Mbps leased line from Camnet would cost US\$ 48'500 per month, clearly beyond the reach of virtually all companies. Furthermore, the quality of the leased lines, which must be obtained from the MPTC, is not very good. As a result of these high prices, new wireless broadband services such as the one launched by MobiTel should prove successful.

3.6 Bandwidth blues

Cambodia has no microwave backbone but the MPTC owns a fibre optic cable that runs from the Thai border, through Phnom Penh to the Vietnamese border. Camnet and BigPond both rent leased lines from the MPTC and Camintel sub-rents a 128 kbps leased line from Camnet for US\$ 5'000 per month. Camnet and BigPond, both satellite link-based ISPs, have their own international gateway, although the MPTC collects revenues from BigPond for using the satellite link. BigPond's satellite connection to Telstra in Sydney has recently been upgraded to 1.5 Mbps, down- and up-stream. While BigPond pays the MPTC US\$ 30'000 per month for the satellite link, Telstra in Sydney receives some US\$ 6'000.

Camnet has a 512 kbps symmetrical satellite connection to the Singapore Telecom Internet Exchange (STIX). Since the beginning of 2001 it also has a connection via Thaicom to UUNet. This asymmetric satellite link is two Mbps down and 512 kbps up. The cost of Camnet's backbone connection is high, especially because Cambodia has to pay the full circuit to STIX, some US\$ 20'000 per month for 512 Kbps. Because Camnet shares circuit costs with Thaicom it pays around the same price, US\$ 20'000 per month, for the two Mbps half circuit. Camnet's international connectivity thus adds up to about US\$ 40'000.

MobiTel's international gateway is by satellite, through Tele2 and provides it with access of 2 Mbps downstream and one Mbps upstream.

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Table 3.3: Cambodia's Internet connections

ISP international Internet connectivity, July 2001

ISP	Bandwidth		Note
	Down	Up	
Camnet	512 Kbps	512 kbps	Satellite connection to the Singapore Telecom Internet Exchange (STIX)
	2 Mbps	512 kbps	Satellite connection to UUNET, via Thaicom
BigPond	1.5 Mbps	1.5 Mbps	Satellite connection to Telstra in Sydney
Telesurf (Mobitel)	2 Mbps	1 Mbps	Tele2 Satellite
TOTAL	6 Mbps	3.5 Mbps	

Source: ITU adapted from ISP interviews.

3.7 Let's interconnect

Cambodia does not have a national Internet exchange so Camnet and BigPond are not interconnected. That means that an e-mail sent by a Camnet user to a BigPond user would exit Cambodia, transit through a third country, and then come back. In order to reduce these transit costs, the government announced in June 2001 that it would oblige the ISPs to set up a Cambodian Internet exchange. Technically this means that BigPond and Camnet would have to migrate their IP addresses to a new national Internet exchange. IP addresses are currently located outside Cambodia. BigPond, for example, obtains IP addresses from Telstra in Australia while Camnet gets them from Singapore. BigPond and Mobitel are also discussing the possibility of interconnection. These moves should eventually have a moderating effect on Internet access prices.

3.8 Public access

There is no exact data on the number of Internet cafés in Phnom Penh and estimates vary between 50-100, with lots more springing up. Although public Internet access is widely available all over Phnom Penh as well as in Siem Reap, there are very few Internet cafés in the rest of the

country and apart from a few rare initiatives, there is no public access in remote areas. Internet cafés in the major cities use regular dial-up connections so the access speed is limited.

While Internet access remains high-priced, basic computer training in the capital is more easily available. Signs across Phnom Penh advertise PC training courses for Riel 1'000 (US\$ 0.25) per hour. These courses are very popular, especially among the young.

Non-commercial projects to provide Internet access to the Cambodian public almost always involve some kind of international organization or donor. For example, low-cost public Internet access was provided at the Public Internet Centre (PIC), established by Pan Asia Networking (PAN)- Cambodia project, a cooperative venture between the MPTC and the IDRC.¹⁵ Other examples include the Open Forum and KIDS (see Box 3.1).

Although the government is aware of the benefits of the Internet and the need to provide public access in cities as well as in the rural areas, Internet access is not its priority. The few initiatives to exploit the benefits of the Internet in rural areas are undertaken

Box 3.2: The tribulations of the Khmer font

The Khmer language faces just about every possible barrier with regards to its use on the Internet. First, the Khmer language represents a relatively small market. There are only about twelve million Khmer speakers in the world. Of the 11.4 million living in Cambodia, less than 10'000 use the Internet. The difficulty of creating Khmer content is no doubt related to the low number of Cambodian Internet users. Second, text entry is difficult. The Khmer alphabet has 150 letters, while a standard keyboard only has 47 keys. Typing Khmer text on a normal keyboard is an exercise in mental gymnastics trying to remember each of the different combinations. On top of that, the Khmer language is highly complex, making it electronically less compatible than other languages. Almost all consonants, for example, have two different forms, depending on their position within a word. Written Khmer also omits spacing between words, turning online publications into a real challenge. In order to avoid manually inserting a space at the end of every line, the user has to download a special software that adds invisible spaces in between words. Whereas English only needs one alphabet layer, and French up to two (to accommodate accented letters), the Khmer script uses up to four layers.

There are a variety of initiatives and projects to facilitate the electronic use of Khmer language. The Open Forum of Cambodia, for example, offers a file conversion program, which translates texts from Khmer to Khmer. This may sound odd but is necessary because there are different Khmer font systems that are incompatible with each other. The UNICODE Consortium (<http://www.unicode.org/>), in charge of the character coding system to facilitate "worldwide interchange, processing, and display of the written texts of the diverse languages of the modern world"¹⁶, has proposed a solution for the Khmer language. Complaints have been made that these solutions are flawed, not very user friendly, and have been developed without any official Cambodian input.

Some Cambodians are circumventing complications by scanning Khmer text and sending it as an attachment to an e-mail or posting the scanned graphic on a web site. Cambodians who know English or French often prefer to visit foreign Internet sites. Khmer portals are more popular with overseas Khmers than with those living in Cambodia. Despite the obstacles, there are a variety of Khmer language web sites as well as portals. A good overview of these can be found at www.hotlinks.com/members/ngoforum/Khmer_Language_Content.

by the international development community, not the government. One of the most excluded areas in Cambodia, the isolated village of Robib in the northern Cambodian province of Preah Vihear, for example, has Internet access due to the American Assistance for Cambodia and Japan Relief for Cambodia. In collaboration with others, these two non-profit organizations have managed to connect some rural schools to the Internet, using computers and a satellite dish that are powered by solar panels and diesel generators. A specific government-backed plan to improve the situation in rural areas does not exist. Since almost 85 percent of the population lives outside the urban centres, the lack of access in rural areas drastically diminishes the country's potential user base.

3.9 The light touch

The Cambodian Post and Telecommunication Law primarily deals with postal matters and the country is only slowly adapting to the challenges of

the Internet. In one respect, this has been both logical and good. For example, the market is nascent, so there is not much to do. At the same time, a light touch is probably best in the early phase of Internet development. On the other hand, some aspects of policy are retarding growth. It is unclear whether the decision to limit the number of ISPs was a good one. The argument was that perhaps it was the only way to encourage private investment in this new sector. But the experience of Cambodia's mobile sector—with four competing operators—would seem to negate that theory. In any case, with BigPond's agreement to end the duopoly, it appears that the Internet market is on the verge of a breakthrough and additional licenses will be awarded before the end of the year 2001.

Norbert Klein from the Open Forum (see Box 3.1) has been administering Cambodia's country code top-level domain (ccTLD), .kh, since 1996. The MPTC is responsible for domain name

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regulations. These call for the use of a second level domain name (e.g., .per.kh, .com.kh, .edu.kh, .gov.kh, .mil.kh, .net.kh and .org.kh). The registration fee is US\$ 100 and the annual renewal fee was US\$ 60 until October 2001, when prices came down to US\$ 40 and US\$ 30 respectively.

The way the government deals with Voice over Internet Protocol (VoIP) is an example of the country's struggle to enforce its regulations. According to a December 1998 declaration, "*any use of telephony via Internet or any business which offers telephony service via Internet is strictly prohibited.*"¹⁷ Despite the ban, VoIP is openly advertised and available in Internet cafés across the country. VoIP not only offers reasonable quality, it also enables calls to be made internationally, for example to the US,

for less than the cost of a domestic call to a mobile phone. It is also very popular to make VoIP calls to neighbouring countries, except for Vietnam, where a firewall blocks these calls. The government has even discussed using VoIP to reduce costs while keeping it illegal for everyone else. The government has hinted that it would start closing Internet cafés that offer VoIP. It has also asked ISPs to remind their users of the ban.

Cambodia does not regulate or censor content in any way. One of the reasons the government has not felt the need to interfere is that there are so few Internet users. The fact that VoIP is prohibited but continues to be offered might change this. There is some discussion about blocking access to web sites that facilitate the use of IP telephony.

¹¹ See "Cambodian Connections." www.panasia.org.sg/hnews/kh/cm01i001.htm.

¹² See "Telstra Launches BigPond Internet services in Cambodia." *News Release*. 2 June 1997. www.telstra.com.au.

¹³ This refers to copper lines and not wireless local loop (i.e., WLL). The experience of WLL in Cambodia for Internet dial-up has not been satisfactory.

¹⁴ "MobiTel Makes the Internet More Accessible." *Press Release*. Undated. www.everyday.com.kh/internetaccess.htm.

¹⁵ See "Cambodian Connections." www.panasia.org.sg/hnews/kh/cm01i001.htm.

¹⁶ <http://www.unicode.org/unicode/standard/standard.html>.

¹⁷ Ministry of Posts and Telecommunications. *Declaration on Prohibition of Use of Voice Over Internet*. N°: 015 PT PrK. 30 December 1998. www.mptc.gov.kh/Regulation/net2phone/raculation.htm.

4. E-applications: The Development Dilemma

4.1 Clean water, PCs or both?

E-applications have the potential to bring benefits to society, the economy and the state. In particular, e-government, e-health, e-education and e-commerce have been identified as not only enhancing economic growth, but also promoting democratic and social progress. Cambodia, one of the least developed countries (LDC) in the world, has many barriers to these potential benefits, including: poor infrastructure, weak institutions, and low levels of literacy and ICT awareness. There is thus something of a paradox that Cambodia, which urgently needs the benefits that Information and Communication Technologies (ICT) can provide, and which could leapfrog the development it missed during its recent unsettled past, lacks the pre-requisite physical, social and political infrastructure. Cambodia faces the classic development dilemma of whether to invest scarce resources in ICT or to focus on more basic poverty alleviation needs such as clean water, primary education and health.

4.2 Not an e-government

Applying the model that the state has three roles in ICT—provider, user and promoter¹⁸— highlights the major shortcomings the Cambodian government faces in this area. The Cambodian government is a relatively new institution and is still evolving and developing the expertise needed to govern properly. International donors consider that poor governance is the single biggest obstacle to social and economic progress in the country.¹⁹ Thus until the Cambodian government strengthens itself, it is hard to expect it to assume a leading role in ICT development in the country. Another problem is that the Cambodian government is not used to trans-

parency and divulging information to the public. For example, few government departments publish annual reports. E-government goes against this tendency and thus is sometimes resisted. As a result, the donor community is currently driving most e-application projects across public sectors of the economy.

4.2.1 Forgetting about fixed

The Cambodian Government, through the Ministry of Posts and Telecommunications (MPTC) <www.mptc.gov.kh>, acts as a provider of ICT infrastructure and services in two ways. Firstly, it is itself a direct provider of fixed telephone lines. It also provides Internet service through its Camnet subsidiary. Camnet provides discounts to government departments, schools, hospitals, NGOs, etc. Through these discounts, Camnet provides a social service to organizations that have access to a telephone line and PC but cannot pay the full cost of Internet subscription. Such subsidies have been continued even though the obligation to offer them as part of an agreement with IDRC has lapsed. Camnet is committed to growing the Internet in Cambodia, and to helping those not served by private market operators. However, organizations that cannot afford the telephone connection, or the discounted Internet connection, or the necessary equipment, are not served. Also, Camnet does not operate outside Phnom Penh. Poor service quality has meant that some ministries now subscribe to Big Pond (the private ISP owned by Telstra Australia). Big Pond indicates that ten percent of its subscribers are NGOs and a further 30 percent are Cambodian authorities.

The second way that the government provides ICT is through joint ventures. For example, Camintel provides fixed

Table 4.1: Cambodian government online

Central government institutions with a web presence, August 2001

Institution	Web presence
National Assembly	www.cambodian-parliament.org
Senate	www.khmersenate.org
Council of Ministers	www.camnet.com.kh/ocm
National Archives of Cambodia (Prime Minister's Office)	www.camnet.com.kh/archives.cambodia
Ministry of Commerce	www.moc.gov.kh
Ministry of Education, Youth and Sport	www.moeys.gov.kh
National Institute of Public Health (Ministry of Health)	www.camnet.com.kh/nphri
National Institute of Statistics (Ministry of Planning)	www.nis.gov.kh
Ministry of Posts and Telecommunications	www.mptc.gov.kh
Ministry of Tourism	www.cambodia-web.net/camtourist
Royal Government of Cambodia	www.ocm.gov.kh

Source: ITU adapted from "Governments on the WWW" at www.gksoft.com/govt/en/kh.html.

telephone service in provincial areas while four mobile operators compete in the mobile market. This latter market segment, where the government has allowed private investment and competition, has resulted in Cambodia having the highest proportion of mobile telephone users in the world. However this is also a reflection that the government has been lax about developing fixed lines that are more appropriate than mobile at this time for ICT access.

What is lacking, apart from Camnet's provision of subsidized Internet access to qualified organizations, is a government policy on universal access to ICT. Moreover, the government has no large-scale projects to spread the use of Internet more broadly in the community and economy. Nor does it have a concrete plan for providing online e-services to its citizens.

4.2.2 Gov.kh

The Cambodian government does not use the Internet extensively. There are over 20 ministries in the country of which only a few have a web presence (see Table 4.1). Of those, only a handful have web sites using

the .gov.kh domain name; the rest have pages hosted by other sites or do not use the .kh domain name. There is a Royal Government of Cambodia web site at www.ocm.gov.kh with links to online government sites. Apart from the municipality of Phnom Penh, it does not appear that there are any other local authorities online. This is generally attributed to the lack of funds within the government and to a lack of vision regarding the benefits of ICT.²⁰

Even the MPTC is not a great user of the Internet. With 2'000 employees, only around 40 (including workers in the provinces) have access to the Internet. The low level of Internet use within the government and its agencies is reflected in the sections on e-health and e-schools below. All levels of government have a long way to go before they can be networked.

Nevertheless there are encouraging signs of ICT projects within the government sphere. The Civil Service payroll has been computerized. There is also a proposed project to connect the Ministries of Commerce, Finance

and Foreign Affairs. Another project in the planning is a Government Administration Information System (GAIS) to be partially funded and assisted by the Republic of Korea.²¹ GAIS involves setting up a government Internet server and computerizing the registration of vehicles, residents, and real estate. It will initially affect all administrative levels of the Phnom Penh Municipality; the Ministry of Public Works and Transport; the Ministry of Land Management, Urban Planning and Construction; and the Ministry of Interior. The budget is US\$ 20 million in concessional loans.²² A major reason that this project has focused on developing a computerized inventory of taxable property and people is that in joining ASEAN in 1999, Cambodia had to commit to reducing tariffs. In doing so, it lost a major source of revenue. Thus the government must look to other sources to generate income.

4.2.3 NiDA to the rescue?

Governments can do many things to promote the use of ICT. Firstly, they can fund or in other ways support the development of programs that enhance ICT use. Until recently, the Cambodian government did not have an explicit ICT vision with which to promote the use of the Internet. That has changed with the creation of the National Information Communications Technology Development Authority

(NiDA) <www.ocm.gov.kh/nida/> in 2000. NiDA is chaired by the Prime Minister and consists of a secretariat of around 40 people. Standards are high, with employees required to have at least a college degree, preferably in computer science. NiDA's main task is to map out an ICT Master Plan for the country to follow. NiDA has developed a short, medium and long-term strategy to pursue the goal of using computer technology to move the government closer to the people. The exact nature of NiDA's duties and powers is still evolving. For example, it is not clear whether NiDA will assume responsibility in the area of ICT regulation and universal access policy.

NiDA helped organize an Information Technology Awareness seminar in September 2001 attended by local government officials, the development community, the private sector, students as well as IT experts from India, the Republic of Korea, Thailand and Singapore.²³ The seminar was inaugurated by the Prime Minister, an encouraging sign of support for ICT development in the country (see Box 4.1).

Secondly, to promote ICT, governments need to create the appropriate regulatory and legislative framework. This includes regulations on intellectual property, electronic commerce, computer crime, etc. Cambodia has been making progress

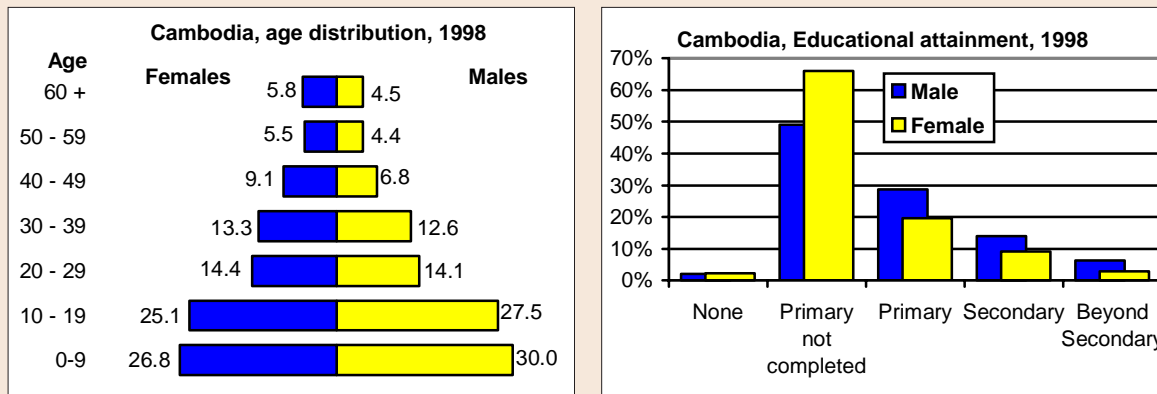
Box 4.1: The Prime Minister on ICT

The Prime Minister of Cambodia, Samdech Hun Sen, opened a seminar on Awareness of Information Technology in September 2001. It is instructive to see his vision of Cambodian ICT made during his opening speech.²⁴ He enumerated six strategies:

- Development of telecommunication infrastructure through liberalization, strengthening legal and regulatory environment and competition.
- Expanding coverage of Internet by attracting private investment.
- Standardization of Khmer language for use on computers. Also improving English language training.
- Improving computer literacy by for example including it in the curriculum of every secondary school and university.
- Transfer of technology and technical skills through participation of private sector in IT development.
- Strengthening laws in intellectual property protection and computer crime.

Figure 4.1: Young but not well-educated

Age distribution and educational attainment (ages 25+), Cambodia, 1998



Source: Ministry of Education, Youth and Sports, National Institute of Statistics.

in this area. The World Intellectual Property Organization (WIPO) has been providing technical assistance to draft laws on trademark, copyright and patents. A draft e-commerce law has been prepared and is available on the MPTC web site. A related issue is the availability of laws and regulations online. In that respect the World Bank has assisted in making Cambodian laws and regulations available over the Internet and on CD-ROM.²⁵

4.3 E-schooling

Cambodia has not only one of the youngest populations in the world (with 55 percent below 20 years of age in 1998) but also one of the least educated (see Figure 4.1). This is a result of the Khmer Rouge period where an estimated 90 percent of Cambodians with a secondary or higher education were either killed or fled the country.²⁶ This indicates that the educational sector faces major challenges but it also means that this is a great opportunity to expose a large proportion of the population to the use and benefits of ICT. However, the Ministry of Education, Youth and Sport (MoEYS) <www.moeys.gov.kh> has no large-scale plan to place computers or telephones in schools, other than universities. The primary goals of the MoEYS are more basic,

such as universal basic education and enhancing literacy, improving the quality of education, and complementing education with job opportunities.

The MoEYS faces immense challenges in meeting these goals despite the fact that in 1998, 10.3 percent of the national budget was devoted to education.²⁷ The problems girls face illustrate the poor infrastructure of many of Cambodia's schools. The proportion of female students drops from 49 percent in pre-school to 33 percent at the secondary level. One explanation is that because some 70 percent of schools have no toilets or drinking water, girls have to leave at the onset of puberty. Ten percent of the primary schools are disadvantaged—that is more than 50 percent of rooms are without a good roof, floor and walls and have no water and no toilets. More than 20 percent of 6-11 year olds remain outside the school system.

The majority of public schools do not have money for telephones, computers, and the Internet. Camtel has offered free Internet to schools but most cannot afford the telephone line, nor do they have electricity or the skills to use the Internet. Internet connectivity is not considered a high priority.

Table 4.2: Cambodia at school

1999-2000

	Number of Schools	Enrolment	
		Total	Girls
<i>Whole Kingdom</i>	6'449	2'447'235	1'083'438
- Pre-School	806	45'068	22'186
- Primary School	5'156	2'094'000	956'084
- Lower Secondary Level	480	226'057	77'714
- Upper Secondary Level	132	82'110	27'454
Higher Education (not included in country total)	9	7'456	NA

Note: Public schools.

Source: MoEYS, NIS.

Of the nine tertiary institutions, four have Internet in at least one department.²⁸ However, they continue to face problems even if they have a computer and connectivity. For example, Hun Seng Library at the Royal University of Phnom Penh was provided with four computers and connectivity via a Local Area Network (LAN). At the time when the university was provided with a technician it could not access a US-based site to pay for the software to operate the LAN. By the time the link was restored, the technician had returned to his country of origin. Five months later, the university still had only one computer connected and three awaiting the availability of a LAN technician. Another problem is the lack of coordination amongst the various assistance efforts. For example, the University of Technology Sydney has set up a student registration database for the Royal University of Phnom Penh while the University of Manila is working on a personnel database. There is no plan to link these two related projects or to set up a database for finance, administration,

etc. Maryknoll, an NGO, is providing staff training for these databases. Unfortunately, some offers for assistance are not acted upon rapidly enough and Cisco's efforts to establish a computer training facility at the University of Phnom Penh are still on hold.²⁹

The MoEYS has a pilot project through which three secondary schools are to be connected to the Internet. Those schools were chosen because they have high levels of English, good facilities, electricity, telephone lines, and they are close to Phnom Penh. This was thought to give them the highest chance of success, and to then extend the project onto other schools. The initiative is funded by the World Bank's World Links for Development project. Due to delays in administration the pilot launch has been postponed until the end of 2001.

One example of a high profile NGO-funded e-school project is found in the remote district of Robib, in the northern province of Preah Vihear (see Box 4.2).

Box 4.2: E-villages and E-charity: A conundrum

The remote provinces of Cambodia are very poor—even by Khmer standards. The province of Preah Vihear's population of 120'000 has an annual average income of less than US\$ 40 per person. It has very little infrastructure—few roads, scarce ICT infrastructure, and limited electricity. It was this remoteness and poverty that caught the eye of NGOs when the opportunity arose to build a school in the district of Robib that would be connected to the Internet. Robib is so remote that, at the beginning of the project, it took two days to get there from Phnom Penh; the last 90 kilometers took 12 hours in a landmine-proof truck.

The Wakako Hironaka School is the first in a planned series of 200.³⁰ It was named for its Japanese benefactor, a former minister and parliamentarian. In fact, one marketing ploy is that donors get to name the school that they build. For just US\$ 13'000 the donor gets to circle a dot on the map and have a two to three room school built at that location (with matching funds from the World Bank), staffed and supplied with materials for two years. For an additional US\$ 1'700, solar panels will be installed enabling computer use and possible future Internet connection <www.cambodiaschools.com>.

While this reads like an ideal solution to the educational problems of a village in one of the least developed states on earth, it is not without its critics. Some NGOs argue that it is not more than a publicity stunt; once the loaned satellite dish is returned, connectivity will be lost. They also argue that the technology is flawed — since the solar panels cannot power the satellite dish, diesel fuel must be trucked in from Thailand. Lack of air-conditioning and the associated dust wreak havoc on computers and there is only limited technical support available in

such a remote location. The project is not cost effective, they say, compared with setting up a public access Internet point in a community center. Moreover, the educational efficacy of providing students with no English, no awareness of IT and little knowledge about the rest of the world, with Internet connected computers, is doubtful. Allowing a stranger the right to re-name a village school is also questioned. Even the name of Robib is said to have been changed.

Similarly, critics are doubtful about the benefits of a related project in Robib that connects the village to medical support in Phnom Penh and the USA. This, it is claimed, was set up to help US doctors in the pilot develop e-health applications. Moreover, locals are experts in dealing with endemic diseases such as malaria and dengue fever, using traditional medicines and in dealing with trauma due to accidents and land mines. Other illnesses cannot be treated locally, so a diagnosis may be of no point without follow-up treatment, transport, city hospitalization, long term care, etc. These projects may therefore be of limited use as long as they cannot offer a way of accessing improved medical services. Would it not be better to provide clean water, better immunization, or better access to standard medical facilities?

In certain cases the answer is certainly 'yes'. In Robib, on the other hand, the clinic serves as a fallback when conventional and traditional diagnosis and treatment do not work. It complements other efforts to bring clean water, medical staff and much needed pharmaceuticals to remote and poverty stricken areas in Cambodia. Patients diagnosed with a condition too serious to be treated locally are taken to a regional hospital, or to the Sihanouk Hospital in Phnom Penh.

4.4 E-health

The population of Cambodia has been ravaged by war, reigns of terror and epidemics over the past 25 years. At the moment, Cambodia is a hot spot for HIV/AIDS, tuberculosis and malaria.³¹ Neonatal mortality is high (90 per 1'000), and mortality before the first birthday is also very high at 54 per 1'000 — (one in nine die before their fifth birthday)³². While the exact number of amputees due to land mines is not known, one estimate is that there are still around 50 casualties per month.³³ Illnesses and accidents traditionally associated with poverty add to this list of woes.

The public health system is financially strapped and relies on NGO volunteers and other international aid sources. Most hospitals in remote areas do not have a telephone, let alone access to the Internet. The Ministry of Health (MoH) has no plans to provide hospitals with such facilities. The MoH has approximately 3'000 employees, using 100-200 computers, 50 of which have Internet. Those are used almost exclusively for e-mail, as connectivity is inadequate for downloading and there is no climate of research. There is no network connecting the head office with the 50 or so computers in the field, nor is there any plan to set up such a network. The Ministry keeps in touch with its provincial branches

via a report that is supposed to be filed monthly. That report provides information on cases seen, treatments provided, etc. None of the reports is filed by e-mail or even fax as the cost is too great even for those hospitals that have a telephone. Mostly, they are brought to the head office by a motorbike courier because the postal system is not reliable. Where the roads are impassible by bike, the trip is made by elephant. The Siem Reap office was networked four years ago but the system crashed more than two years ago and there has been no money to rebuild it.

There is an NGO-driven telemedicine project in Robib (see Box 4.2). The health center there has access to the Internet via a link with a local school that has satellite connectivity to the Internet. Since February 2001, a nurse and a technician travel once a month from Phnom Penh's Sihanouk Hospital of Hope to the town of Robib with a digital camera. The nurse examines patients and if unable to diagnose, has the technician take photos. Those photos are sent via the Internet at the school to Partners Telemedicine, a US health organization staffed by doctors from the Harvard Medical School and the Massachusetts General Hospital. Once examined, a diagnosis is offered and the patients informed on the same day. If treatment is not available locally, some of the patients are taken to the Sihanouk Hospital, or a local cooperating hospital. This level of travel for medical attention is not unusual in a country where people tend to stay in their villages. Dr Graham Gumley at the Sihanouk Hospital says that *'more than half of our outpatients come to us by foot, bicycle or motorcycle from hundreds of miles because there are no medical facilities near where they live. Often their condition deteriorates because of the long, strenuous trip'*³⁴. Telemedicine is seen as a possible alternative to the tyranny of distance.

4.5 e-commerce

There is not much of a domestic drive for e-commerce in Cambodia. This

may be largely because the Cambodian way of doing business is to receive cash at the time of transaction. Credit is not popular, receipts are rarely given, and few accounts are kept. While it is often said that this is also the result of the country's history, most developing countries face the same problems. With its draft e-commerce law, Cambodia hopes to be ready once the demand for e-commerce develops.³⁵

The low level of Internet diffusion in Cambodia, especially outside of Phnom Penh suggests that there is little room for e-commerce to develop. Indeed, there appears to be virtually none. Moreover, according to Camnet the network does not have enough capacity to support e-commerce applications. The government-owned ISP does, however, have plans to visit the Multimedia Super Corridor (MSC) in Malaysia to discuss and possibly learn from the MSC's e-commerce solutions.

Another obstacle to e-commerce has been the lack of confidence in banks. At the time of the attempted 1997 coup, banks closed their doors for three months, making transactions impossible, and throwing large parts of the economy into distress. Two major banks never reopened and all deposits were lost. Many Cambodians prefer to keep their savings in gold. It is somewhat anomalous to see gold shops in even the poorest areas. When large items, such as a motorbike, are bought it is not unusual to exchange gold for them. While the banking system appears more stable at the moment, a number of banks were closed as a result of a November 2000 bank re-licensing.³⁶

There is almost no use of credit cards in Cambodia other than by tourists and expatriates. However, the Cambodia Mekong Bank issued the first Cambodian credit cards in April 2001, and expects to have 500 cardholders by the end of 2001.³⁷ The Cambodia Mekong Bank has also recently installed an ATM at its central branch in Phnom Penh. To use the machine it is

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necessary to have a deposit in that branch to cover the amount. It simply allows money to be withdrawn at the bank without entering the bank. No banks have networked branches.

There are some examples of electronic commerce to the extent that the goods are ordered electronically. Several handicraft cooperatives associated with NGOs, for example, sell their wares on the Internet. Even if these sites are hosted in Cambodia, the payment is made to a bank located abroad. One example is Rehab Craft <www.camnet.com.kh/rehabcraft>, a Cambodian NGO for citizens with disabilities. Assisted by the Ministry of Foreign Affairs and Trade of New Zealand and a Hongkong SAR charity, Rehab sells textile and wood products over its web site. The village of Robib (See Box 4.2) sells handcrafted silk products to overseas buyers <www.villageleap.com>. The name of the web site is an allusion to the concept of rural villages using the Internet to leapfrog into the global economy.

Another example of nascent e-commerce is the open Forum's online publication of the Mirror <www.forum.org.kh/eng/mirror>, a 16-page weekly newspaper that translates selected Khmer language newspaper articles into English. The Mirror can be ordered online and paid by credit card (for those who live outside Cambodia) or by banktransfer (for people living in Cambodia).

The Cambodia Daily, an English language journal, also offers some of its articles on its web site <www.cambodiadaily.com>. While the daily newspaper itself is available only as a print edition in Cambodia some selected articles (containing information on Khmer issues) can be read online. The Cambodia Daily web site is designed and hosted by KIDS, an ideal example of a small business that lives off the Internet (see Box 4.3). The Internet has also provided employment to some other people in Cambodia: In July 2001 Digital Divide Data (<www.digitaldividedata.org>), a self-sustaining co-operative, opened an office in Phnom Penh and hired some twelve disabled

Cambodians to retype the earliest issues of a US university journal. This kind of offshore data processing allows Cambodians with little education but good typing skills to earn a fair amount of money. The typists earn about US\$ 50 a month, compared to US\$ 45 in the garment industry.³⁸

One particularly promising area is the travel industry. Cambodia's unique history and the spectacular ruins of Angkor are a major tourist draw, especially since the political environment has stabilized. 466'365 tourists visited Cambodia in 2000, a 34 percent increase compared to 1999. The Ministry of Tourism expects the number of tourists to increase to one million in 2003.³⁹ While the government recognizes the potential of tourism, and is aware of the importance of rebuilding and developing the infrastructure, the role of e-commerce does not seem to be central to government policies. On the one hand the country is preparing itself to accommodate the increasing number of tourists by constructing new hotels and training Cambodians in the tourist industry. In Siem Reap, the home to the Angkor ruins, for example, nine hotels with 900 bedrooms are being built and a new airport will soon be able to welcome some 900'000 tourists a year.⁴⁰ But today's tourist industry has changed, especially with the Internet. If countries want to get the most out of it, they will have to adapt to the habits of the 'surfing' traveler. People used to book their trip, including the flight, the hotel and the sightseeing tour through a travel agent but nowadays many visitors will prefer to do the booking themselves – through the Internet. The Cambodia Ministry of Tourism has a web page at <http://www.cambodia-web.net/camtourist>. However there is scarce and outdated information and no links to hotels or other travel industry sites. Furthermore the URL for the web site is not immediately intuitive. The major problem with the Cambodian government and tourism industry falling behind in the e-commerce area is simple: others are not. Foreign companies realize the potential of Cambodia's tourism and are eager to

Box 4.3: KIDS in the e-café

The Khmer Internet Development Service (KIDS) <www.camnet.com.kh/kids> started back in 1997 when four female business students asked Lidee (an association of Khmer professionals) to help them set up a small business. The young women not only had the ability to learn computer applications quickly but also knew how to teach others.

KIDS was Cambodia's first public Internet café, started at a time when it cost US\$ ten per hour to use the Internet via a commercial ISP. KIDS was able to offer access at US\$ one per hour for Khmers and US\$ two for non-Khmers thanks to a discount from the government ISP Camnet and financial support from Save the Children and the Asia Foundation. Students have free access to the Internet at KIDS, and most of KIDS' customers are now Khmer. A lot of customers use the Internet to access entertainment sites (e.g., popular sites and applications include pop star web sites and chatting). Even though these sites as such hold relatively little educational value, they provide an incentive for people to learn how to use a computer and the Internet. They thus allow Internet illiterates to acquire the basic skills they need to access more educational and informative web sites.

In addition to operating Internet cafés (which now number three), KIDS also designs web sites. In July 2001 it was charging US\$ 100 per site, significantly below market prices. They also work out barter deals; in exchange for KIDS' services, a company displays a KIDS banner ad. In certain cases KIDS' services are offered for free such as the design of a web site used by AIDS victims to promote and sell quilts.



Cambodian youth@ the KIDS Internet café

Box 4.4: E-archiving: "Those who cannot learn from history are doomed to repeat it"⁴¹

One uniquely Cambodian application of the Internet is the archiving of the holocaust of the Khmer Rouge. Past acts of cruelty are being recorded on various sites hosted in Cambodia and abroad. Documentation of the holocaust is seen as having several roles:

- It is preliminary to the proposed tribunal for former Khmer Rouge leaders;
- It is therapeutic for those who suffered and continue to suffer the nightmare of the killing fields;
- It is preventative against such things happening again in Cambodia, or elsewhere.

Researchers traveling throughout Cambodia armed with camera, tape player, scanner and Global Positioning System (GPS) devices have been painstakingly recording individual accounts and documentary evidence. Their efforts can be seen on several web sites such as the Documentation Center of Cambodia <welcome.to/dccam> and the Cambodia Genocide Program at Yale University <www.yale.edu/cgp/main.htm> and the University of New South Wales <www-cgp.sistm.unsw.edu.au> as well as the Digital Archive Of Cambodian Holocaust Survivors <www.cybercambodia.com/dachs/index.html>.

earn sightseers' dollars, yens and euros and have web sites to do so. For example www.cambodia-hotel-travel.com/, or www.cambodia-hotel.com/ are sophisticated sites that support online hotel reservations. Both sites, however, are owned by companies that have their offices in Canada and Thailand. While there are no exact estimates

as to how much money the Cambodian economy is losing, it is obvious that some tourism revenues are generated elsewhere. The longer Cambodia waits, the more time it will give non-Cambodian companies to establish their web presence. The more time that passes by, the more difficult it will become for local companies to win back market share.

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- ¹⁸ See for example, ITU. *The Dot City: Singapore Internet Case Study*. April 2001. www.itu.int/ITU-D/ict/cs/singapore/material/Singapore.pdf.
- ¹⁹ "The central theme of the meeting was the issue of governance – recognized by all as the single biggest obstacle to social and economic development. Priority areas in governance reform include fighting corruption, building credibility in the legal and judicial system, protecting individual and property rights and pressing ahead with public administration reform. Good governance remains of critical importance for the private sector to be able to develop in Cambodia and for attracting higher levels of foreign direct investment that would stimulate the country's longer-term growth and reduce its aid dependency." See World Bank. "Cambodia Consultative Group meeting results: Aid partnership supports Cambodian development efforts." *Press Release*. May 26, 2000. <http://wbln0018.worldbank.org/news/pressrelease.nsf/673fa6c5a2d50a67852565e200692a79/46959b770f8c7b77852568eb0053cb9f?OpenDocument>.
- ²⁰ Despite the scarcity of central and local government online presence, there is no shortage of Cambodian political parties with a web site. They, at least, seem to realize the power of the Internet for disseminating information and attracting international support. See Kydra Dupond and Eric Pape. "E-mail is a real revolution." *Salon*. 15 March 1999. <http://www.salon.com/21st/feature/1999/03/15feature.html>.
- ²¹ The Export-Import Bank of Korea. "EDCF Agreement signed between Korea and Cambodia." *Press Release*. 18 May 2001. www.koreaexim.go.kr/english/eximnews/asia20010518.htm Also see: Korea National Computerization Agency. "NCA and NiDA Collaborate on IT." *Press Release*. 13 April 2001. <http://www.nca.or.kr/homepage/ehome/ehome.nsf/f964af844c8a560dc92569890007fa5c/8119797da188b839c9256a2d0012e98f?OpenDocument>.
- ²² The government is also considering the use of revenue-sharing arrangements for some aspects of the project. See U.S. Department of State. "Computer Database for Motor Vehicle." 19 October 2000. <http://infoserv2.ita.doc.gov/ocbe/ForeignM.nsf/679c088699b484498525674e0000eb9f/b95c313cf52aa7508525697e006cf2b0>.
- ²³ See "Experts Give Advice at Technology Conference." *The Cambodia Daily*. 12 September 2001. <http://www.un.org.kh/PRESS/September/September-PDF/ICT-001.pdf>.
- ²⁴ See Address By Samdech Hun Sen. Prime Minister of the Royal Government of Cambodia. Opening Ceremony of the Workshop on Public Awareness about Information Technology. 11 September 2001. www.camnet.com.kh/ocm/government87.htm.
- ²⁵ "Under the Technical Assistance Project, the Bank has supported the regular publication of Cambodia's laws and regulations in three languages (Khmer, English and French). These laws and regulations, which are produced in a monthly bulletin, are also accessible through the Internet and in the form of CD software. These initiatives are being expanded to cover on a selective basis courts judgments and decisions which may be of interest. There is clearly a need not only to strengthen these initiatives but also to take urgent steps to revive the official journal." Mr. Bonaventure Mbida-Essama. "Development of a Legal and Judicial Reform Strategy: Mission to Cambodia (July 7 thro '22, 2000)." World Bank Phnom Penh Office. www.khmersenate.org/worldbank.htm.
- ²⁶ Joseph Fedora. "A Sister who hustles." *Maryknoll Magazine*. October 2000. www.maryknoll.org/MEDIA/xMAGAZINE/xmag2000/xmag10/m10s3.htm.
- ²⁷ According to MoEYS: "For the current year 1998, the government has allocated 147 billion riels (about \$US 40 million at current exchange rate) to the education sector, thus representing 10.3% of the national budget or about 1.5% of the GDP." See http://www.moeys.gov.kh/profile/edu_in_cambodia/finance_community.htm. However, other information from MoEYS states that government educational funding was US\$ 25.7 million in 1998 while development partners contributed another US\$ 48.4 million for a total of US\$ 74.1 million spent on the education sector. http://www.moeys.gov.kh/dev_partner_profile/dev_partner_pro.htm.
- ²⁸ For an anecdote on attempts to provide Internet access for all Royal Phnom Penh University students see Jacques Leslie. "Operation Phnom.com." *Wired*. November 1999. www.wired.com/wired/archive/7.11/cambodia_pr.html.
- ²⁹ www.cisco.com/warp/public/779/edu/commitment/intl/partnerships/ldc/pr_asia_at_a_glance.html.
- ³⁰ Japan Relief for Cambodia & American Assistance for Cambodia. "First Three of 200 Solar-Paneled, Computer-Equipped Cambodian Rural School Will Open November 4 in Three Remote Preah Vihear Villages." *Press Release*. November 1, 1999. www.camnet.com.kh/cambodiaschools/press_release_in_english.htm.
- ³¹ According to one report, Cambodia has the highest HIV infection rate in Asia. <http://www.maryknoll.org/MEDIA/xMAGAZINE/xmag2000/xmag10/m10s2.htm>.

- ³² www.camnet.com.kh/nphri/assets/images/MainPart.
- ³³ For an estimate of land mine casualties see: Siemens. "A Mind for Mines." *Research and Innovation*. 1/99. w4.siemens.de/FuI/en/archiv/zeitschrift/heft1_99/artikel09/index.html For a figure on recent land mine casualties see the UNDP Cambodia web site at: <http://www.un.org.kh/UNDP/prog-man.html>
- ³⁴ "Remote Cambodian Village Establishes Internet Telemedicine Link Aimed at Closing Digital Divide." *PR Newswire*. 13 February 2001. www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/02-13-2001/0001426714&EDATE=
- ³⁵ The draft e-commerce law is posted on the MPTH web site at: www.mptc.gov.kh/Reculation/ecommerce.htm.
- ³⁶ See Import-Export Bank of Thailand web site: www.exim.go.th/main_banking_combodia_emerging.htm.
- ³⁷ "Cambodians to get credit cards." *Bangkok Post*. 19 April 2001. scoop.bangkokpost.co.th/bangkokpostnews/bp20010419/190401_business16.html.
- ³⁸ Cambodians to retype early Harvard newspaper editions. Chris Decherd, Associated Press. July 23, 2001. At <http://boston.com/news/daily/23/crimson.htm>.
- ³⁹ Cambodia Expects up to 1 Million Tourists in 2003. *The Mirror*. Vol. 5, No. 219. 1-7 July 2001.
- ⁴⁰ Mysteries of Angkor ready to unravel before the tourist hordes. Agence France Presse. November 15, 2001.
- ⁴¹ Quote from George Santayana on the Digital Archive Of Cambodian Holocaust Survivors web site: www.cybercambodia.com/dachs/about-us.html.

5. Conclusions

5.1 State of the Internet in Cambodia

The Mosaic Group <www.agsd.com/gdi97/gdi97.html> has developed a framework for characterizing the state of the Internet in a nation. They consider six dimensions, each of which has five ordinal values ranging from zero (non-existent) to four (highly developed). The dimensions are as follow:

- **pervasiveness:** a measure based on users per capita and the degree to which non-technicians are using the Internet.
- **geographic dispersion:** a measure of the concentration of the Internet within a nation, from none or a single city to nationwide availability.
- **sectoral absorption:** a measure of the degree of utilization of the Internet in the education, commercial, health care and public sectors.

- **connectivity infrastructure:** a measure based on international and intranational backbone bandwidth, exchange points, and last-mile access methods.
- **organizational infrastructure:** a measure based on the state of the ISP industry and market conditions.
- **sophistication of use:** a measure characterizing usage from conventional to highly sophisticated and driving innovation.

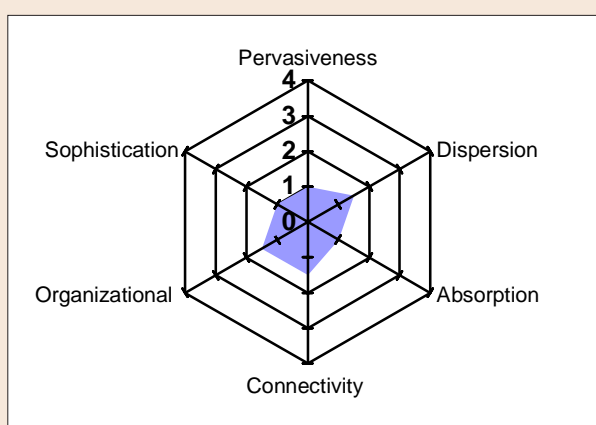
Cambodian values for these dimensions are shown below.

Pervasiveness is rated at level 1, *Embryonic*. At July 2001, there were an estimated 10'000 Internet users in the country or 0.08 percent of the population.

Geographic Dispersion is rated at level 1.5, *Moderately dispersed*. Internet access is theoretically

Figure 5.1: State of Internet in Cambodia

Dimension	Value
Pervasiveness	1
Geographic Dispersion	1.5
Sectoral Absorption	1
Connectivity Infrastructure	1.5
Organizational Infrastructure	1.5
Sophistication of Use	1
TOTAL	7.5



Note: The higher the value, the better. 0 = lowest, 4 = highest.
Source: ITU adapted from Mosaic Group methodology.

available from almost all provincial capitals for the price of a local call. However there are very few fixed telephone lines outside of the capital.

Sectoral Absorption is rated at level 1, *Rare*. This ranking is a function of the type of connectivity in education, government, health care and business. There is rare connectivity at the university level. Most universities cannot afford access costs. Apart from some private schools and a special NGO project, there is no connectivity at the primary and secondary level. Some government ministries are on the web although there is no central portal. Few provincial governments have a web site. The Ministry of Health has a web site, otherwise usage in the health sector is rare. Usage in the business sector, despite some nascent e-commerce, is minimal.

The **Connectivity Infrastructure** is at level 1.5, between *Thin* and *Expanded*. International connectivity is six Mbps incoming and 3.5 Mbps outgoing. There is only one POP outside of the capital and no nationwide Internet backbone. Nor is there a domestic Internet exchange. Few leased lines are in place and there is no ADSL or cable modem for broadband local access. However a fixed wireless network was launched in March 2001 offering access speeds up to one Mbps.

The **Organizational Infrastructure** is at level 1.5, between *Single* and *Controlled*. There are two ISPs with their own international backbone, a third that provides access in provincial areas but with no backbone and an e-mail provider. In addition, another company provides broadband Internet access. Entry into the ISP market is not possible at this time although it appears that may be changed soon.

Sophistication of Use is at level 1, *Minimal*. The most popular applications among most users appear to be e-mail and information retrieval.

5.2 Recommendations

Cambodia has one of the lowest levels of Information and Communication

Technology (ICT) development in the South East Asian region. This is partly a reflection of its low level of income, which affects other factors such as literacy and education that have a bearing on ICT use. At the same time, years of war and civil unrest delayed construction of communication infrastructure and destroyed the little that existed. At the beginning of January 2001, Cambodia had only 30'880 telephone lines for a telephone penetration of 0.26 per 100 inhabitants, one of the lowest in the world. This shortage of fixed telephone lines—and the fact that they are concentrated in the capital Phnom Penh—is a serious constraint on Internet development in the country.

An obvious reason for the low level of Internet penetration in Cambodia is the high cost of Internet access. Cambodia, which is one of the poorest countries in South East Asia—and one of the poorest in the world, has some of the highest Internet prices in the world and by far the highest in the region.

On the positive side, Cambodia has the highest ratio of mobile telephone subscribers to fixed line subscribers in the world. At the end of the year 2000, 81 percent of all of Cambodia's telephone subscribers were using mobile phones. This high mobile phone usage is a result of an open market—there are four mobile operators—and the realization that a quick and cheap way of installing communication infrastructure is to use wireless technology. While there is only one fixed telephone for every 386 Cambodians, there is one mobile for every 100. The relatively high usage of wireless phones suggests that mobile Internet might be a promising option. However operators have been slow to introduce the needed network upgrades to support this.

Recommendations for improving access to Information and Communication Technology include:

Reduce Internet prices. It is obvious that a country that is one of the poorest in the world cannot afford to have some of the highest Internet

tariffs. Given the disparity between an average Khmer salary and the cost of Internet access, few in Cambodia can afford to use the web. Bringing down prices has to be one of the government's top priorities. A major factor contributing to the high tariffs is the cost of international connectivity, estimated at over 80 percent of Cambodian Internet Service Provider operating expenses. Cambodia should actively investigate ways to reduce these costs. One way is to publicize its plight in international forums, pointing out the absurdity of poor nations such as Cambodia subsidizing Internet users in developed countries.⁴² The Kingdom should also consider granting additional ISP licenses (including international gateway facilities) in order to benefit from lower costs, service quality and innovation that competition provides. It should also grant Camnet, the government-owned ISP, full autonomy in carrying out its activities.

Universal Access. There is no concrete plan for promoting universal ICT access in Cambodia. There needs to be a government policy and timetable for enhancing access to ICT. In a country where hardly anyone can afford Internet access, let alone a PC, the provision of reasonable and widely available public access is imperative. This would include:

- 1) Concessionary or even free Internet tariffs for public access locations such as Internet cafés, schools and libraries. This should also include provision of access lines, personal computers and training since there are a number of examples where organizations have not been able to avail themselves of Camnet's reduced Internet rates because they cannot afford the telephone connection or personal computers.
- 2) Creation of a fund—to which all telecommunication operators would contribute—to finance infrastructure development in underserved areas. One target

for the fund could be to install public Internet access in all provincial capitals.

- 3) Provision of universal voice access via pre-paid mobile cards. In this respect, the population coverage of mobile in the country should be carefully monitored to determine what proportion of Cambodians are within reach of a mobile signal. Mobile operators should be encouraged or even required to achieve high levels of population coverage. Subsidized handsets and pre-paid cards should be provided to poor Cambodians. The use of wireless technology for ICT applications such as text messaging, e-mail and web access should also be promoted.

MPTC separation. There is a conflict of interest with the Ministry of Posts and Telecommunications of Cambodia (MPTC) since it is responsible for policy and regulatory issues as well as being a telecommunication operator. Also, because MPTC derives a considerable portion of income from international traffic and revenue sharing with mobile operators, it has been lax about extending the fixed-line telephone network. It has also been inferred that the MPTC network is not being well maintained. Policy and regulatory issues and operations should be separated within the MPTC. This would involve the creation of a separate telecom operator (e.g. Telecom Cambodia). The telecom operator should be granted autonomy and even be privatized to encourage network roll out and help attract a foreign strategic investor.

Test bed for 3G mobile. Cambodia is number one in the world in regards to the share of mobile phones to total telephones. Thus it would logically stand to benefit from mobile Internet. However thus far, Cambodia's mobile phone operators have mainly promoted basic voice use. Cambodia's mobile phone operators all have strategic foreign investors that have expertise in these areas. They should be encouraged to use Cambodia as a

test-bed for mobile Internet in developing countries. They can leverage the country's high utilization of mobile phones to promote services such as Short Messaging Service (SMS), GPRS (high speed Internet access) and eventually third generation mobile.

e-Government. There are no citizen-relevant online applications being developed by the government. This should be done as a matter of urgency in order to attract interest to the Internet and create a reason for using it. Most government web sites are in English and aimed at foreign community— multi-lateral, bil-lateral or NGOs (perhaps because developed by them).

Attracting bi-lateral and multi-lateral assistance. Many bi-lateral and multi-lateral organizations are keen to promote ICT access in

developing countries and have funds and projects disposable for doing so. Indeed, the launching of the Internet in Cambodia was achieved through bi-lateral assistance. The Government of Cambodia should avail itself of donor support to assist the implementation of some of the recommendations listed above as well as finance other initiatives that would allow the Internet to develop deeper roots in the country. By the same token, donors should actively seek out and support partners, particularly non-governmental organizations, which have been vital in developing the Internet in Cambodia. Coordination among development partners sponsoring ICT projects should be improved to avoid duplication and leverage on commonalities. The idea of at least one annual meeting between the government of Cambodia and partners to develop ICT projects should be explored.

⁴² Asia-Pacific operators and organizations have been highlighting the unfairness of paying the full circuit cost for Internet connectivity. Ironically Singapore has been at the forefront of this movement yet it charges Cambodia the full cost of its Internet connection. The International Telecommunication Union (ITU) has also highlighted the barrier high international connectivity costs pose to Internet development and issued a recommendation in 2000. See "Report on the Outcome of the Assembly," 6 October 2000. World Telecommunication Standardization Assembly. <http://www.itu.int/newsarchive/press/documents/wtsa2000rep.htm#International>.

Annex 1: List of meetings

No.	DATE	TIME	Appointment with
1	09/07/01	10:00 am	Camnet
2	09/07/01	01:30 pm	Cambodia Shinawatra (CamShin)
3	09/07/01	03:30 pm	MPTC: Planning and Finance Department
4	10/07/01	09:30 am	National Information Communication Technology Development Authority (NiDA)
5	10/07/01	11:00 am	Telstra, Big Pond
6	10/07/01	02:00 pm	Mobitel
7	10/07/01	15:30 pm	Ministry of Education
8	11/07/01	08:00 am	NetSchool
9	11/07/01	09:00 am	Ministry of Health
10	11/07/01	10:30 am	Cambodia Communication (Samart)
11	11/07/01	02: 00 pm	Camintel
12	11/07/01	03:30 pm	Open Forum of Cambodia
13	11/07/01	04:30 pm	Advisor to H.E. Sok An, Senior Minister, Minister for the Council of Ministers
14	12/07/01	09:30 am	Camtel
15	12/07/01	11:00 am	Khmer Internet Development Services (KIDS)
16	12/07/01	12:30 pm	Hun Sen Library
17	13/07/01	02:30 pm	Japan Relief for Cambodia
18	13/07/01	05:00pm	Future Light Orphanage

Annex 2: Acronyms and abbreviations

ASEAN	Association Of South East Asian Nations
BCC	Business Cooperation Contract
Camintel	Cambodia Indosat Telecommunication
Camshin	Cambodia Shinawatra
CamTel	Cambodia Mobile Telephone Company
Casacom	Cambodia Smart Communications Company Ltd.
ccTLD	Country code top-level domain
GAIS	Government Administration Information System
GDP/GNP	Gross Domestic Product/Gross National Product
GSM	Global System for Mobile Communication
ICT	Information and Communication Technology
IDRC	Canadian International Development Research Centre
ISP	Internet Service Provider
IT	Information Technology
KIDS	Khmer Internet Development Services
LAN	Local Area Network
LDC	Least Developed Country
MoH	Ministry of Health
MoEYS	Ministry of Education, Youth and Sport
MPTC	Ministry of Posts and Telecommunications of Cambodia
MSC	Multimedia Super Corridor
NGO	Non-governmental organization
NiDA	National Information Communications Technology Development Authority
NIS	National Institute of Statistics
PAN	Pan Asia Networking
PIC	Public Internet Centre
POP	Point of Presence
SKA	Sender Keeps All
SMS	Short Messaging Service
STIX	Singapore Telecom Internet Exchange
UNDP	United Nations Development Programme
UNTAC	United Nations Transitional Authority in Cambodia

Annex 3: Useful links

Organization	Website
Main government-related ICT organizations	
Ministry of Posts and Telecommunications of Cambodia	www.mptc.gov.kh
Ministry of Education, Youth and Sport	www.moeys.gov.kh
National ICT Development Authority	www.ocm.gov.kh/nida/
Main ICT providers	
Ministry of Posts and Telecommunications of Cambodia	www.mptc.gov.kh
Camintel	www.camintel.com
Mobitel	www.mobitel.com.kh
Camnet	www.camnet.com.kh
BigPond	www.bigpond.kh
Mass media	
National Television of Cambodia	www.tvk.gov.kh
Phnom Penh Daily	www.phnompenhdaily.com
Academic	
Ministry of Education, Youth and Sports	www.moeys.gov.kh
Cambodia Schools	www.cambodiaschools.com
Health	
Ministry of Health	www.moh-cambodia.com
Electronic commerce	
Rehab Craft Cambodia	www.camnet.com.kh/rehabcraft
Robib Village Products	www.villageleap.com
Portals	
Khmer Connection	www.khmer.cc/home
Cambodia Online Directory	www2.bigpond.com.kh/directory/
Other	
National Institute of Statistics	www.nis.gov.kh
Council for the Development of Cambodia (CDC)	www.cambodiainvestment.gov.kh
Royal Government of Cambodia web site	www.ocm.gov.kh

Annex 4: Framework dimensions

Level 0	<i>Non-existent</i> : The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	<i>Embryonic</i> : The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	<i>Established</i> : The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	<i>Common</i> : The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	<i>Pervasive</i> : The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least one in 10 (10% or greater).

Level 0	<i>Non-existent</i> . The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. A country may be using UUCP connections for email and USEnet.
Level 1	<i>Single location</i> : Internet points-of-presence are confined to one major population centre.
Level 2	<i>Moderately dispersed</i> : Internet points-of-presence are located in at least half of the first-tier political subdivisions of the country.
Level 3	<i>Highly dispersed</i> : Internet points-of-presence are located in at least three-quarters of the first-tier political subdivisions of the country.
Level 4	<i>Nationwide</i> : Internet points-of-presence are located in all first-tier political sub-divisions of the country. Rural dial-up access is publicly and commonly available and leased line connectivity is available.

Sector	Rare	Moderate	Common
Academic - primary and secondary schools, universities	>0-10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Commercial - businesses with > 100 employees	>0-10% have Internet servers	10-90% have Internet servers	>90% have Internet servers
Health-hospitals and clinics	>0-10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Public-top and second tier government entities	>0-10% have Internet servers	10-90% have Internet servers	>90% have Internet servers

Sectoral point total	Absorption dimension rating	
0	Level 0	<i>Non-existent</i>
1-4	Level 1	<i>Rare</i>
5-7	Level 2	<i>Moderate</i>
8-9	Level 3	<i>Common</i>
10-12	Level 4	<i>Widely used</i>

		Domestic backbone	International Links	Internet Exchanges	Access Methods
Level 0	<i>Non-existent</i>	None	None	None	None
Level 1	<i>Thin</i>	≤ 2 Mbps	≤ 128 Kbps	None	Modem
Level 2	<i>Expanded</i>	>2 - 200 Mbps	> 128 kbps -- 45 Mbps	1	Modem 64 Kbps leased lines
Level 3	<i>Broad</i>	>200 Mbps -- 100 Gbps	>45 Mbps -- 10 Gbps	More than 1; Bilateral or Open	Modem > 64 Kbps leased lines
Level 4	<i>Immense</i>	> 100 Gbps	> 10 Gbps	Many; Both Bilateral and Open	< 90% modem > 64 Kbps leased lines

Level 0	<i>None</i> : The Internet is not present in this country.
Level 1	<i>Single</i> : A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	<i>Controlled</i> : There are only a few ISPs because the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	<i>Competitive</i> : The Internet market is competitive and there are many ISPs due to low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	<i>Robust</i> : There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

Table 6: The Sophistication of Use of the Internet	
Level 0	<i>None</i> : The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	<i>Minimal</i> : The small user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	<i>Conventional</i> : The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straight-forward enhancement for an existing process (e.g. e-mail vs. post). This is the first level at which we can say that the Internet has "taken hold" in a country.
Level 3	<i>Transforming</i> : The user community's use of the Internet results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities. One strong indicator of business process re-engineering to take advantage of the Internet, is that a significant number (over 5%) of Web sites, both government and business, are interactive.
Level 4	<i>Innovating</i> : The user community is discriminating and highly demanding. The user community is regularly applying, or seeking to apply the Internet in innovative ways that push the capabilities of the technology. The user community plays a significant role in driving the state-of-the-art and has a mutually beneficial and synergistic relationship with developers.