Bits and Bahts: Thailand Internet Case Study

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Vanessa Gray, Tim Kelly and Michael Minges wrote this report. It is based on field research undertaken 20-25 August 2001 as well as documents and articles identified in the footnotes. We would like to thank Hugh Thaweesak Koanantakool (NECTEC), Sira Limchareon (CAT) and Maevadi Hungspreugs (NECTEC) for their valuable comments on the draft version of this report. The views expressed are those of the authors and may not necessarily reflect the opinions of the International Telecommunication Union (ITU) or its members. 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 at: <www.itu.int/ITU-D/ict/cs>.

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1. Country background

1.1 Overview

The Kingdom of Thailand, with an area of 514'000 square kilometres, is located in the centre of South East Asia. It shares borders with Myanmar to the northwest and west, with Laos to the northeast and east, Cambodia to the southeast and Malaysia to the south. Thailand, which means *'the land of the free'*, has a 1'840 kilometre coast on the Gulf of Thailand to the east and an 865-kilometre coast along the Andaman Sea to the west. Topographically the country is divided into four distinct areas: the mountainous North, the fertile Central Plains, the semi-arid plateau of the Northeast, and the Southern Peninsula, with its tropical beaches and offshore islands. Thailand has a tropical climate and three distinct seasons: the cool season from November to February, the hot season from March to May and the rainy season from June to October.

Figure 1.1: Map of Thailand

Source: The World Factbook.

1.2 Demography

The decennial Population and Housing Census reported a population of 60.6 million on 1 April 2000, making Thailand the fourth largest country in South East Asia. Annual population growth from 1990 - 2000 was 1.05 per cent. The country's average household size in 2000 was 3.9. About two thirds of the population live in rural areas and one third resides in urban areas. Some 6.3 million people, about ten per cent of the population, live in the country's capital, Bangkok. Administratively, the country is divided into seven regions, 76 provinces, 7'255 *tambons* (grouping of villages) and 69'866 villages. About one quarter of the population is under the age of 15 while nine per cent is over 60. While the population is

Table 1.1: Population indicators

Item	Year 2000
Total population (million)	60.6
Population growth rate	1.1
Population density (per sq.km.)	118
Rural population (%)	68.9
Age Distribution :	
Below 15 years (%)	24
15-59 years (%)	67
60 years and older (%)	9

Source: ITU adapted from National Statistical Office.

predominantly Thai (around 90 per cent), the most important ethnic minority are the Chinese. Other minorities include Malays, Cambodians, Indians, non-Thai hill tribes, and some Vietnamese. The country's official language is Thai. English is understood in urban and tourist areas. Some 95 per cent of the population is Buddhist and about four per cent is Muslim.

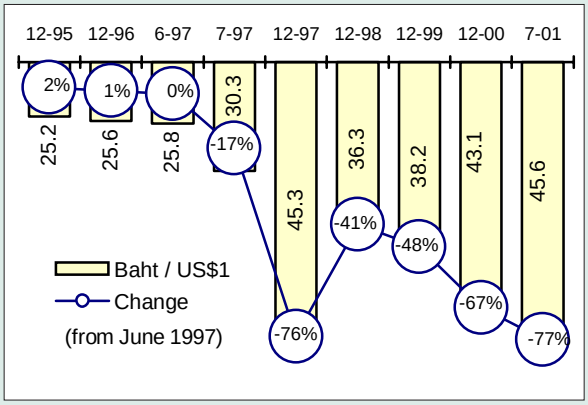
1.3 Economy

Over the last few decades, Thailand made impressive economic advancement. It averaged an annual economic growth of eight per cent between 1976 and 1996. Between 1988 and 1996, the number of people living in poverty was reduced by more than half, falling from 32 to 11 per cent. This progress came to a sudden halt in 1997 when the Asian financial crisis hit. Indeed the crisis started in Thailand, when the nation's currency, the Baht, came under speculative attacks. Previously tied to a basket of currencies, authorities were forced to float the Baht on 2 July 1997. By the end of July, the Baht had lost 17 per cent of its value over the previous month (see Figure 1.2). At July 2001, the Baht was still 77 per cent below the pre-crisis value.

The crisis had a severe impact on the Thai economy. Gross Domestic Product (GDP) fell by over ten per cent in 1998 and GDP per capita dropped back to 1994 levels. According to the 1999 household survey, 16 per cent of the population lived below the poverty line, compared to 11 per cent in 1996, reversing earlier gains. The country's Gross National Income per capita was US$ 2'010 in 2000.

The government responded with a comprehensive emergency programme, assisted by a US$ 14 billion loan from bilateral and multilateral institutions. The economy started to recover in 1999. Despite the declining value of the Baht, GDP rose by 4.2 per cent in 1999. After two years of recovery and a GDP per capita growth rate between 4 and 4.5 per cent in 1999 and 2000, it is expected to be slightly lower in 2001, at around 3.5 per cent. Recent economic indicators suggest that Thailand's economy, while recovering from the financial crisis, remains fragile.

Figure 1.2: Baht takes a dive



Source: ITU adapted from Bank of Thailand.

Thailand has traditionally had a relatively low unemployment rate, though high levels of under-employment. Before the crisis, unemployment stood at around

Table 1.2: Visit Thailand

Top Destinations	Arrivals in 2000	% change
1. China	31'236'000	+15.5
2. Hong Kong	13'059'000	15.3
3. Malaysia	10'000'000	26.1
4. Thailand	9'574'000	+10.7
5. Singapore	7'003'000	11.9 *
6. Macau	6'682'000	+32.3
7. Republic of Korea	5'336'000	+14.5 *
8. Indonesia	5'012'000	+6.0 *
9. Australia	4'882'000	+9.5
10. Japan	4'758'000	+7.2 *

Source: World Tourism Organization.

3.6 per cent. It almost doubled in 1997/98 but dropped back to about five per cent in 1999 and 3.3 per cent in 2000. At 8.1 per cent, inflation was historically high in 1998 but dropped to 0.3 per cent in 1999 and has since been relatively stable. The country's law stipulates fiscal conservatism, which has traditionally kept it from accumulating a large deficit.

The structure of Thailand's economy is relatively diverse. As a percentage of GDP, agriculture represents about twelve per cent, services represent 47 per cent and industry makes up 42 per cent. Growing exports over the last 25 years have had a positive effect on the country's economy. They also played an important role in the recovery from the financial crisis. In 1999 Thailand received some US$ 49 billion from exports, compared to US$ 5 billion in 1979 and US$ 20 billion in 1989. Since 1993 the structure of Thailand's exports have changed. Agricultural exports have decreased and manufactured exports increased. Today manufactured products make up 86 per cent, 50 per cent of which are machinery and technological products. Thailand's export markets are roughly evenly distributed. While North America accounts for 20 per cent of exports, Europe represents 15 per cent and Asia 37 per cent.

Tourism is of growing importance to the economy. According to the World Tourism Organization, Thailand receives the fourth largest number of tourists in the Asia-Pacific region (see Table 1.2). Tourism expenditures accounted for 253 billion Baht (US$ 6.7 billion) in 1999, about five per cent of GDP.

Table 1.3: Human Development Indicators

Thailand compared to selected South East Asian countries, 1999

HDI Rank	Country	Life expect-ancy at birth (years)	Adult literacy rate (%)	Comb-ined school gross enrol-ment 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	Viet Nam	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: ITU adapted from UNDP.

1.4 Human development

Thailand ranks 66th out of 174 on the United Nations Development Programme's Human Development Index (HDI), placing the country in the medium human development category. The HDI is composed of a basket of indicators including life expectancy at birth, adult literacy, school enrolment and GDP per capita. Table 1.3 shows that the HDI varies greatly in South East Asia and that Thailand, together with Singapore and Malaysia, is in the upper third HDI

category in the region. Thailand has made great progress over the past 25 years. Life expectancy, for example, increased from 60 years in the late 1970s to 70 years in 1999. One irony is that while Thailand has the highest literacy rate in the region, its school enrolment ratio is relatively low. Primary school enrolment was 89 per cent in 1997 (the latest year for which statistics are available). Enrolment ratios drop sharply for secondary and tertiary schooling (56 and 22 per cent respectively).

1.5 History

Migrants from the southern part of China established the independent Thai Kingdom in Sukhothai in 1238. The first King of the present Chakri dynasty, Rama I, changed the capital to Bangkok, '*Village of the Wild Plums'*, in 1782. Thailand is the only country in Southeast Asia not to have been colonized. In 1932 a bloodless coup organized by young intellectuals educated abroad, turned the 800 year-old absolute monarchy into a constitutional one. In 1939 the country's name changed from Siam to Thailand. During the Second World War Thailand was occupied by the Japanese. After the Japanese defeat and withdrawal in 1945, the country experienced only short periods of democracy and was ruled by different military regimes.

The country is headed by King Bhumibol Adulyadej (Rama IX) who has reigned since 1946. Although the King's political power is limited, he is a symbol of national identity and unity and influences through his moral authority and popular respect. When another military coup took place in 1991, civilian protests and interference by the King led to democratic elections in 1992. Multi-party coalitions have not proven very stable and the government, led by a Prime Minister, has changed several times before the completion of its four-year term. The January 2001 parliamentary election gave the relatively new Thai Rak Thai Party (Thais Love Thais) 50 per cent of all seats and Thaksin Shinawatra was appointed Prime Minister.[1]

Thailand was a founding member of the Association of Southeast Asian Nations (ASEAN) and is a member of the Asia-Pacific Economic Cooperation forum (APEC) and the World Trade Organization (WTO).[2]

[1] Mr. Shinawatra founded one of the country's largest telecommunication conglomerates, Shin Corporation, in 1983 and his family owns 46 per cent of the shares.

[2] The next director-general of the WTO will be H.E. Dr. Supachai Panitchpakdi of Thailand, who will serve a three-year term beginning 1 September 2002.

2. Telecommunication and mass media

2.1 Telecommunications Sector

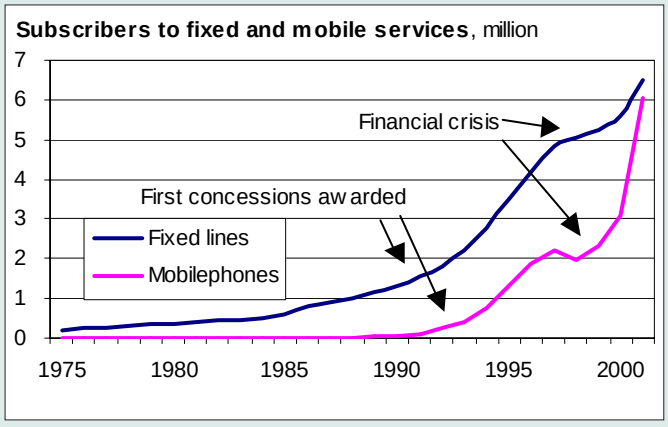
The origins of telecommunications in Thailand date back to the 19th Century. In 1875, His Majesty, King Rama V granted royal approval to the Ministry of Defence to lay the first telegraph cable between Bangkok and the outlying province of Samut Prakan, situated on the east bank at the mouth of the Chao Phraya River, a total distance of 45 kilometres.[3] The first telephone service was installed in 1881. Thailand joined the ITU (International Telegraph Union, as it was then) on 20 April 1883, as one of the first Member States in Asia after India (1869) and Japan (1879).

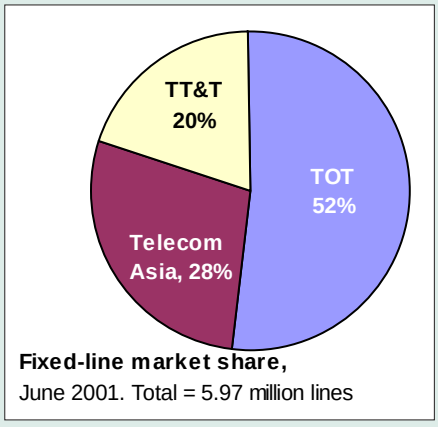
The development of the telecommunications sector continued on a small scale, and by the 1930s there were several thousand telephone subscribers, mainly in the capital. Up to this point, the *Post and Telegraph Department* (PTD), an arm of the government, was directly responsible for telecommunication services. In 1954, part of the telephone service was separated from PTD and became the *Telephone Organization of Thailand* (TOT) (initially serving the Bangkok metropolitan area and extended to nationwide coverage several years later). Later in 1997, remaining operations including postal and monetary, telegraph, telex, international telecommunications, radio communications and others were separated and became the *Communication Authority of Thailand* (CAT). Subsequently the PTD was significantly reduced in size, though it retained responsibility for frequency management.

Thailand's subsequent network growth has been greatly affected by two factors. First, the policy shift in the early 1990s towards the award, by TOT and CAT, of concessions to private owned companies to undertake network development under Build-

Figure 2.1: Thailand, network development

Long-run (1975-2001) evolution in fixed and mobile networks and June 2001 market share for fixed-line network





Note: In left chart, years refer to September 30 financial year. Figures for Sept. 2001 are estimated on the basis of actual June 30 figures and growth rates.
Source: ITU World Telecommunication Indicators Database.

Transfer-Operate (BTO) agreements. Second, the effects of the financial crisis of the late 1990s (see Figure 2.1). By September 2001, Thailand had reached a fixed-line teledensity of almost ten and the number of mobile users was on the point of overtaking fixed-line users. After slow growth, and even decline in mobile, between 1997 and 1999, network growth has now been re-established.

While past policies were effective in introducing fresh capital and circumnavigating regulations that prevented direct private participation in the sector, they have left a legacy of contractual arrangements, which is far from ideal for future development. Effectively, the two main state-owned operators have been acting as the licensing agency. The two current priorities for reform are, on the one hand, the creation of an independent regulatory agency and, on the other hand, the conversion of the current concessions into competing operations. Unfortunately, the different players have different sets of incentives for the progress on these two reform issues and, consequently, the whole process has come to somewhat of a standstill. Thai telecommunications is at a turning point but the main necessity is to move on from the current policy stagnation.

2.2 Public Telecommunication Operators

As described above, Thailand has inherited a complex market structure. While the two state-owned enterprises (SOEs) legally own the entire telecommunications infra-structure in the country, concessionaires operate large parts of it under revenue-sharing agreements. In some cases, networks operated by the concessionaires are now larger than those of the SOEs. Although it is planned to privatize the SOEs, and to convert the concession contracts to interconnection agreements, this process is taking longer than expected and many details are still unresolved.

2.2.1 Fixed telephone operators

The **Telephone Organization of Thailand (TOT)** <www.tot.or.th> is the larger of the two SOEs. It was created in 1954 and has a mandate to provide domestic fixed-line telecommunications, both local and long-distance, plus international service with neighbouring countries (Cambodia, Lao PDR, Malaysia and Myanmar). TOT has some 24'500 employees and an annual turnover including revenue from concessions (in the year to September 30, 2000) of 49.2 billion Baht (US$ 1.2 billion), up four per cent over the previous year.

TOT has monopoly control and ownership of all domestic telecommunication networks in Thailand. But, starting in the mid 1980s, a new policy began of offering build-transfer-operate (BTO) concessions to different private sector organizations, generally combining local interests with foreign partners. The whole environment changed in the early 1990s when TOT awarded two contracts, to TelecomAsia and Thai Telephone and Telecommunication (TT&T) (see Table 2.1).

- The **TelecomAsia** <www.telecomasia.co.th> contract covered the provision of two million lines (later extended to 2.6 million) in the Bangkok region. TelecomAsia is founded around the Charoen Pokphand (CP) Group, which is Thailand's largest conglomerate through its agricultural and food processing activities. It owned 22 per cent of TelecomAsia at end 2000. TelecomAsia's foreign partner is NYNEX of the United States, which owns 18 per cent. Part of TelecomAsia was later listed on the Thai stock market. Among its many subsidiaries is the ISP, Asia Infonet, in which it holds a 66 per cent share. TelecomAsia transferred its 2.6 million line network to TOT in 1996 and it continues to

Table 2.1: Build-Transfer-Operate concessions

Status at September 2000

Service	Project	Concession-naire	Duration (years)	Awarded by	Contract date	Status
Telephone lines	2.6 million fixed lines in Bangkok area	Telecom Asia	25	TOT	1992	3 amendments to provide public phones, VAS, and PCS
	1.5 million fixed lines in provincial areas	TT&T	25	TOT	1993	
Pay phones	Card Phone	Lenso	15	CAT	1994	
Long Distance	Optical Fibre along rail way	Com-Link	20	TOT	1991	
	East Coast Submarine Optical Fibre	Jasmine Submarine Telecom	20	TOT	1991	
	West Coast Submarine Optical Fibre	Thai Long Distance Telecom	15	TOT	1996	
	Domestic satellite transmission	Acumen	15	TOT	1991	
	ISBN	Acumen	15	TOT	1991	
	VSAT	SiamSat	22	CAT	1994	
	VSAT	WorldSat	22	CAT	1995	
	VSAT	Usat	22	CAT		Terminated 1998
Data	DataNet	Advanced Data Network	25	TOT	1990	Amended 1997
Videotex		Lines Technology	15	TOT	1993	Cancelled 1987
Cellular	NMT 900, GSM 900	AIS	25	TOT	1990	
	AMPS 800, GSM 1800	TACS	27	CAT	1990	Amended 1996
	Digital GSM 1800	Wireless Comm.	17	CAT	1996	Assumed by CP Orange
	Digital DCS 1800	DPC	16	CAT	1996	Bought by AIS
Paging	Phone Link	Advanced Paging	15	TOT	1990	Revenue sharing cancelled in 1997
	Page Phone	Hutchison	15	TOT	1990	
	World Page	World Page	15	TOT	1994	
	Digital	Packlink	15	CAT	1990	
	Alphanumeric	Lenso	25	CAT	1990	Amended 1995
CT2	Fonepoint	Phone Point	10	TOT	1991	Cancelled 1998
Trunked Mobile Radio	WorldRadio	United	15	CAT	1992	
Mobile Data		Network Consultant	20	CAT	1994	
Other	Directory publishing	Shinawatra Directories	10	TOT	1995/1995	n.a.
		Business Int'l	5	CAT		Termination 1999
	Info Transfer Service	Reuters	5	CAT		End of contract 1996

Note: Only revnue-sharing concessions granted by CAT and TOT. AIS = Advance Info Service; CAT = Communication Authority of Thailand; TACS = Total Access Communications; TOT = Telephone Organization of Thailand; TT&T = Thai Telephone and Telecommunication Company.
Source: ITU adapted from CAT and TOT.

Table 2.2: The big five revenue sharing agreements

Company (business)	Length of contract	Expiry date	Share of revenue provided to state-owned enterprise
TelecomAsia (fixed-lines, Bangkok)	25 years	2016	16%
TT&T (fixed-lines, Provinces)	25 years	2016	43.1%
AIS (mobile)	25 years	2016	25%
TAC (mobile)	27 years	2018	20%
Shin Satellite	30 years	2021	10.5%

Source: Bangkok Post.

operate it under a revenue-sharing agreement. As of 30 June 2001, TelecomAsia had activated 1.69 million lines, growing by 13 per cent per year. In 2000, TelecomAsia launched a PHS-based mobile service, using the 1800 MHz spectrum, which reached 393'000 subscribers at year-end. CP Group is also an investor in the CP Orange mobile operator (see below).

- The **TT&T** <www.ttt.co.th> contract covered the provision of one million lines (later extended to 1.5 million) in the provinces. TT&T has a number of owners with shareholders that include Jasmine International (20%), Loxley (13%), Italian-Thai Development (10%), Thai Farmers Bank and NTT West (18%) of Japan. By June 2001, TT&T had activated some 1.19 million lines but it is growing at a a slow rate (less than two per cent per year). Both Jasmine and Loxley have their own ISPs. TT&T has struggled with debt problems, and has been through several restructuring exercises.

Both TelecomAsia and TT&T are loss-making, but TT&T's problems are the more severe, partly due to its less profitable rural constituency but mainly due to the unfavourable revenue-sharing agreement it has with TOT. As Table 2.2 shows, TT&T must pay TOT 43.1 per cent of revenue. These terms are much less favourable than those afforded to other operators. This is despite the fact that it is more costly and less profitable to serve subscribers in rural areas.

International

The **Communication Authority of Thailand (CAT)** <www.cat.or.th> provides Thailand's international communications (apart from with neighbouring countries which is handled by TOT). It was established in 1977 and took over these functions from the PTD. CAT is also responsible for postal operations. It is a fully-state-owned enterprise and, like TOT, is slated for privatisation.

Like TOT, CAT has also issued a number of contracts to private companies for providing telecommunication services (see Table 2.1). CAT has contracts with mobile operators that compete directly with TOT's concessionaire.[4] In particular, CAT's BTOs include the mobile networks of DTAC and CP Orange, which compete with TOT's concessionaire, AIS. CAT also has a shareholding (32 per cent directly plus 3 per cent for CAT's employees) in each of the 18 ISPs licensed in Thailand.

2.2.2 Mobile cellular operators

The situation in mobile is similar to that in the fixed-line network with

Box 2.1: IP Telephony in Thailand

Although TOT and CAT both have a theoretical monopoly over domestic and international services respectively, neither is fully protected from the effects of competition. CAT in particular has lost market share to discounted telephone services, such as call-back and Voice over Internet Protocol (VoIP). In order to restrict the erosion of market share, both have recently introduced IP Telephony offerings that effectively compete with their own standard PSTN offerings.[5]

In 1999, **CAT** launched a VoIP service called PhoneNet as a low-priced alternative to its basic international telephone service. The State agency has subcontracted Hatari Technology Co. Ltd. to market the service. In return, Hatari will earn 10 per cent on sales of the service up to Bt 40 million (US$0.9 m) and 15 per cent on sales of Bt 100 million (US$2.3 m) for five years. The service covers approximately 75 countries. To access the phone-to-phone service, users must first buy a calling card that will give them a 12-digit access code. There are two types of calling cards: Silver and Gold Cards. The cards cost Bt 5'000 and Bt 10'000, respectively. Savings range up to 30 per cent.

For its part, TOT launched a VoIP service under the name Y-Tel 1234 to provide a cheap domestic long-distance call service in 2000. To use the service, users do not need cards or a subscription. All they have to do is to dial extra digits "1234" before dialling the destination number. The service is available to any telephone including public telephones. Currently, however, only TOT subscribers are able to use the service. The pricing of the service was reduced as part of a promotional campaign in August 2001, to be one Baht per minute during weekdays and 0.5 Baht during the weekend, which represents a considerable saving over the regular long distance service, priced at 3 - 18 Baht per minute. A PC-to-PC service (Y222) is also planned.

The low rates have been opposed by TOT's concessionaires, which fear that TOT is pricing below cost.[6] They are moving to develop their own IP Telephony services. For instance, **TelecomAsia** is offering a free PCT terminal (a type of mobile handset offering limited mobility) if subscribers purchase IP Telephony services from them. Following negotiations, TOT set rates for resale of its IP Telephony service by the concessionaires. The rates range from one Baht per minute for volumes under 50 million minutes per month to 0.76 Baht for more than 70 million minutes per month.[7] However, given that, in some cases, these *wholesale* rates are higher than TOT's *retail* rates, it does not provide much incentive either for the concessionaire or for potential users of their services.

each of the incumbent SOEs having a number of concessionaires that operate under revenue-sharing agreements (see Tables 2.1 and 2.2).

The current market leader is **AIS Mobile** (Advanced Information Systems, or ADVANC <www.ais900.com>), which runs both an analogue NMT network and a GSM digital mobile network, under a concession from TOT, awarded in 1990. AIS also acquired a further franchisee, **DPC** (concession with CAT) in mid 2001. Under the concession agreement, around 25 per cent of revenue goes to TOT in lieu of interconnection payments. AIS is 40.51 per cent owned by Shin Corp., which in turn is party owned by Thailand's Prime Minister Shinawatra. Shin Corp also owns the Shin Satellite, CS Communications (an ISP) as well as holdings in Lao and Cambodia. SingTel of Singapore owns a further 18.63 per cent. The remainder is held by a variety of banks, finance houses and smaller shareholders.

At year-end 2000, AIS had some 1.98 million subscribers, of which 82 per cent were on post-paid contracts. Just under half a million subscribers were still on the older NMT system By year-end 2001, the company expects to have 4.2 million subscribers, with all the new growth being in digital. In 2000, AIS's revenue was 26.2 billion Baht (US$595 million) of which two thirds came from sales of services (although relatively little of this is from data; see Box 2.2), 28 per cent from handsets (through a subsidiary, Advanced Wireless) and the remainder from paging and data communications. AIS's Average Revenue Per User (ARPU) was US$282 per year in 2000 compared with US$308 in 1999. Despite the fall in ARPU, AIS's profitability (net profit margin) rose from 10.6 per cent to 16.6 per cent during the same period.

Despite its relatively late introduction, pre-paid has been one reason why recent growth of mobile has been so rapid (subscriber numbers will have doubled in 2001). AIS sells scratchcards with a minimum fee of 500 Baht (US$11), which can be topped up at ATM machines. The tariff for post-paid service (standard package) is a fixed monthly fee of 500 Baht with local, suburban and long-distance calls priced at 3, 6 and 12 Baht per minute respectively. Other heavy volume user packages have call prices as low as 1 Baht per minute in return for a higher fixed fee. AIS aims to have 91 per cent population coverage by year-end 2001.

Handsets remain relatively expensive in Thailand. There is no cross-subsidy of handsets by either manufacturers or service providers. There is also no *legal* market for second hand telephones. However, prices have come down since the start of 2001, mainly due to manufacturers off-loading surplus stock following a slowdown in sales in Europe. Prices now start at around 4'000 Baht (US$90) compared with 40'000 Baht (US$900) just a few years ago.

The second player in the Thai market is TAC (Total Access Communication), which rebranded itself as **DTAC** <www.dtac.co.th> in March 2001. DTAC's concession agreement is with CAT. They currently pay 20 per cent of revenue and this will increase to 25 per cent in 2004. In addition, they also pay an access charge of 200 Baht (US$4.50) per subscriber per month. For prepaid, DTAC has negotiated a different arrangement to pay 18 per cent of revenue to TOT (in addition to the 20-25 per cent they pay to CAT). These payments effectively keeps prices high.

DTAC gained its license in 1990 and started operations in 1991, first with analogue and later with GSM. DTAC's major shareholder is UCOM. In May 2000, the Norwegian operator Telenor was introduced as a strategic partner, initially with 28.8 per cent, rising to 29.9 per cent of the share capital, in return for a cash injection.

At year-end 2000, DTAC had some 1.4 million subscribers, of which only 12 per cent were prepaid. Just under 60 per cent of DTAC's subscribers were on GSM, but this has risen sharply. By end July 2001, the company had 2.1 million subscribers and, if current growth rates continue, this will be close to 2.7 million by the end of the year. By which time some 70 per cent of the population will be covered.

There are a number of other existing market players, including both **TOT** and **CAT**'s analogue networks, though these are relatively small and, in the case of the analogue networks, declining. However, it is anticipated that new market entry, scheduled for late in 2001, will shake up the market:

- The entry of **CP Orange** is eagerly anticipated. Originally, the company operated as "Wireless Comms Services", under a concession from CAT awarded in 1996. The company ran into financial difficulties after the Asian financial crisis in 1997. CP Group (Charoen Pokphand) acquired the business in Feb 1999 and sold a 34% stake to Orange (owned by France Telecom), and later sold a further 15% giving Orange a 49% share. TelecomAsia (partly owned by CP) owns 41% and CP Group 10%. CP also operates a PHS license, though this is not seen as being a problem. CP is also present in Cambodia through Samart. The license runs to 2013. CAT owns the network under the concession agreement and it was due to be handed over on 15 September 2001. Service will be launched towards the end of 2001. Complete rollout to all provinces will be completed during 2002. CP Orange had 1'200 employees in mid 2001 and this was due to rise to 2'000 by the time they are operational. It has probably been the biggest mobile investor in 2001 and will launch will a fully 2.5G (GPRS) compliant network. Total investment is likely to run to US$800 million with Siemens

Box 2.2: Mobile data in Thailand

By comparison with its South East Asian neighbours, notably the Philippines, Thailand has only limited mobile data use and relatively little use of Short Message Service (SMS). It is estimated that in August 2001, there were around five million SMS messages a day sent in Thailand. This compares with around 50 million per day in the Philippines! What are the factors that have limited SMS use in Thailand?

- Probably the biggest barrier is language. Surprisingly, to date, no Thai language interface has been developed for GSM mobiles, meaning that it is not possible to input Thai text, though it is possible to receive messages in Thai sent via the Internet. The market entry of CP Orange and Hutchison could change this situation.
- A second barrier is that, unlike elsewhere, SMS was never free in Thailand. The price was originally set at 4 Baht per message, though this has been reduced to 2 – 3 Baht, depending on the package. The ratio between the price of a local call and the price of an SMS message is consequently around 1.5:1 as opposed to 9:1 in the Philippines.
- Lack of content, especially local language content, is also a problem. In the last year, ring tones and Chinese horoscopes have become popular, but there is still a long way to go.

As a result of these problems, take-up of Wireless Application Protocol (WAP) has also been slow. DTAC introduced its WAP service through a soft launch on 30 November 2000 with a hard launch in June 2001. They are using Telenor technology and work closely with ISPs KSC and Internet Thailand. They have a WAP portal called Djuice, but there is a lack of local language content. Traffic is currently running at around 30'000 minutes per day.

The GPRS market is unlikely to take off until the entry of CP Orange, although both DTAC and AIS have plans. The situation with regard to third generation (3G) is somewhat confused by the regulatory situation. The Asian Institute of Technology recently organized a seminar to encourage debate, but there is currently no great push for 3G. However, given the Thai predilection for awarding franchises, it is likely that they will be awarded sooner rather than later once the NTC is established. Indeed, some operators claim to already have a 3G license.

and Motorola as the main contractors.

The other new market entrant, **Hutchison CAT Wireless Multimedia** is also due to launch later in 2001 using a CDMA spectrum allocation (currently held by **Tawan Mobile**). The owner is Hutchison Whampoa of Hongkong SAR and the franchisor is CAT. There are doubts about the viability of CDMA which has not fared well elsewhere in the region, but Hutchison plans to press ahead with rolling out a full 3G network using the cdma2000 (a competitor to the wideband CDMA standard in use elsewhere).

2.3 Regulation and policy-making

2.3.1 Policy structure

The **Ministry of Transport and Communications** (MOTC, <www.motc.go.th>) is the policy-making body for telecommunications in Thailand. Its responsibilities in the field of radiocommunications are authorized by the Post and Telegraph Department (PTD, <www.ptd.go.th>), which currently operates under Radiocommunications Act B.E. 2498 (1955) as amended by Radiocommunications Act (No.2) B.E. 2504 and Radiocommunications Act (No.3) B.E. 2535 and the National RadioFrequency Management Board Announcement on Frequency Assignment Criteria. Policies on radiofrequency management are determined by the National RadioFrequency Management Board. Moreover, article 3 of the Decree sets out the structure of the PTD, which covers all aspects of telecommunications and posts, including management of civil radio frequencies and type approval. PTD is a revenue-generating department, achieving a cost-recovery rate of 158 per cent in 1999. Nevertheless, its budget was cut by 31 per cent in that year.

2.3.2 Policy development

The Constitution of Thailand (B.E. 2540 (1997), Section 40) states that "transmission frequencies for radio or television broadcasting and radio telecommunication are national communication resources for public interest". The Constitution further commits the country to establishing independent regulatory bodies for posts and telecommunications and for broadcasting. The establishment of an independent regulatory body is also consistent with Thailand's commitments under the World Trade Organization's (WTO) basic telecommunications agreement (4th Protocol to the General Agreement on Trade in Services) signed in February 1997. Thailand's schedule of commitments includes opening its international telecommunications market by 2006.[8] They also incorporate the WTO regulatory reference paper, which includes, inter alia, a commitment to establish a transparent interconnection regime and a separate regulatory body.

Under the Act on the Organizations to Assign RadioFrequency Spectrum and to Regulate Sound Broadcasting, Television Broadcasting and Telecommunication Services (B.E. 2543 (2000)), the PTD will be transformed into the National Telecommunication Commission (NTC), independent from the government. However, the process of establishing the NTC, which began in 1997 has been delayed. One consequence of this delay is that the consideration of new or additional frequency assignments, and the issuance of new or additional business operation licenses are not allowed. This blockage on market entry might be interpreted as favouring existing incumbents.

2.3.3 Foreign ownership

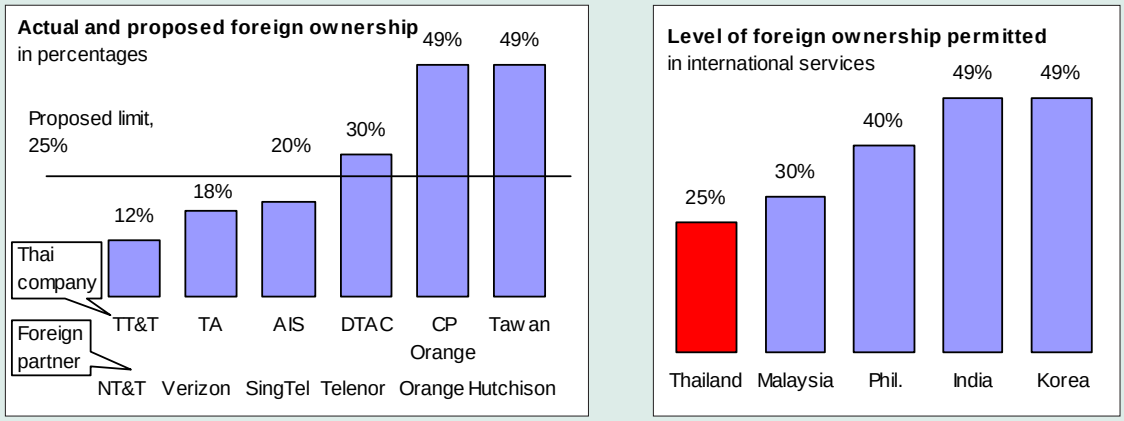
One of the policy issues the incoming NTC will have to deal with is the new rules on foreign investment and ownership. The new telecommunications law appears to set a cap on foreign ownership of 25 per cent. This is higher than the commitments made in the WTO offer (where the cap was set at 20 per cent) but it is much lower than the actual situation where operators like CP Orange and Hutchison have up to 49 per cent foreign ownership (see Figure 2.3). It is also much lower than in comparable countries in the region.

There would be a number of problems that could include:

- Finding Thai investors to buy-out the foreign investors;

Figure 2.2: Actual foreign ownership and proposed limits

Actual and proposed in Thailand and actual limits in selected Asian economies



Source: ITU, Pyramid Research.

- Persuading local investors to contribute a higher share of investment if refinancing the company;

- Dealing with the consequences of concession conversion (see above).

2.3.4 Privatisation

The privatisation process for the SOEs, TOT and CAT, is another victim of the policy paralysis described above. Although the MoTC gave a green light to privatisation in May 1999, little progress has been made. One of the main stumbling blocks has been the concession conversion process.

In theory, the privatisation process is due to take place in two phases:

- Phase 1: Corporatisation of the SOE's under the Corporation Act;

- Phase 2: Privatisation, through the creation of a holding company, followed by the sale to a strategic partner, followed by an IPO to reduce the government's holding to below 30 per cent.

The current uncertainty over the limits on foreign ownership have cast the sale to a strategic partner into doubt. Few foreign investors would be willing to invest substantial capital without the promise of a controlling interest in the company.

2.3.5 Universal service

Between 1996 and 2000, Thailand's teledensity (telephone lines per 100 inhabitants) improved only marginally, from 7.2 to 8.6, but the number of households with a telephone doubled from 14 per cent in 1996 to 28 per cent at the start of 2001 (see Table 2.4). The reason behind this apparent contradiction is because of the growth in mobilephones. Many households now have only a mobilephone, suggesting that this is where the real progress in extending universal access is being achieved. It can be expected that the percentage of pre-paid mobile subscribers will also grow, in line with other developing Asian economies, so that a larger number of Thais can have access to telecommunication services.

Other indicators also suggest progress. The number of payphones has tripled from below 60'000 in 1996 to almost 180'000. The waiting list for telephone service has fallen from a peak of 1.8 million in 1993 to just 415'000 at the start of 2001. Again, it is probably the introduction of mobilephone service that enabled the dramatic reductions in the waiting list between 1993 and 1996, but further reductions have been hard to achieve. This is probably because those remaining on the waiting list are now in rural areas, which are hard to reach, rather than in urban areas.

The percentage of the population covered by mobilephone service will be a key indicator to track in the future. The largest mobile operator, AIS, hopes to have 91 per cent mobile coverage by the end of 2001. There may be some scope for regulatory intervention to encourage the extension of service to remote and rural areas, for instance through network sharing.

Most other universal access initiatives are currently stymied by the lack of a regulatory commission. There are plans, for instance, to create a universal service fund, but this is awaiting the new legislation. The Constitution specifically recognises the right of all parts of the country to equal access to telecommunication services. In 1999, 55'116 out of 69'324 villages had a telephone. It is hoped that all of Thailand's villages will have a telephone by the end of 2001. However, this target has been postponed several times.

Table 2.3: Main telecommunication indicators for Thailand, 1991-2000

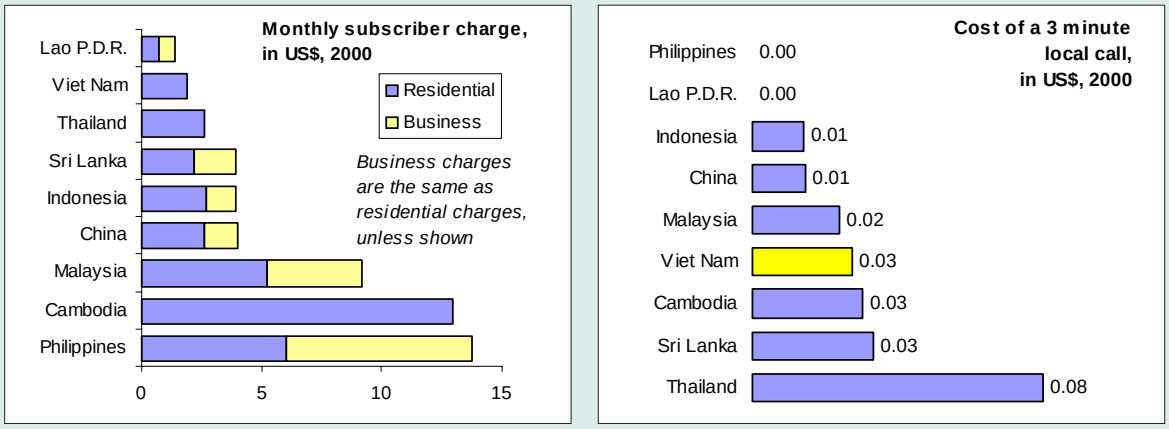
Year Ending 30.09

Unit		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
DEMOGRAPHY, ECONOMY											
Population (1)	10x3	55'126	55'710	56'300	56'896	57'498	58'107	58'722	59'344	59'972	60'607
Households (2) 10x3		12'500	12'729	13'336	13'994	14'100	14'300	14'400	14'400	15'600	15'661
Gross domestic product (3)	10x9	2'507	2'831	3'196	3'599	4'094	4'610	4'707	4'636	4'688	4'891
Average annual exchange rate per US$(5)		25.52	25.40	25.32	25.15	24.91	25.34	31.36	41.36	37.81	40.11
Consumer price index (6)		84	87	90	95	100	106	112	121	121	123
Telecom equipment exports	10x6	349	395	426	488	573	704	756	773	846	...
Telecom equipment imports	10x6	360	430	677	1'042	1'045	953	1'101	452	624	...
TELEPHONE NETWORK											
Main telephone lines in operation (7)	10x3	1'553	1'790	2'215	2'751	3'482	4'200	4'827	5'038	5'216	5'791
Main telephone lines per 100 inhabs.		2.82	3.21	3.93	4.83	6.06	7.23	8.22	8.49	8.70	9.23
% households with a telephone		...	7.6	...	10.1	...	14.0	...	21.9	...	27.7
% digital main lines	%	70.9	74.7	79.0	82.8	86.9	89.4	100.0	100.0	100.0	100.0
% residential main lines	%	65.9	66.3	68.1	68.2	67.8	67.3	65.9	66.4	67.0	67.9
Public payphones	10x3	26.1	30.2	36.7	42.1	49.4	57.5	91.1	113.2	139.3	179.0
Waiting list for main lines	10x3	1'299	1'592	1'860	1'596	1'083	822	620	556	420	415
MOBILE SERVICES											
Cellular mobile telephone (of which) (8)	10x3	124	251	414	737	1'298	1'845	2'204	1'977	2'339	3'056
- Digital cellular (9)	10x3	—	—	—	10	92	240	470	589	1'032	2'460
Cellular subscribers per 100 inhabs		0.22	0.45	0.73	1.30	2.26	3.17	3.75	3.33	3.90	5.04
Radio paging (10)	10x3	88	158	252	377	486	652	790	862	779	970
OTHER SERVICES											
ISDN		—	—	—	45	327	587	1'010	1'396	2'112	4'329
ISDN B channel equivalents		—	—	—	90	654	1'174	2'020	3'044	6'044	13'726
TRAFFIC											
National trunk telephone (minutes)	10x6	837	1'055	1'337	1'716	1'978	2'087	2'023	1'788	1'675	...
Int'l out. telephone traffic (minutes)	10x6	121	140	163	193	233	266	284	303	299	355
Int'l inc. telephone traffic (minutes)(11)	10x6	175	213	231	271	278	320	350	313	328	427
Local telephone traffic (pulses)	10x6	3'133	3'863	4'885	6'136	7'173	8'136	8'602	8'706	8'710	9'258
STAFF											
Full-time telecommunication staff (12)		24'840	29'603	30'988	32'869	34'936	35'036	35'173	34'852	33'991	33'100
QUALITY OF SERVICE											
Faults per 100 main lines per year (13)	%	65.0	50.0	45.0	43.0	45.0	28.7	25.9	28.6	17.8	19.6
TARIFFS (Baht)											
Telephone connection		3'350	3'350	3'350	3'350	3'350	3'350	3'350	3'350	3'350	3'350
Residential teleph. monthly subscription		100	100	100	100	100	100	100	100	100	100
Business teleph. monthly subscription		100	100	100	100	100	100	100	100	100	100
3-minute local call (peak rate)		3	3	3	3	3	3	3	3	3	3
Cellular connection (14)		1'000	1'000	1'000	1'000	1'000	1'000	1'000	1'000	1'000	1'000
Cellular monthly subscription (15)		500	500	500	500	500	500	500	450	450	500
Cellular - 3-min. local call (peak rate) (16)		9	9	9	9	9	9	9	9	9	9
REVENUE AND EXPENSE (Baht)											
Total telecom services revenue (17)	10x6	32'483	36'437	45'904	60'039	77'514	82'213	93'490	96'408	111'835	129'738
- Telephone service revenue (18)	10x6	30'373	33'688	39'082	41'655	49'378	58'180	63'911	63'177	75'000	78'858
- Mobile communication revenue	10x6	...	...	7'500	11'400	17'900	21'700	27'700	29'527	30'395	42'063
CAPITAL EXPENDITURE (Baht)											
Annual telecom. Investment (19)	10x6	12'566	8'909	16'360	41'468	33'924	47'851	61'655	26'862	30'829	34'967
BROADCASTING											
Television receivers (20)	10x3	7'998	8'745	9'570	10'748	11'407	12'500	14'200	15'115	16'700	17'200
Cable TV subscribers	10x3	...	90	126	200	210	380	480	610	146	150
Home satellite antennas (22)	10x3	...	...	13	100	...	45	112	144	179	231
INFORMATION TECHNOLOGY											
Personal Computers (23)	10x3	300	450	570	680	810	1'000	1'200	1'300	1'382	1'471
Internet hosts (24)		—	5	276	1'728	4'055	9'245	14'378	20'527	40'176	63'447
Estimated Internet users	10x3	—	0.06	5	20	55	135	375	500	1300	2'300

Note: Year ending 30 September.
(1) Source: UN, National Statistical Office, Other years: ITU estimate, 2000: Latest census. (2) 1960,1970,1980: UN. 1992-94: Bank of Thailand. 2000: National Statistical Office. Other years: ITU estimate. (3) Source: IMF. (5) Source: IMF. (6) Source: IMF. (7) 2000: estimate. (8) 2000: As of 31st August. (9) 2000: As of 31st August. (10) Refers to TOT-concession subscribers. 2000: As of 31st August. (11) CAT only. (12) Including CAT telecom staff from 1991. (13) Yearly estimate from monthly data. (14) Data refer to TOT. (15) Data refer to TOT. (16) Data refer to TOT. (17) CAT and TOT. (18) CAT and TOT. (19) CAT and TOT. (20) Source: Through 1990, UNESCO. From 1991, break, Post and Telegraph Department, 1996-97: ITU estimate. (22) Source: UBC, ITU estimate. (23) Source: ITU estimate. (24) Source: Internet Software Consortium.
Source: Post and Telegraph Department (PTD).

Figure 2.3: Comparative tariffs

Fixed telephone tariffs among selected Asian economies, in US$, 2000



Source: ITU World Telecommunication Indicators Database.

2.4 Tariffs

2.4.1 Retail tariffs

Thailand's fixed-line telecommunications tariffs have remained essentially unchanged for a number of years, although the number of tariff options and packages, as well as new technical options such as IP Telephony (see Box 2.1), have proliferated. However, as Table 2.4 shows, for many years, the price of fixed-line connection has been 3'350 Baht (US$76), the price of monthly subscription 100 Baht (US$2.25) and a local telephone call (untimed), 3 Baht (7 US cents). There is no differentiation between business and residential subscribers.

These tariff levels put Thailand at the low end of the region for monthly subscriber charges but at the high end for local call charges. In mitigation, it should be added that local call charges in Thailand are untimed, so for Internet use, the comparative cost is much lower. Nevertheless, it suggests there is considerable scope for arbitrage by other calling options, such as mobile or IP Telephony.

The system of franchises described above effectively eliminates the scope for price competition, in that the franchisees would not be allowed to compete with the incumbent franchisors. Again, the policy paralysis over the creation of a regulatory agency also limits scope for change.

Leased line tariffs are around 8'000 Baht (US$182) per month for a 64 kbit/s line. Both TOT and CAT, as well as their franchisees, offer leased lines, but there is no price competition. Leased line charges were last reviewed in January 2001 when prices were reduced by between 3-30 per cent.

2.4.2 Interconnect tariffs

As noted above, there is no system of interconnection in Thailand, but rather a system of revenue-sharing, which was set at the time each license was negotiated. The revenue-sharing deals are highly variable, meaning there has been little change even though the balance of traffic, for instance between fixed and mobile networks, has shifted over time. Thailand is theoretically committed to introducing an interconnect regime, as part of its WTO schedule of commitments, but is unable to do so until the regulatory agency is established.

2.5 International traffic

Responsibility for Thailand's international traffic is split between

TOT, which provides service to neighbouring countries, and CAT, which serves the rest of the world. Thailand runs a net deficit of traffic with the rest of the world (in other words, incoming traffic exceeds outgoing), but not nearly to the same extent as other developing ASEAN economies. In 1999, international outgoing traffic amounted to around 260 million minutes and incoming to 320 million minutes, a ratio of 1:1.25, compared with 1:16, say in the case of Viet Nam. Indeed, Thailand's incoming traffic has actually declined recently due to a fall in call-back traffic, and because of the declining value of the Thai Baht relative to the US dollar.

Thailand has a relatively balanced traffic pattern, with no single country dominating, though the United States is the major partner, contributing some 19 per cent of the total (including traffic routed to third countries, via the United States). Japan contributes a further 16 per cent of traffic followed by Singapore (10 per cent).

Thailand's international tariffs have come down recently, with the biggest reductions occurring on the route to the United States; coming down from 184 Baht for a three minute call in 1996 to 72 Baht (US$ 1.60) in 2001. Further reductions are available using CAT's PhoneNet IP Telephony service. However, there has not been the same level of reduction in calls to Asian locations, possibly because there is less competition on those routes.

2.6 Mass Media

Thailand has a well developed media sector with high degree of access among the population. Thailand's press is one of the freest in Asia. There are a variety of media ranging from printed newspapers to satellite-delivered television. Thailand is also a hub for foreign media, with many establishing their regional presence in Bangkok.

2.6.1 Printed press

There are around 30 daily newspapers printed in Bangkok including two in English (the *Bangkok Post* <www.bangkokpost.com> and *The Nation* <www.nationmultimedia.com>, plus several in Chinese. The leading Thai newspapers *Matichon* and *Siam Rath* are popular among the well educated. *Thai Rath* and *Daily News* are more oriented towards the mass market. *Sin Sian Yit Pao* is Thailand's leading Chinese-language newspaper. Bangkok-based newspapers are available across the country. Provincial newspapers are published every two weeks.

According to UNESCO, in 1996 (latest data available), daily newspaper circulation in Thailand was some 3.6 million or 64 per 1'000 inhabitants.[9]

2.6.2 Broadcasting

Responsibility for broadcasting rests with the Mass Communications Organization of Thailand (MCOT) <www.mcot.or.th>, and the Public Relations Department of Thailand (PRD) <www.prd.go.th>, both within the Prime Minister's Office. They also operate broadcasting stations and MCOT is also responsible for the Thai News Agency. A new broadcasting act is being discussed in parliament. It proposes the creation of a National Broadcasting Commission to regulate the industry, parallel to the NCT. The Thai broadcast scene is fairly sophisticated. A number of television stations are retransmitted around the world via satellite. Many radio and television stations have at least a web site with program listings. A growing number also offer audio and video streaming.

2.6.2.1Radio

Thailand has 524 local and national radio stations, 211 of them AM while the rest are on FM. The biggest operators are the Public Relations Department (PRD) with 147 radio stations, followed by the Royal Thai Army with 127 stations and the Mass Communication Organization of Thailand with 62 stations. AM is primarily listened to by rural dwellers while FM is mainly in the large cities. Interestingly most radio stations must

take a news feed from Radio Thailand at 7 am and 7 pm, but are otherwise free to broadcast their own content including news.[10] Surprisingly only 77 per cent of households have a radio, a lower percentage than for television.

2.6.2.2Television

Thailand was the first country in South East Asia to launch regular television transmissions in 1955 and the first to launch colour programs in 1967. There are six free-to-air television channels (see Table 2.5). They are all government-owned although private companies under concession operate three of them. Some 92 per cent of Thai homes have a television set.

Thailand has both cable and satellite pay television. United Broadcasting Corporation (UBC) <www.ubctv.com> is currently the only nationwide provider of pay television, although licenses have been granted to two other companies. In addition there are 86 regional cable pay television operators generally averaging fewer than 1'500 subscribers.

UBC has two major shareholders, Telecom Holding Co., Ltd. (41 per cent) and MIH Limited (31 per cent). Telecom Holding is owned by TelecomAsia that in turn has a concession for telephone lines in Bangkok. MIH is a South African-based media company with operations in many countries. UBC's cable network is primarily in the Bangkok area and can potentially reach more than 800'000 homes, though it had 149'785 subscribers at December 2000. TelecomAsia is leveraging its part-ownership of UBC by launching a cable modem service. UBC's satellite service is available nationwide. Its DStv Direct-to-Home system uses the Thaicom3 satellite. Because it utilizes the Ku-Band, the reception dishes are small and easy to install. It had 231'171 satellite subscribers at December 2000.

All together UBC had 380'956 subscribers to its pay networks at December 2000, or only 2.7 per cent of television households. This low figure is partially explained by the fact that its cable network is only available in the Bangkok area. Although there are other regional operators of cable networks, statistics are not available for how many subscribers they have. However at a maximum they have only 130'000 subscribers. UBC itself estimates its potential market—those that could afford pay television— at some two million households, or five times more than it currently has. So, why are there so few subscribers? Perhaps because of the prevalence of cheap pre-recorded entertainment options such as VCDs, DVDs and VCRs.

Table 2.4: Thai TV

Free-to-Air television stations

Station	Owner/Responsible Agency	Status	Website
Channel 3	MCOT	Operated by concessionaire	www.tv3.co.th
Channel 5	Royal Thai Army	Army managed commercial TV station	www.tv5.co.th
Channel 7	Royal Thai Army	Operated by concessionaire	www.ch7.com
Channel 9	MCOT	State enterprise	www.mcot.or.th
Channel 11	PRD	Non-commercial	www.prd.go.th
ITV	ITV Public Company Limited	Operated by concessionaire	www.itv.co.th

Source: ITU adapted from PRD.

One interesting development is marrying the Internet with satellite to provide television broadcasts using IP technology. Shin Broadband Internet announced its "iPTV" (Internet Protocol TV) service in October 2001. The service allows users to receive television broadcasts beamed down from satellite to their PCs. The nation's six free-to-air channels will be provided as well as topical channels including learning, sports and music videos. In addition there will be a pay-per-view channel. Subscribers pay an application fee of 6'000 Baht (US$136) plus monthly "content" fees ranging between 1'200 and 9'000 Baht depending on the programming selected. The cost of the satellite dish (1'200 – 2'000 Baht) will be subsidised. It anticipated that the number of subscribers will be around 10'000 in the first year.[11]

Table 2.5: Thai broadcasting indicators

Year 2000

Number of households with radio	12.1 million
Per cent of households with radio	77.2
Number of households with television	14.3 million
Percent of households with television	91.5
Number of cable television subscribers	149'785 *
As per cent of households	1.0%
As per cent of television households	1.0%
Number of Direct To Home satellite television subscribers	231'171
As per cent of households	1.5%
As per cent of television households	1.6%
Total multi-channel households	380'956
As per cent of households	2.4%
As per cent of television households	2.7%

Note: *UBC only.
Source: ITU adapted from National Statistical Office, UBC.

[3] For a detailed account of the history of Thai posts and telecommunications, see the PTD web site at: http://www.ptd.go.th/estab.htm.

[4] CAT (like TOT) launched its own analogue mobile network back in the late 1980s. This network is slowly being phased out and had only around 20'000 subscribers at the end of 2000.

[5] For more information, see the case study of IP Telephony in Thailand, available at: http://www.itu.int/osg/spu/wtpf/wtpf2001/casestudies/thailandfinal.pdf.

[6] See http://scoop.bangkokpost.co.th/bkkpost/2001/august2001/bp20010803/030801_business04.html.

[7] See http://scoop.bangkokpost.co.th/bkkpost/2001/september2001/bp20010924/business/24sep2001_biz14.html.

[8] See the WTO web site at: http://www.wto.org/english/tratop_e/serv_e/telecom_e/sc85s2.wp5.

[9] http://unescostat.unesco.org/statsen/statistics/yearbook/tables/CultAndCom/Table_IV_8_Asia.html.

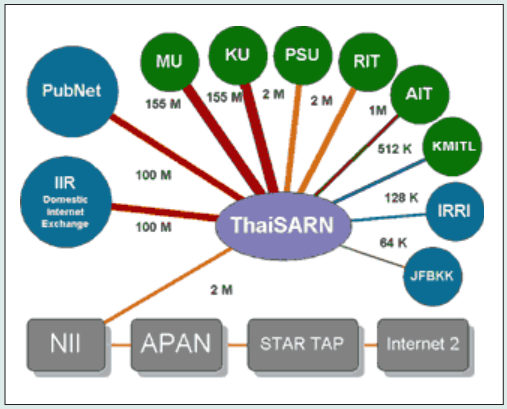
[10] See "Broadcasting" at the PRD's web site: http://www.prd.go.th/prdnew/eng/media_e/broad.html.

[11] "Shin Broadband launches iPTV – the first Internet television for Thais." *Press Release*. 30 October 2001. http://www.shincorps.com/news/en_iPTV.pdf.

3. The Internet in Thailand

As in many countries that were early adopters of the Internet, Thailand's academic sector was an eager experimenter with computer networks. UUCP connections to Australia, the US and Japan were tested by the Asian Institute of Technology (AIT) as far back as 1987.[12] The Communications Authority of Thailand (CAT) X.25 service (Thaipak) was used to establish the link. The same year, a researcher from AIT was authorized to administer the .TH domain name. The Prince of Songkhla University established a dial-up connection with assistance from Australia in 1988. Calls were made twice a day (from Australia where tariffs were cheaper) to exchange e-mails. By 1991, five Thai universities were connected via a UUCP network and in August 1992 there were some 50 e-mail users. Finally in July 1992, Chulalongkorn University established the first permanent Internet connection via a 9.6 kbps line to UUNET in the US. The National Electronics and Computer Technology Centre (NECTEC) also set up a node that year which eventually evolved into the nation's academic network, the Thai Social/Scientific Academic and Research Network (ThaiSARN) ('sarn' means information in Thai). In October 1993, ThaiSARN established the first World Wide Web (WWW) server in the country. Today, ThaiSARN's network serves as both a national backbone and Internet exchange. The ThaiSARN3 network provides connectivity for the academic community to three major international networks: SINET, APAN and the Internet-2. In March 1995, the Internet moved out of the academic realm when Internet Thailand launched service as the first commercial ISP. The role of dedicated people, bilateral assistance, and government support cannot be underestimated in their impact on the establishment of the Internet in Thailand and its continued sustainability.

Figure 3.1: ThaiSARN3 Network



Source: NECTEC.

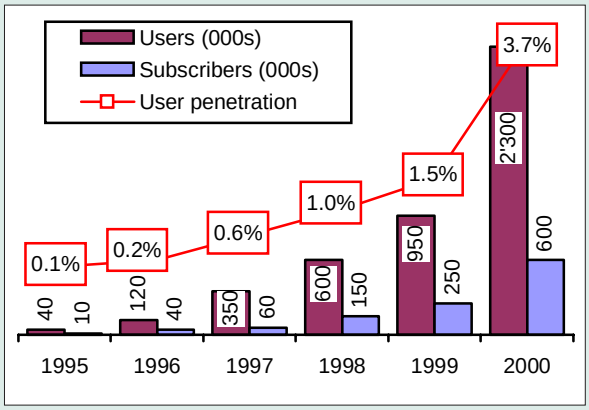
3.1 The market today

There are 18 ISPs operating in Thailand today. Measuring the size of the Thai Internet market is not easy. Subscriber data is difficult to reconcile due to the prevalence of prepaid Internet cards. It is believed that many subscribers have multiple prepaid cards and that they account for over half the market.[13] Likewise a figure for the number of users is also difficult to obtain. There are no regular methodologically consistent market surveys on the number of Internet users that are typically carried out in more developed markets. Despite these limitations, a minimum figure for the number of Internet users in Thailand at the end of 2000 is 2.3 million or 3.7 per cent of the

population.[14] It is also estimated that there were around 600'000 subscribers (including prepaid cards).

Due to the lack of reliable and comparable subscriber data, ISPs are typically ranked by other measures such as revenues, bandwidth or traffic generated. By those criteria, there are significant differences in the size of the ISPs with the top five accounting for over 70 per cent of all traffic. It is generally agreed that these five also account for the majority of subscribers—both dial-up and leased line—as well as revenue. The top five are Internet Thailand, KSC, CS Communications, LoxInfo and Asia Infonet.

Figure 3.2: Thai Internet market



Source: ITU, NECTEC.

3.2 Broadband

Until recently, demand for fast Internet access has been met by conventional leased lines and, in a few cases, Integrated Services Digital Network (ISDN) lines. Lately, there have been moves to provide high-speed local access via cable modem and ADSL. The spread of broadband access is being delayed by high costs that are partly related to the nature of the Thai telecommunication market that forbids ISPs from directly providing infrastructure. On the one hand this delays the introduction of consumer broadband products. Most ISPs are unwilling to make the relatively high investment, particularly when they feel that demand is still low due to their perception that Thai Internet market is still not ripe for broadband. On the other hand, the introduction of mass broadband products would undercut the lucrative revenues ISPs and infrastructure providers are receiving from providing leased lines. Another mitigating factor against broadband—at least for residential use—is that many users access the Internet from outside the home due to a lack of telephone line or PC. Finally, in other countries, heavy Internet users migrate from dial-up to broadband access to avoid metered telephone usage charges. The fact that there is a flat fee for dial-up Internet use in Thailand means there is less of an economic reason for users to move to broadband.

Despite these barriers, there is demand for broadband technology. Some ISPs state that the quality of ISDN is not satisfactory. The fact that leased lines are relatively expensive also suggests that there is a demand for a more reasonably priced alternative. Demand for broadband applications, particularly games, is also growing. Indeed the number one complaint among Thai Internet users is a lack of speed.[15]

Even though TOT could provide ADSL over its telephone lines, it has chosen to not get directly involved in broadband provision. Instead it has formed enterprises with two companies to offer ADSL. *Lenso DataCom* is a joint venture between the Lenso Group and TOT established in 1999; it provides an ADSL service called Q-Net.[16] The UCOM Group provides ADSL lines via its *United Broadband Technology* (UBT) subsidiary, a joint venture with TOT. *TelecomAsia*, which is the concessionaire for fixed lines in the Bangkok area, has been testing ADSL technology since 1999. It commercially launched ADSL service in July 2001.[17] Its so-called TA Express will initially offer ADSL speeds at 128 kbps – 1 Mbps (to be later expanded to 8 Mbps). TelecomAsia also provides cable subscription television in the Bangkok area through its UBC joint venture. At December

2000 it had 150'000 subscribers. TelecomAsia provides cable modem service offering two speeds, 256 kbps and 1 Mbps, that could reach a potential 800'000 households in Bangkok.

3.3 Regulatory and policy issues

There is not currently a regulatory authority responsible for the Internet in Thailand. By default, decisions regarding the Internet have fallen to CAT, the government owned international telecom service provider. This is based on stipulation in Thai law that states that all telecom services must be provided by either CAT or TOT; they can then assign the rights to others in terms of joint ventures or other business arrangements. CAT has been granted the lead for Internet issues because a full Internet service requires international connectivity.

3.3.1 Licensing

ISP licenses are issued by CAT. In exchange for a license, ISPs must provide 32 per cent of their shares to CAT and up to an additional three per cent to CAT employees. In most cases, these shares are provided to CAT for free. ISPs must also pay for CAT's participation in case of capital increases to maintain the 32 per cent shareholding. Thus far, 18 licenses have been issued. No licenses have been granted since March 2000 pending the creation of the National Telecommunication Commission (NTC). CAT also requires that companies pool their investment in ISPs through an intermediary holding company rather than direct ownership. Limits on foreign ownership in ISPs were raised to 49 per cent from 20 per cent following the 1997 financial crisis. Although CAT is on the Board of Directors of the ISPs and reviews annual business plans, it generally takes a passive role in ISP operations.

Table 3.1: ISPs in Thailand

	Name	License Date
1	A-Net Co., Ltd.	Mar-96
2	Asia Access Internet Service	Apr-96
3	Asia Infonet Co., Ltd.	Nov-96
4	C.S. Communications Co., Ltd	Jan-97
5	Cable & Wireless Network (Thailand)	Feb-00
6	Chomanan Worldnet Co., Ltd.	Oct-97
7	Data Line Thai Co., Ltd	Oct-96
8	E-Z NET Co., Ltd.	Nov-99
9	Far East Internet Co., Ltd.	Oct-97
10	Internet Thailand	Mar-95
11	Jasmine Internet Co., Ltd	Mar-96
12	KSC Commercial Internet Co., Ltd.	Jun-95
13	Loxley Information Service Co., Ltd.	Mar-96
14	Samart CyberNet Co., Ltd.	Mar-96
15	Siam Global Access Co., Ltd.	Dec-96
16	Roynet Co., Ltd.	Oct-99
17	The Idea Net	Nov-96
18	WorldNET & Services Co., Ltd.	Jul-96

Note: Licenced by CAT.
Source: ITU adapted from CAT and NECTEC.

There is some confusion about whether TOT can provide ISP licenses. After all it also provides international telecom service to bordering countries. Theoretically it would be legal for it to establish an Internet gateway with connections to these bordering countries. Indeed it planned this with a new ISP that was going to offer free Internet access. However this initiative was blocked. TOT does own 32 per cent of one ISP, Internet Thailand. TOT also offers Internet access through its TOT online service.

It is foreseen that when the sector is liberalized and NTC created, licensing will move to a more conventional scheme. It is expected that CAT will divest of its holdings in most ISPs and that ISPs will pay annual license fees.

3.3.2 Interconnection

There are two public Internet exchanges in Thailand (see Figure 3.3). The ThaiSARN Public Internet Exchange (PIE) is operated by NECTEC. The second exchange is Thailand Internet Exchange Service (THIX) operated by CAT.

ISPs are not allowed to directly provide their own infrastructure and must contract with licensed infrastructure providers for domestic connections. This means that an ISP

cannot directly provide a leased line to a customer but must work through authorized data communication providers that have been granted concessions by CAT or TOT.

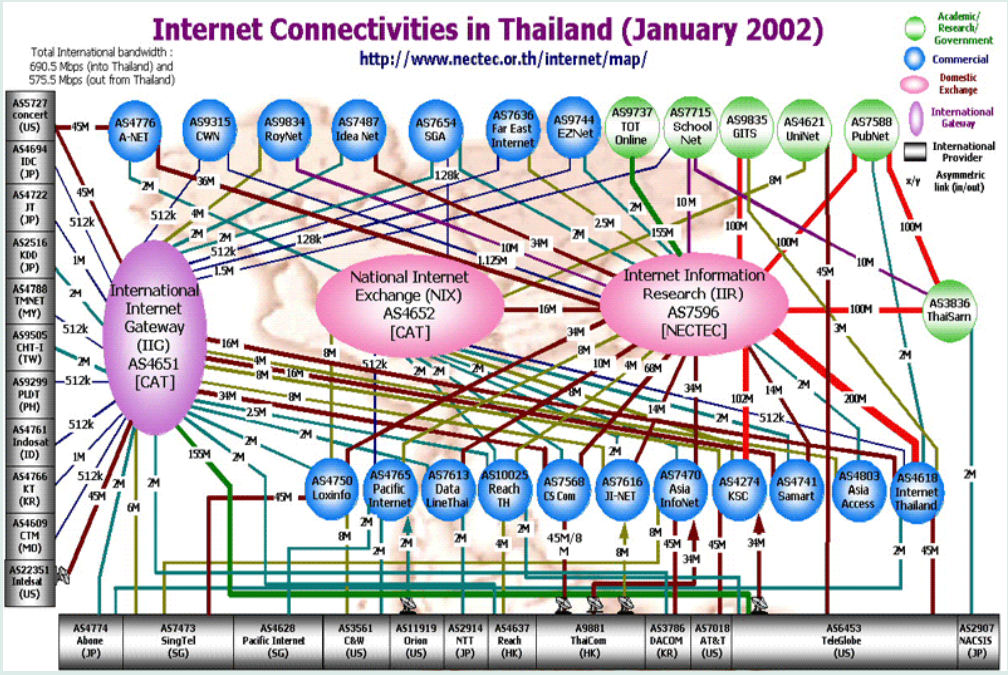
CAT has a monopoly on international Internet connectivity. It operates an International Internet Gateway (IIG) to which other ISPs connect. ISPs have two options for obtaining international bandwidth. They can contract with CAT to provide the entire international bandwidth. Or they pay CAT for the Thai portion of the circuit and make their own arrangements with foreign ISPs for the other half of the circuit.

3.3.3 Pricing

Dial-up Internet access has two price elements: the ISP charge and the telephone charge. The price of an unlimited local telephone call is three Baht (6.6 US cents). The fact that Thailand uses a flat fee telephone call charge is an advantage for Internet access. Another consideration for dial-up access is that over half of the subscribers do not have conventional Internet account but use prepaid cards. The major ISPs provide prepaid cards in various denominations with the price declining as more time is spent online. Prepaid cards are generally valid for six months and can be purchased or recharged online as well as at retail outlets such as Internet cafés, convenience stores and banks.

Thailand has among the lowest dial-up Internet prices in the South East Asia region. One reason is that local telephone calls in Thailand are charged at a flat fee unlike other countries in the region. There have been attempts to do away with the ISP charge completely for dial-up Internet access. Several companies had proposed free Internet access in conjunction with TOT but these were not allowed. Nonetheless, TelecomAsia has offered promotions for its fixed line customers by

Figure 3.3: Internet exchanges in Thailand



Source: NECTEC.

Table 3.2: Prepaid Internet pricing

Internet Thailand's pricing plans, August 2001

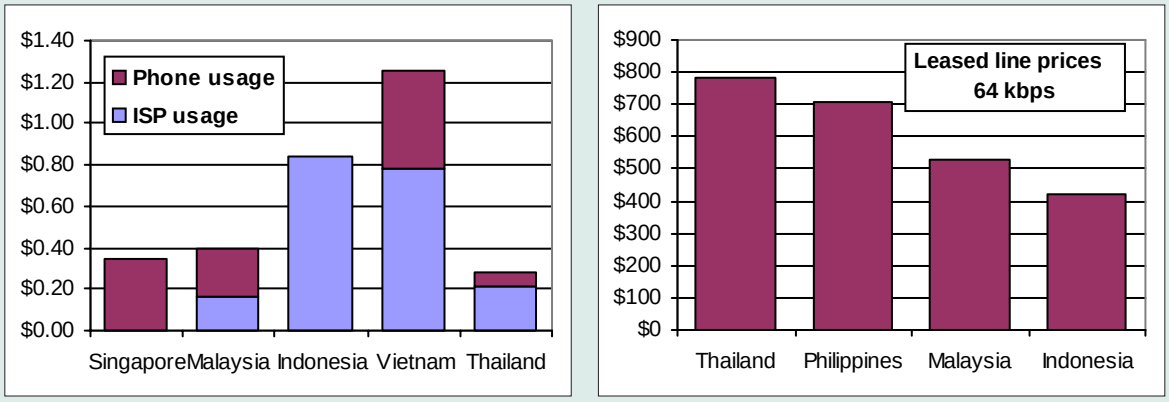
Inet Easy					
	Easy Orange	**Easy Green**	**Easy Blue**	**Easy Pink**	**Easy Purple**
Price of card - Baht - US$	149 $ 3.29	349 $ 7.70	449 $ 9.90	649 $14.31	849 $18.72
Hours included	15	36	55	85	155
Price per hour - Baht - US cents	9.93 21.9¢	9.69 21.4¢	8.16 18.0¢	7.64 16.8¢	5.48 12.1¢

Inet Access			
Price per hour	**(08.00-18.00)**	**(18.00-24.00)**	**(24.00-08.00)**
Mon – Fri - Baht - US cents	13 28.7¢	10 22.1¢	5 11.0¢
Sat-Sun - Baht - US cents	10 22.1¢		5 11.0¢

Note: Inet Easy does not require registration. Inet Access requires registration and payment of Baht 150 registration fee. Data at 28 August converted by June 30 exchange rate (Baht 45.35 = 1 US$).
Source: ITU adapted from Internet Thailand.

Figure 3.4: The cheapest and one of the most expensive

Dial-up Internet prices (per hour) and leased line prices, selected South East Asian countries, US$, August 2001



Note: In the left chart, phone usage for Thailand is based on one flat rate call. Phone usage for Indonesia is bundled into ISP charge. For Singapore, there is no ISP usage charge for Internet access.
Source: ITU adapted from ISP data, TDRI.

providing free Internet access through its ClickTA ISP.

While Thailand has some of the lowest dial-up prices in the region, leased line pricing is another story. The fact that ISPs are not allowed to directly provide their own infrastructure drives costs up. This is due to a lack of competition as well as reselling. As a result a leased line customer must pay twice: once to the physical leased line provider and again to the ISP for Internet access.

3.3.4 Content

There are no content controls in the Thai Internet. There is no formal censorship of content nor are content providers required to register. CAT does encourage ISPs to offer family plans with filtering software such as Net Nanny.

Thailand Network Information Centre (THNIC) <www.thnic.net> administers the TH Internet domain. The registration fee is Baht 1'500 (US$ 55) valid for a period of two years. After that, the annual renewal fee is Baht 800 (US$ 28). Thailand follows the common classification for second level domain names (see Table 3.3). There were almost 69'000 hosts using the TH domain at May 2001.

3.3.5 Universal Access

Thailand has made large strides in access to the Internet. According to a survey conducted in early 2001, there were some 3.5 million users in the country or 5.6 per cent of the population.[18] This makes Thailand the largest Internet market in South East Asia based on the number of users. There is at least one user in some 2.3 million households—14 per cent of all homes—either via a personal subscription or from elsewhere. Another positive development is the gender friendliness of the Thai Internet with usage split almost equally between males and females. Finally, dial-up Internet access is available in all provinces of the country for the price of a local call (three Baht flat rate). In areas where there is no local ISP Point of Presence, TOT has implemented a feature whereby a user dials 1222 for local access to the Internet.

Nonetheless, Thailand has its own Digital Divide, between urban and rural, between young and old, and

Table 3.3: The TH World

Domain counts and Host counts for .TH domain, 3 May 2001

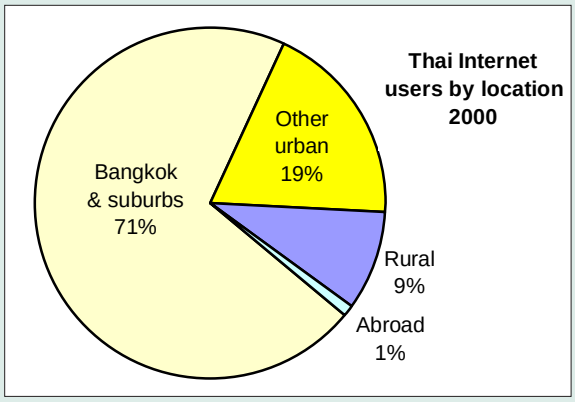
Second-Level Domain	Description	Number of Third-Level Domain	Number of Hosts	Number of hosts with name starting with *www*
AC.TH	academic institutions 1/	472	18'771	548
CO.TH	commercial entities and business entities 2/	5'344	35'364	2'312
GO.TH	government use, such as ministries or agencies of the government 3/	219	1'398	252
MI.TH	military use	8	93	19
NET.TH	Internet or network service providers 4/	26	10'211	85
OR.TH	non-profit organization	343	2'831	212
Total		**6'412**	**68'668**	**3'428**

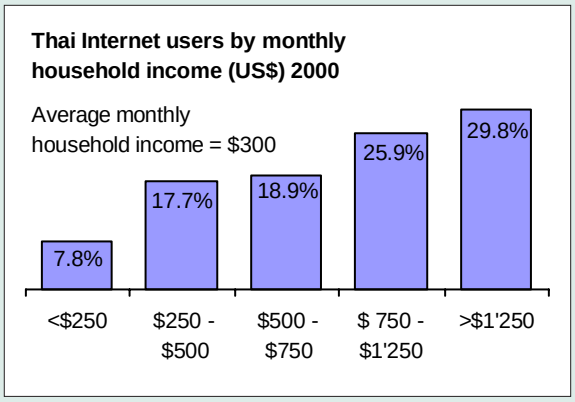
Note: 1/ Applicants for domain names under this category must be educational institutions registered within Thailand. 2/ Applicants for domain names under this category must be commercial entities which are either registered within Thailand. A foreign company which is not so registered may only apply for such a domain name if it has a representative in Thailand and this local representative must itself be registered within Thailand and be authorised by the foreign company to apply for the registration of the domain name. 3/ Applicants for domain names under this category must be members of the Royal Thai Government. 4/ A verification from the Communications Authority of Thailand is required.

Source: ITU adapted from THNIC.

Figure 3.5: Thai Digital Divide

Distribution of Thai Internet users by location and monthly household income, 2000





Note: In the right chart, Thai Baht values have been converted to US$ using the annual average exchange rate for the year 2000 (40.11) rounded to the nearest US$ 50.
Source: ITU adapted from NECTEC.

between rich and poor. The majority of users are in the Bangkok metropolitan area (see Figure 3.5, left chart). Overall, 90 per cent of Thai Internet users are in urban areas even though they only account for around one third of the population. As expected, Internet penetration rises with income (see Figure 3.5, right chart). Yet the cost of an entry level prepaid Internet card (Baht 150) covering 15 hours of use is only around one per cent of average monthly household income. Even adjusting for lower incomes (e.g., those in rural areas) the price of 15 hours of Internet access is still a maximum of three per cent of household income. This suggests that barriers to increased Internet access in Thailand are more than economic. In addition there is much room for growth. For example although 27.7 per cent of households have a telephone line, only three per cent have an Internet subscription.

Universal access to information infrastructure is vaguely touched on in Section 78 of the Constitution:

> **"Section 78.** The State shall decentralize powers to localities for the purpose of independence and self-determination of local affairs, develop local economics, public utilities and facilities systems and *information infrastructure in the locality thoroughly and equally throughout the country* as well as develop into a large-sized local government organization a province ready for such purpose, having regard to the will of the people in that province."[19]

The development of a Universal Access Law is one of six areas that the National Information Technology Committee (NITC), chaired by the Prime Minister, is working on. [20] For the time being however there is no formal framework for all telecommunication operators and ISPs to assist in universal access to the Internet. Nevertheless several ISPs provide discounted access to schools and Internet cafés. The availability of prepaid Internet cards is also a boon to universal access since they lower the cost of entry by eliminating monthly subscription charges. They also make it easier for those without PCs or fixed telephone lines to access the Internet since they can use prepaid cards from Internet cafés. According to NECTEC, 21 per cent of Thai users access the Internet from a cybercafé.

The government has several targeted programs for expanding access to the Internet at public locations. For example by December 2001 some 4'000 schools were online through the SchoolNet program (see Chapter 4). Expanding rural Internet access is a key government policy. In that respect, TOT and the Ministry of Interior are implementing a project called *Tambon Net*. A tambon—of which there are some 7'400— is an administrative unit that groups around ten villages. The project calls for providing access to the Internet via 3-5 telephone lines at government offices in each tambon. There are plans to implement this in some 1'000 tambons before the end of the year 2001. Another TOT project is the installation of public Internet access in its branches. So far it provides access in 300 of its offices (out of about 3'000). CAT also began installing Public Internet Booths in late 1999 in major provinces. It has since extended this throughout the country and it is expected that every Amphoe (a district, of which there are 795) will have a CAT public Internet booth by the end of 2001.

3.3.6 Quality of Service

There are no formal regulations regarding Internet quality of service. There appears to be a trade-off in the market with some ISPs offering lower prices at the expense of quality while others charge more for premium service. Access to some ISPs is difficult with lines busy or dropping. Indeed this was put forth as one of the reasons behind users having multiple prepaid cards. They switch cards when they cannot get through on one ISP. There are a number of freelance measurements of ISP quality of service that consumers can refer to. For example the Thai Internet Users Group measures the round trip delay from ISPs to Internet exchanges.[21]

Box 3.1: Thailish: Thailand, English and the Internet

One barrier to increased Internet penetration in Thailand is language.[22] On the one hand there is not enough Thai language content while on the other hand, manoeuvring through cyberspace requires some degree of English fluency. According to a survey conducted by NECTEC, the vast majority of Thai Internet users had some English proficiency (see Box Figure 3.1, left chart). This suggests that if you cannot understand a little English, then you will not likely surf the Internet. This is reinforced by another finding of the survey where around one fifth of Thai Internet users cited language as a problem with the Internet. With English spoken by only an estimated five per cent of Thais, language barriers severely restrict the potential Internet market.[23]

An added complication is that the Thai written language has its own character set. There are some 44 Thai constants and around 30 vowels requiring almost 90 different letters on the keyboard (compared to 66 for English).[24] So not only does Thailand have to cope with English and a lack of local content but also with all the complexities that arise from fitting Thai to computer hardware and software. One of the barriers to slow mobile Short Message System (SMS) take-up in the country has been attributed to the lack of Thai language support in mobile handsets. It appears that most Thai's send SMS messages from computers connected to the Internet.

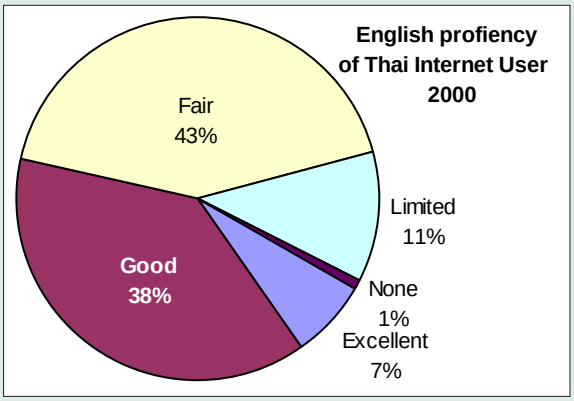
Recognizing the large size and potential of the Thai market, major foreign information technology companies are developing Thai language support and portals. Although it does not provide Thai in its popular Hotmail e-mail program, Microsoft offers Thai versions of its Windows operating system and Office applications. Terra Lycos launched a Thai language portal in December 2000.[25] M-Web, the South African Internet company, purchased the most popular Thai portal Sanook.com as well as ten other web sites. They receive more than 3.5 million page views a day. M-Web has the intention of furthering developing Thai content on the web sites as well as launching a Thai web browser.[26]

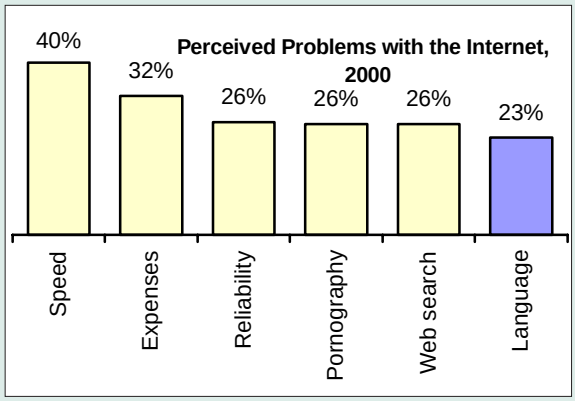
One major development that will assist Thai Internet users is the creation of an English to Thai web site translator.[27] Developed by NECTEC and NEC of Japan, 'ParSit' translates English web sites or text into Thai. There have also been controversial attempts to expand English language training in primary and secondary schools.[28]

Thailand faces the dilemma of whether to increase Thai content or expand English language learning among its citizens. Or it could opt for both. Indeed many Thai web sites today have English menu choices such as "About Us" or "FAQ" mixed in with Thai text, a sort of Thailish of cyberspace.

Box Figure 3.1: The English barrier

English proficiency and perceived problems with the Internet, Thai Internet users, 2000





Source: ITU adapted from NECTEC. "Internet User Profile of Thailand 2000."

[12] There are several excellent accounts of early Internet developments in Thailand upon which this section is based. For example see: Sirin Palasri, Steven Huter, and Zita Wenzel. *The History of the Internet in Thailand*. The Network Startup Resource Center (NSRC), 1999. ISBN 0-87114-288-0. http://www.nsrc.org/case-studies/thailand/english/index.html. For an abbreviated timeline see: Hugh Thaweesak Koanantakool. "The Internet in Thailand: Our Milestones." Available at: http://www.nectec.or.th/users/htk/milestones.html.

[13] The reason being that users will juggle between ISPs based on quality or tariffs. For example if a user cannot dial into one ISP they will try another. Alternatively users will switch between ISPs based on differing day and night pricing.

[14] Regularly compiled estimates of the number of users or subscribers do not appear to exist. According to the Internet Information Research Centre of the National Electronics and Computer Technology Center (NECTEC), there were 2.3 million users in October 2001.

[15] NECTEC. *Internet User Profile of Thailand 2000*. 2001.

[16] See the web site at: http://www.lensodatacom.co.th/index.html.

[17] "TA introduced new service products based on Broadband Technology." *TelecomAsia Press Release*. 10/07/2001. http://www.telecomasia.co.th/about/presscenter/press_releases/aboutus_press170701_en.html.

[18] Somkiat Tangkitvanich. "Internet in Thailand." Thailand Development Research Institute. Presentation provided to the authors of this report in August 2001.

[19] Constitution of the Kingdom of Thailand. Enacted on the 11th Day of October B.E. 2540. http://203.152.23.33/html/fslaw_e.htm.

[20] A draft was prepared and sent to the NITC in September 2000. See "Universal Access Law Drafting Camp" at http://www.nitc.go.th/itlaws/ua78/ua-law-pic.html and "Draft law to avert digital divide ready for NITC." Bangkok Post. 6 September 2000. http://scoop.bangkokpost.co.th/bangkokpostnews/db060900/060900_database01.html.

[21] See http://www.inet.co.th/cyberclub/nikornv/ispwatch/ and http://internet.thinet.com/review.html.

[22] According to one Thai Internet expert: "The language problem is one of the major concerns in developing countries, especially in Thailand where only a small percentage of population can read and write English. It would be a pity investing all of the infrastructure just for people to see what they understand and they go for some other things such as entertainment, porno or downloading mp3 music. I would call this problem in my own words as "the last meter" problem…Challenging tasks are ahead of all developing countries! You either have to create more content in your language, or teach the citizen to be more fluent in other languages, or use ICT to help with this." Thaweesak Koanantakool. "Personal Reflections". 30 January 2001. www.dse.de/ef/digital/koanan-e.htm.

[23] World Bank. "Rural Information Empowerment Project Document." April 2001.

[24] See "Keyboards a hurdle for most Thai users." *Bangkok Post*. 24 July 1996. http://scoop.bangkokpost.co.th/bangkokpostnews/bp960724/2407_data27.html.

[25] "Thailand Launch Expands Terra Lycos Presence to 41 Countries." *Terra Lycos Press Release*. 4 December 2000. www.terralycos.com/press/pr_12_4e_1.html.

[26] "M-Web (Thailand) aims to develop a relationship with Thai Internet users by providing a comprehensive Internet experience in the Thai language tailored to the Thai culture through local customization. In order for M-Web (Thailand) to accomplish this we envision not only all content on our sites being in the Thai language, but also plan to launch a Thai language Internet browser customized for the M-Web Network." MIH Limited. *Form 20-F Annual Report*. Fiscal Year Ending 31 March 2000.

[27] "The web learns to talk Thai." *Bangkok Post*. 27 December 2000. http://scoop.bangkokpost.co.th/bangkokpostnews/db271200/271200_database01.html.

[28] A former Thai education minister had a future vision where "…most Thai students are fluent in English and able to learn by computer" and he strongly promoted teaching English from primary school. This has run against arguments that there are not enough qualified English teachers, that primary school students are too young to learn another language and that funding was not available. See "The Education Ministry needs an education." *Bangkok Post*. 18 March 1998. http://scoop.bangkokpost.co.th/bangkokpostnews/bp19980318/180398_news22.html.

4. Sector absorption

4.1 Government

The Thai government has launched a number of policies and initiatives over the last decade to drive Information and Communication Technology (ICT). Perhaps the foremost player has been the *National Electronics and Computer Technology Centre* (*NECTEC*) created in 1989. NECTEC is one of three research centres under the National Science and Technology Development Agency (NSTDA) that in turn is part of the Ministry of Science and Technology. A formal ICT policy body, the *National Information Technology Committee* (*NITC*) was established in 1992. Chaired by the Prime Minister and consisting of senior officials from the public and private sector, the mission of NITC is to promote ICT for social and economic development. NECTEC serves as the secretariat for NITC.

In 1996, the government approved the first national IT plan. Dubbed IT-2000, the plan was developed by NITC and NECTEC. It was allocated 4.2 billion Baht (US$ 168 million) and integrated into the 8th National Economic and Social Development Plan covering the period 1997-2001. IT-2000 identified three main areas for development: information infrastructure, human resources and good governance. Good governance refers to the potential use of ICT in the public sector and the different ways in which the government can contribute to the development of ICT.

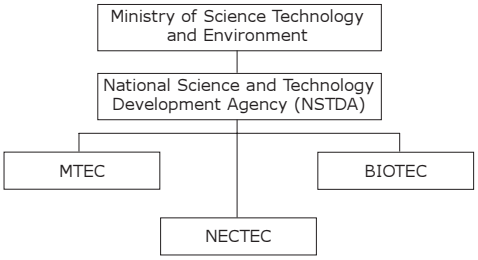
An IT2010 policy framework was approved by NITC in October 2001. The NITC submitted IT2010 for cabinet endorsement who instructed NECTEC to team up with all stakeholders to define a "National ICT Plan for 2002-2006". This five-year plan is to focus on strategies in five main sectors and three main thrusts to make development in Thailand more effective (see Figure 4.2).

In response to the e-ASEAN initiative, the NITC created the *e-Thailand* subcommittee, which is chaired by the Minister of Science, Technology and

Figure 4.1: Thailand's ICT organizations

Introduction to NECTEC

National Electronics and Computer Technology Center (NECTEC)



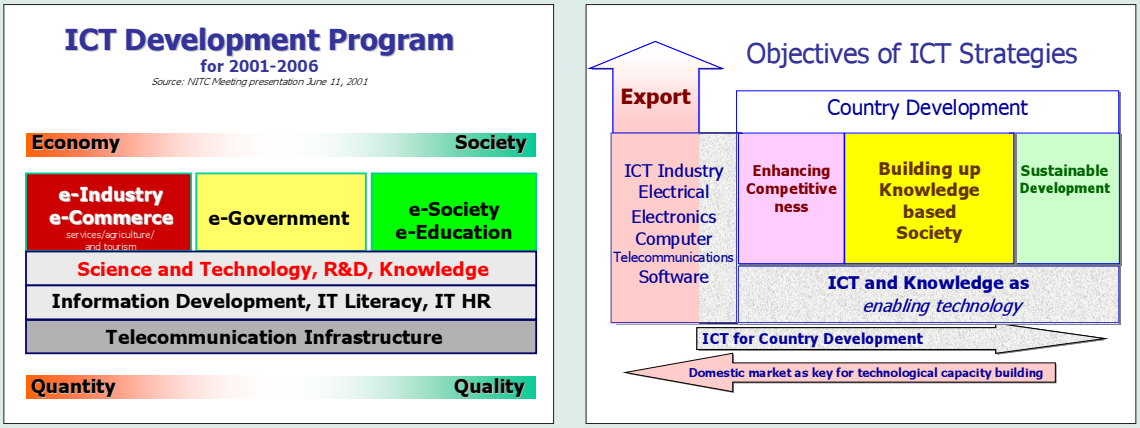
Role of NECTEC

National Information Technology Committee (NITC)

Establishment	1992
Chair	Prime Minister
Committee Members	Senior Officials from Public Sector Representatives from Private Sector Experts
Fundamental Purpose	Promote the Use of IT in Thailand for Economic and Social Development
Secretariat	National Electronics and Computer Technology Center (NECTEC)

Source: NECTEC.

Figure 4.2: Thailand ICT strategies



Source: NECTEC.

Box 4.1: ICT in Thailand's National Development Plan

Develop telecommunications networks and information technology to make Thailand a regional centre.

(1) Implement telecommunications and information technology liberalization plans consistent with the demands of rapid technological change, in order to provide adequate and widely available quality services at competitive and fair prices.

(2) Develop telecommunications and information networks in key economic zones and region-central cities to connect with national networks, in order to create equality in access to education and public telecommunications systems.

(3) Develop telecommunications networks and services to support the education and health-care systems and other public services.

(4) Improve the reliability and speed of the public postal service; invest in improvements in postal technology; improve postal service management; and set service charges at commercially appropriate rates, in order that the service can become self-financing.

(5) Coordinate efforts between the public and private sectors in developing the telecommunications industry by supporting research and development activities and developing the size and quality of the telecomunications field's human resource base. In addition, support skills development for information technology personnel at all levels.

(6) Establish non-partisan and flexible mechanisms at the national level to regulate and monitor telecommunications services, in order to promote increased efficiency, quality of services and standards consistent with technological progress, and set service fees which are fair to both users and providers. This is in order to generate opportunities for the private sector to invest in and develop the telecommunications business to its full potential and to increase access for people in rural areas to modern telecommunications networks similar to that available to the urban population.

(7) Amend legislation related to the telecommunications industry in order to open it up to private sector participation and investment, allowing free competition in the provision of services, so that quality of service and appropriateness of fees, instead of potential revenue for the government, are the main criteria in decision-making. In addition, draft legislation which facilitates the use of information technology for economic and social development.

Source: 8th National Economic and Social Development Plan (1997-2001).

Environment. *e-Thailand*'s principal objective is to come up with a concrete plan on the development and implementation of e-services, e-trade, and e-government. According to the e-Thailand initiative, "*the purpose of e-government is mainly to improve the effectiveness and efficiency of government administration and public services by allowing citizens to be able to access the services anytime from anywhere in the country*". *e-Thailand* has asked all government organizations for their participation in order to develop a national action plan for online applications, such as ID-cards, payment forms, tax forms etc,.

4.1.1 Government as user

Government as a user looks at the ways in which the administration uses ICT technologies internally "*to make sure that all government agencies are armed with good equipment, communication network and capable staff*".[29] Under the banner of Government Information Technology Services (GITS), Thailand is pursuing a number of activities to improve the way government uses ICTs.

The Government Information Network (GINet) is one of the main projects arising from IT-2000. GINet is to be a high-speed network connecting all government agencies across the country. By setting up a common infrastructure, the government hopes to avoid the extra costs and inefficiencies of uncoordinated and duplicated data networks that would arise if different agencies pursued their own connections. GINet, which will eventually link every province to its backbone, runs on the Telephone Organization of Thailand (TOT) existing network and uses ATM network technology. Bandwidth will eventually upgraded to 155 Mbps but now consists of 128 kbps and 2 Mbps connections. In April 2000 the GINet backbone was available in 20 provinces and connected several agencies.

GITS goes beyond the provision of infrastructure and offers various applications and value-added-services to help civil servants benefit from ICT. A virtual private network (VPN), for example, allows users to establish a secure connection while using GINet. A pilot Certification Authority (CA) allows GITS participants to use digital signatures. There is a directory service providing e-mail addresses of staff in all agencies. The provision of daily electronic newspaper clippings is another application. While coordination between different government organizations is still limited, there are plans to define specific guidelines and standards regarding information. This would assist civil servants to find out about existing data and facilitate the sharing and exchange of information. Overall efficiency within the government should improve, especially by avoiding duplication. This 'data consistency' scheme is also seen as a precursor towards e-services that the government plans on providing to its citizens.

Another project is the Chief Information Officer (CIO) initiated in 1998. The idea is to increase ICT knowledge within each government ministry and agency by providing one of their staff with in-depth training. CIOs attend a two-week training course organized by NECTEC and the Office of the Civil Service Commission. The program has been successful at raising levels of ICT literacy. Some 300 CIOs 'graduated' between 1999 and 2001. Eventually every civil servant will have to pass a computer literacy test before being promoted.

A related project aims at increasing ICT awareness at the highest government level. The Chief Executive Officers (CEO) Program, approved by the Cabinet in 2000, compels the two highest-ranking officials within each government organization (i.e., the Permanent Secretary and the Director General) to attend a half-day training session on the benefits of ICT. By the end of 2001, all CEOs will have attended the course.

4.1.2 Government as provider

While the government has implemented several ICT projects for its own use, online services for the

Thai public are still limited. However the government is aware of the benefits of e-services. The first concrete recommendations on national e-applications, in form of an action plan, are expected to be approved by the Cabinet in the near future. It is likely that these will come out of the ECTI-21 and e-Thailand initiatives described earlier.

In the meantime, some government agencies have launched online applications. For example the nation's tax authority, the Revenue Department of Thailand lets companies pay Value Added Taxes (VAT) online, using a secure system.

4.1.3 Government as promoter

The following government projects, most of which have been mentioned at some point in the case study, indicate that Thailand has been an active promoter and supporter of ICT from a relatively early stage.

- In 1992 the government established the NITC, the formal policy body for national IT development.
- NECTEC was set up promote R&D in the IT sector. Next to its role as research organization, NECTEC provides funding to public organizations and universities, as well as ICT training courses for public and private needs. As the NITC's secretariat, NECTEC has become the country's principal driving force in ICT.
- The government has adopted a concrete national IT policy framework. The first one was IT-2000 covering the period 1997-2000. The second, IT-2010, covers the years 2000-2009.
- At the very beginning of the Internet, the government provided universities with the necessary funding to get connected to the Internet. The government's ThaiSARN was the first national backbone.
- As early as 1995, the government organized a public awareness campaign, 'Thailand IT Year 1995'
- In 1998, SchoolNet was launched to provide free Internet access to primary and secondary schools.
- The *e-Thailand* subcommittee has been set up to develop a national plan for the development of government online services.
- A Software Park was created to help develop the software industry.

4.2 Education

Thailand's government devotes special attention to learning and education has been described as "*the most important long-term investment for the nation.*" [30] Indeed education receives the lion's share of the government budget, some 25 per cent in the year 2000. Historically, there has been a strong link between Information and Communication Technology (ICT) and the education sector. Academics played a key role in introducing the Internet to Thailand. The Asian Institute of Technology tested basic e-mail services in 1987 and dial-up e-mail was established by Songkhla University in 1988. Chulalongkorn University established the nation's first permanent connection to the Internet in 1992. The same year, the country's national backbone—the Thai Social/Scientific, Academic and Research Network (ThaiSARN)—was created to serve the educational sector.

These initial accomplishments did not permeate the entire educational sector. While all of Thailand's universities are connected to the Internet, the same is not true of the primary, secondary and vocational school system. Furthermore not enough has been done to develop educational applications. Another weakness has been shortcomings in ICT training leading to a lack of skilled human resources.

There has been a concerted push by the government over the last few years to address these issues. Thailand's National Information Technology Committee (NITC) has identified three pillars of IT development and education, referred to as '*investing in people*', is one of them. One of the top priorities of the IT-2000 master plan is to use ICT to improve the educational sector and the development of human resources.

While the Ministry of Education (MoE, <www.moe.go.th>) remains in charge of traditional educational matters, e-education has been largely guided by the National Electronics and Computer Technology Center (NECTEC). NECTEC, a semi-autonomous agency under the Ministry of Science, Technology and Environment, started as an ICT Research and Development organization. Its responsibilities have expanded over the years. Besides providing universities with funding for research projects, it has also taken the lead in coordinating and implementing ICT related initiatives in the educational sector. According to NECTEC, the MoE does not yet have the necessary funding but may eventually inherit the responsibilities and projects combining ICT and education.

4.2.1 SchoolNet

Most of Thailand's some 33'000 primary and secondary schools have at least access to a computer (see Table 4.1) simplifying the task of connecting them to the Internet. The process of connecting schools dates back to 1995 when the ThaiSARN network was extended to cover secondary schools. About 50 secondary schools in Bangkok were connected as part of the *SchoolNet* <www.school.net.th> project. NECTEC supported the project by providing dial-up access ports and a server.

Meanwhile, the *Kanchanapisek Network* (Golden Jubilee) <goldenjubilee.or.th>, an initiative of Princess Maha Chakri Sirindhorn, was launched in December 1996, the anniversary of the King's 50th year on the throne. Golden Jubilee is a dial-up network providing access to Thai language content about the King and royal development projects. A turning point for SchoolNet came in February 1998 when the Princess allowed it to be merged with Golden Jubilee. The project became known as SchoolNet@1509 referring to the four digit dial-up code for nationwide

Table 4.1: Thailand at school

Number of primary and secondary schools, universities, students, teachers, and access to ICT (in percentage), 2000

	Institutions	Teachers/ Professors	Students	Number of Institutions with PCs	Number of Institutions with Internet
Primary Schools	30'715	361'967	4'654'080	23'698 (77%)	686 (2.2%)
Secondary Schools	2'669	126'385	2'580'759	2'430 (91%)	1'182 (44%)
Universities	50 private 24 public	340 (*in 1999*)	1'013'888	(100%)	(100%)

Source: ITU adapted from NECTEC and Ministry of Education.

Internet access.[31] Additional support was provided by the Telephone Organization of Thailand that provided leased circuits and allowed access to the Internet to be made for the price of a local call. The Communication Authority of Thailand also supported the project by providing international Internet bandwidth. Between 1998 and December 2001 the SchoolNet project connected some 4'000 schools to the Internet.

The connection of the first 1'500 schools cost some 50 million Baht (US$ 13 million), a large part of which was supplied by the Golden Jubilee Network fund. Another 54 million Baht has been earmarked to expand the project and to connect a total of 5'000 schools by the end of 2002. This will include all secondary schools, as well as close to 1'500 primary schools, and even a few nursery schools. With support from TOT, SchoolNet provides 'free' Internet access to schools across the country. The telephone call charge, which schools continue to pay, has been fixed at three Baht per call (local tariff by dialing the pre-fix 1509) from anywhere in the country so that none of the schools have to bear a long-distance call charge (see Figure 4.3).

While SchoolNet provides the dial-up services, the Ministry of Education (MoE) is responsible for the provision of computers. If necessary, SchoolNet provides training courses to teaching staff to make sure that they are sufficiently ICT literate. Both the MoE and NECTEC offer these training courses, including a course on how to repair a computer. NECTEC also provides a special seminar on how to operate SchoolNet servers.

Once a school is up and running, a NECTEC team may visit to find out what impact access to the Internet has had and the way in which it is used. During the implementation of SchoolNet, NECTEC found that one of the main barriers to usage was a lack of relevant Thai content. It is often difficult to motivate pupils to use the Internet because of the limited number of relevant web sites and applications that catch their attention. NECTEC, in cooperation with other agencies, has launched a variety of projects to provide more relevant content. Kasetsart University was contracted by NECTEC to develop an educational site, the result of which is the SchoolNet digital library (www.school.net.th/library), launched in January 2000. Students may use the online library to search from more than 1'000 Thai language articles. These articles are gathered, categorized and catalogued by a group of teachers, as well as the university team.

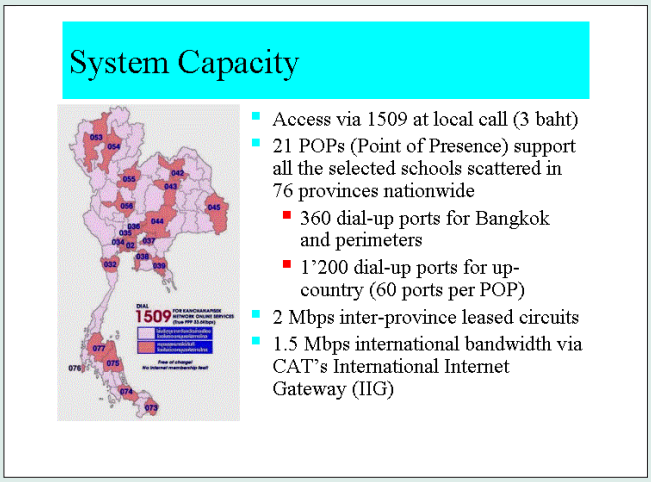
NECTEC further set up a web-page competition to encourage students to create online content. The results of these efforts have been encouraging and Thai students may now choose from a variety of web sites with useful information and educational material. Some 600 schools have created their own web site.

4.2.2 Universities

As mentioned, the academic sector, especially the universities, played a major role in the development of the Internet in Thailand. ThaiSARN, which is part of NECTEC, was the backbone

Figure 4.3: SchoolNet

March 2001



Note: Figure corresponds to configuration for 1'500 schools. Since then SchoolNet has been expanded.
Source: NECTEC.

connecting all universities until 1997, when the Ministry of University Affairs launched the Inter-University Network (UniNet, <www.uni.net.th>) and most universities migrated to the new network. The establishment of UniNet allowed NECTEC to reduce funding for ThaiSARN and to launch SchoolNet. UniNet uses a 155 Mbps ATM fibre optic network in the Bangkok area. Regional nodes are connected via 2 Mbps leased lines. UniNet's connection to the Internet is 45 Mbps. It also is connected to Internet2 via a 10 Mbps link.

All 74 universities in Thailand, private as well as public, are connected to the Internet. Several universities collaborate with the private sector and receive R&D funding from private companies as well as from NECTEC. The National Science and Technology Agency (NSTA) launched its "Reverse Brain Drain" (RBD) project in January 1997 to attract professional Thais abroad to return and share their expertise in their home country. Backed by a 10 year fund of 2.2 billion Baht (US$ 55 million), RBD provides overseas Thai's with financial incentives to take up short-term teaching and research activities. RBD projects within the high-technology arena include research on Global Positioning Systems, microelectronics, integrated circuit design and electromagnetic interference.

4.2.3 Research & Development

More than ten research laboratories within NECTEC and a wide network of researchers across the country make the agency a major R&D provider to private companies and other organizations. Apart from its own R&D activities, NECTEC supports other research projects by providing funding to the public sector, especially universities. It also disseminates ICT related information (in the form of text books, journals and publications) through its internal publishing house. NECTEC further runs an advanced human resource development center that offers in-depth training courses on a variety of ICT-related topics.

In 2000 Thailand allocated a total of seven billion Baht for the five-year Science and Technology Action Plan for strategic R&D projects, which is overseen by NECTEC and includes projects such as the development of modern telecommunication equipment. One of the first outputs is a cordless phone handset, part of NECTEC's Wireless Local Loop (WLL) research project. According to NECTEC, '*the return of this investment is clearly visible as the R&D amount is so small compared to the current import balance of telecommunications in the order of 100 billion Baht per year*..." [32]

4.2.4 Software Park Thailand

Thailand's software industry is composed of around 500 companies and 20'000 professionals. The NITC has taken several initiatives to increase the number of skilled ICT workers and provide incentives for them to stay in Thailand. Its main project is the Software Park, set up by NECTEC in 1997.[33] The Software Park building, located close to the airport in Bangkok, has attracted 43 software companies, including 14 multinational ones. Companies are provided with a LAN and high speed Internet access (up to 8 Mbps) at reduced prices. There is no corporate income tax for the first eight years and rents are subsidized (after the approval by the Board of Investment). The software Parks also provide start-up companies with "Incubator Facilities".

The objective is to stimulate the development of the Thai software industry by attracting local and international partners and to provide them with sophisticated infrastrucure and technologies. The Software Park also organizes professional training seminars and 'business match-making' activities aimed at bringing Thai and foreign companies together to discuss potential collaboration. The Park further arranges for Thai companies to visit similar businesses in other countries and to learn from their experiences. One of the problems of the project is that it was created just a few months prior to the financial crisis. Funding has therefore

been limited and there is not enough financial support to expand. Despite these barriers, NECTEC is hoping to attract even more businesses and to boost the country's software market.

4.3 Health

4.3.1 The Ministry of Public Health

Thailand devotes 7.3 per cent of the government budget to public health. The Ministry of Public Health (MoPH) is divided into seven different departments, all of which have their own intranet, e-mail directory and web site. The Ministry employs some 200'000 people, 15'000 of which are so-called *Internet members*. They are provided with a password to dial-up to the Ministry server and access the Internet free of charge. They include hospital and Ministry employees across the country with roughly half from the Bangkok area. Once a year the Ministry selects its access provider under a competitive bidding process. In 2001 the Ministry was connected through Pacific Internet, over a 1.5 Mbps leased line from United Information Highway. According to the Ministry, the Internet is predominantly used to send and receive e-mails.

Thailand has 92 provincial hospitals, all of which have Internet access, either through the MoPH or through an ISP. There are 740 district hospitals and 75 provincial offices. The provincial offices are headed by a doctor and in charge of health prevention and promotion but they do not provide medical treatment. Nine thousand district health centers provide basic health care services at the grass root level. They can access the Internet by dialing-up to the provincial hospital but a lot of them simply dial-up a commercial ISP.

There is a perceived need within the MoPH to establish a wide area network (WAN), including a connection to all provincial hospitals. Plans for this health network, developed by a consultant, were adopted in the Ministry's 2000-2003 IT Master Plan and approved by the previous government. Due to financial constraints after the economic crisis, the central budget bureau has been reluctant to approve the plan. So far only twelve provincial hospitals have been connected and it is not clear how the project will proceed. Another issue is the project's connectivity. Based on an agreement with the Ministry of Interior (MoI), the health network will be running on the MoI's ATM network. This has triggered concerns about its quality of service, especially since the MoI is not a commercial network provider.

4.3.2 Online information

The Ministry's web site <www.moph.go.th> provides an overview of recent newspaper articles related to health issues. There is also a range of health related links and information, such as a site on Thai traditional medicine, consumer protection and Thailand health acts. There are also links to professional associations, such as doctors, dentists and pharmacists.

The Food and Drug Administration (FDA) within the MoPH has successfully implemented an online application allowing companies to register for a license to market new products. This facilitates and speeds up the licensing process and is especially useful since a separate license is required for each province.

Several other initiatives to develop online applications have not been successful, for example, when the Ministry tried to use the Internet to promote financial decentralization, as well as local accountability. It set up an online cost control system to allow provincial hospitals to manage their budget online but the lack of bandwidth and the slow response were unacceptable. Ultimately, the provincial administrations simply refused to fill in the data. An online consultation project for users to discuss health related questions over the Internet never materialized. Plans to increase the level of computerization for processing health insurance claims have been limited. None of the health care systems are

Table 4.2: Thailand Health Facts

Number of Government Hospitals (MoPH), 1999	67
Number of Non-MoPH Government Hospitals, 1998	768
Number of private hospitals, 1998	473
Number of Municipal health centers, 1999	212
Number of Government dental clinics, 1998	1'592
Number of Health Centers, 2001	9689
Number of public doctors, 1998	15'000
Number of private doctors, 1998	4'500
Doctors to population ratio, 1998	1:3'100

Source: ITU adapted from National Statistical Office and Ministry of Public Health.

fully computerized and most records are typed and kept on paper.

4.3.3 Telehealth

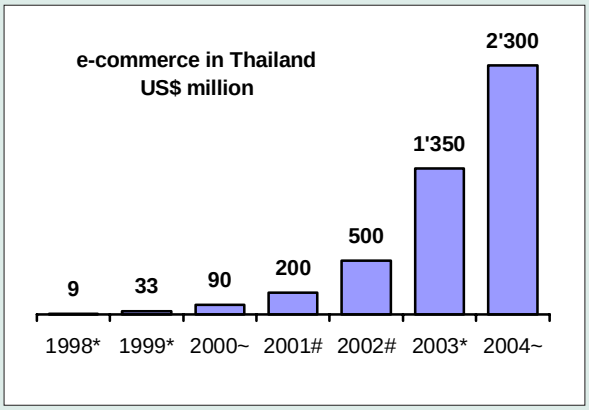
Expectations were high when the MoPH launched a nationwide telemedicine pilot project in 1994. The project was aimed at bringing quality health care to remote areas. Just before the economic crisis, 19 hospitals across the country had a satellite connection to the Information Technology Office of the Ministry. Since 1998, the project has ground to a halt.

While the telemedicine project has been a victim of the economic crisis, the MoPH has been able to set up a distance-learning program. Several doctors offer daily lectures from a teaching hospital in Bangkok. The lectures cover topics ranging from medical issues to public health administration and are aimed at all levels of health care staff. They are sent to 20 different sites using the Thaicom2 satellite network. Although the lectures, which can last up to two hours, are not archived for later viewing on the Internet, the Ministry is thinking about ways of making them more easily available. The Ministry has explored the possibility of using multicasting but has not able to find the necessary funding.

4.4 e-commerce

Electronic commerce revenues in Thailand have been estimated at US$ 90 million in 2000 and are forecast to rise to US$ 2.3 billion in 2004, a growth rate of around 125 per cent a year (see Figure 4.4). Despite what appears to be a high growth rate, e-commerce in the country falls short when compared to neighbouring nations. For example, Indonesia, with a lower per capita income and smaller Internet market, generates more e-commerce revenue than Thailand. At the same time, Malaysia and Singapore, though richer than Thailand, are much smaller in terms of population and yet produce

Figure 4.4: e-commerce in Thailand



Source: ITU adapted from TDRI (*), IDC (~) and ITU estimates (#).

significantly larger e-commerce revenues. According to the May 2001 Economist Intellingence Unit/Pyramid Research's e-Business Readiness Rankings, which rate the country's preparedness for e-business, Thailand ranks 46th out of 60 countries (see Table 4.3).

Recognizing that Thailand needs a boost to reach its e-commerce potential, the Government has a number of initiatives. It established the Electronic Commerce Resource Center (ECRC) <www.ecommerce.or.th> within NECTEC in December 1998. ECRC has three main tasks: (1) to raise awareness about e-commerce and promote cooperation between private and public sector; (2) to collect information and monitor e-commerce development; and (3) to help develop e-commerce capacity through training. In October 2000, the government approved the National Policy Framework for Electronic Commerce drafted by the ECRC. This Framework was adopted into the National Economic and Social Development Plans (Plan 9) for the development of sustainable and knowledge based economy.

Obstacles restraining e-commerce include the lack of credit cards as well as a lack of confidence among consumers and the business sector in using credit cards. Cultural factors also play a role. The number of credit cards in Thailand more than doubled between 1991 and 1997.[34] However the economic crisis caused a drop from two million at the end of 1997 to 1.6 million at the end of 1999. Since then the number has been climbing again and stood at 2.2 million in June 2001. The number of credit cards is equivalent to around five per cent of the adult population. This low ratio restricts payment options for Business-to-Consumer (B2C) e-commerce. According to an online survey, one quarter of potential buyers have not made an online purchase because they do not have a credit card. Alternatives such as ATM bank cards—of which there were some 20.7 million in 2000 covering 50 per cent of the adult population—or prepaid and cash on delivery need to be pursued if B2C e-commerce is to develop.

Table 4.3: The Economist Intelligence Unit/ Pyramid Research e-Readiness Rankings

e-Readiness Rankings (of 60)	Country	e-Readiness Score (of 10)
1	US	8.73
2	Australia	8.29
3	UK	8.10
4	Canada	8.09
5	Norway	8.07
6	Sweden	7.98
7	Singapore	7.87
8	Finland	7.83
9	Denmark	7.70
10	Netherlands	7.69
.	.	.
.	.	.
.	.	.
33	Malaysia	4.83
39	Philippines	3.98
46	**Thailand**	**3.75**
49	China	3.36

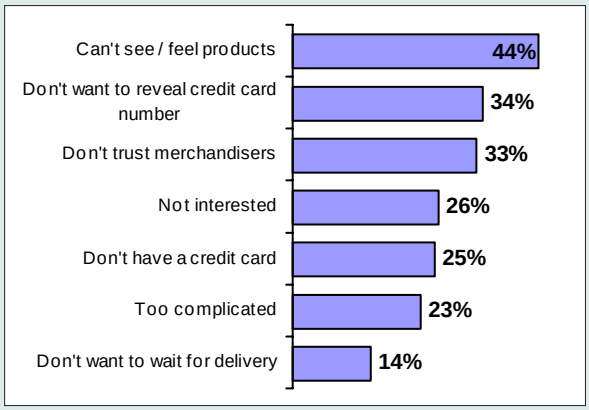
Source: See www.ebusinesforum.com for the full version.

Cultural factors also affect e-commerce take up. In Thailand, shopping is an important activity, as much social as practical. Consumers like to touch and feel products and where permitted, bargain, prior to making a purchase. Another issue is the cheap availability of electronic media such as computer software and music and video CDs that in other countries are main products for online purchases. In Thailand, software and media piracy is fairly widespread. According to the Software and Information Industry Association Thailand's software piracy rate was 81 per cent in 1999.[35] This figure is significantly above the Asia Pacific average (47per cent) but has been declining and is below that of several other countries in the region.

NECTEC has been charged with drafting laws covering *Electronic Transactions and Digital Signature*, *Data Protection*, *Computer Crime*, *Electronic Fund Transfer* and *Universal Access*. It is also responsible for

Figure 4.5: We don't want to buy online

Reasons Thai Internet users do not want to make online purchases, 2000



Source: ITU adapted from NECTEC, Internet User Profile of Thailand 2000.

boosting consumer and business confidence in e-commerce. The Electronic Transactions Act was published in the Government Gazette on December 4, 2001. It will come into force on April 3, 2002. The Universal Access and Data Protection laws were submitted to the Cabinet for approval during the last quarter of 2001. The other laws are being discussed and drafted by the respective authorities. The guidelines on Consumer Protection for the Sale and Advertisement of the Health Care Products through the Internet were drafted by the Food and Drug Administration (FDA), NECTEC and the Faculty of Pharmaceutical Sciences at Chulalongkorn University in a seminar on e-Commerce and consumer protection of health care products, held in August 28, 2001.

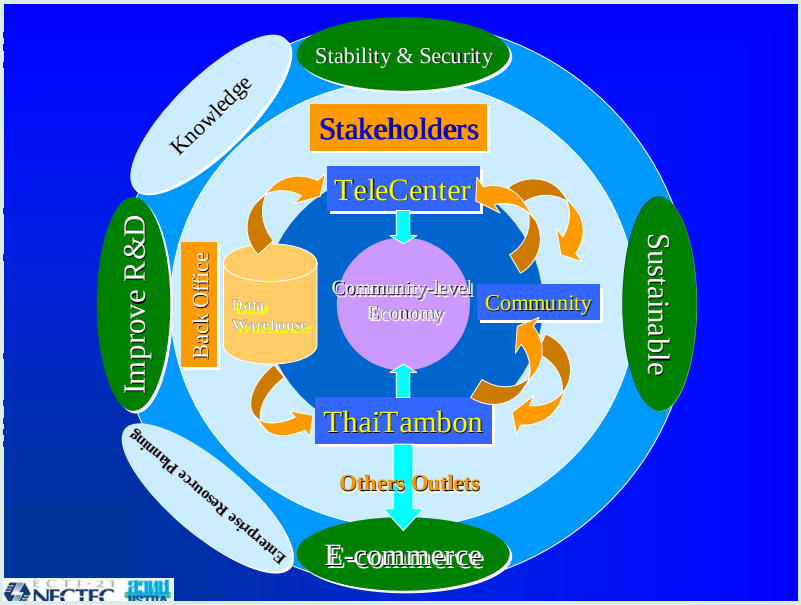
Despite these barriers, e-commerce is developing in the country. Some 19.1 per cent of Internet users reported making an online purchase in 2000, up from 18.4 per cent in 1999. A web site survey by NECTEC's Electronic Commerce Resource Center reported 3'765 active web sites in Thailand at the end of 2001. Some eleven per cent of these sites facilitate advanced e-commerce applications including online ordering transactions. The number of .co.th business domains rose from 372 in June 1997 to 6'251 in October 2001. A growing number of banks are providing e-banking services with confidence boosted by certification from the Bank of Thailand.

There are also a number of e-commerce projects. For example, Thai.com is a portal developed by Internet Thailand. It provides an e-commerce enabled platform for shops, banks and others from which they can sell their products and services.

In order to enhance the uptake of e-commerce in Thailand, several national projects have been developed. Since 1998, the Ministry of Commerce has initiated several projects to promote e-commerce. ThaiEcommerce.net (1998) was a pilot project to support companies wanting to sell their products electronically with an e-commerce infrastructure. This service was provided free of charge. Another project, called Export Promotion through E-Commerce <www.thaitrade.com> (2001), was to promote e-commerce for Thai manufacturers and exporters. The Ministry of Industry's Department of Industrial Promotion has also developed a site, <www.smethai.net>, to promote e-commerce for SMEs through a variety of services such as financing, training, and by providing them with free homepages. In addition, e-commerce projects by industries have been developed since 1999. The e-commerce for tourism web portal <www.tourismthailand.org> was developed by the Tourism Authority of Thailand; an e-commerce for agriculture site was set up by the Ministry of Agriculture and Cooperatives. A value-added network (VAN) has been implemented to facilitate EDI in the finance and banking industry.

A major Business-to-Business portal has been launched by a subsidiary of CP Group, one of Thailand's largest companies. The so-called Pantavanij.com market place aims to hook up 400 suppliers.[36] Founding

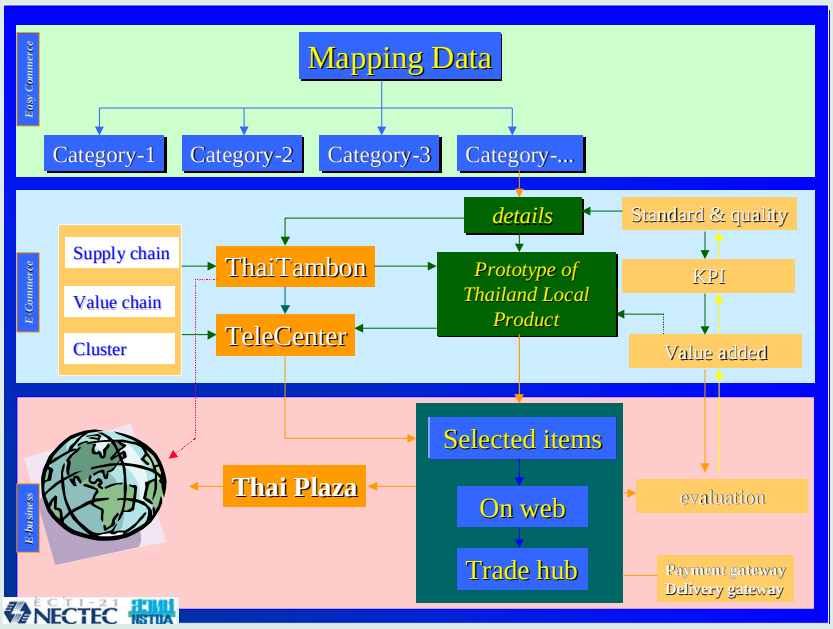
Figure 4.6: National Concept for Sustainable Economic Development in the Rural Areas



Source: NECTEC.

Figure 4.7: 1 Tambon[37] 1 Product Project

NECTEC project to develop community product data warehouses for Tambons



Source: NECTEC.

members include large banks as well as telecommunication companies such as TelecomAsia and United Communications. Since launching in June 2001, the system has handled over 1'000 orders, totalling 45 million Baht. The site makes money from charging a two per cent transaction fee.

Thailand's rural community will not be left out of e-commerce. The Ministry of Agriculture and Cooperatives is working with NECTEC to develop agricultural databases for farmers. It is hoped that farmers will be able to query and interact with the information through Internet access points being set up at some 7'000 districts. One initiative is the 1 Tambon 1 Product project[37], a kind of e-commerce system for selling local products via the Thai Plaza portal (see Figure 4.7). Another project involves providing ICT training for farmers through so-called Tambon Technology Transfer Centres.

[29] Thaweesak Koanantakool. 'Struggling towards a knowledge-based Society', Paper presented at the International Symposium on IT and Development Cooperation, July 2000.

[30] Ibid.

[31] For technical details about the SchoolNet network see Paisal Kiattananan, et. al. "Network Design and Resource Management Scheme in SchoolNet Thailand Project." In Proceedings of the 1999 Internet Society Conference. http://www.isoc.org/inet99/2e/2e_1.htm.

[31] Thailand Country Paper 'Current Developments of IT in Thailand', by Thaweesak Koanantakool and Chadamas Thuvasethakul, presented at the Capacity Building Workshop on ICT Strategies for Developing Asia, February 2001, Singapore.

[33] For a general overview see Rom Hiranpruk. "Software Park Thailand." Presentation at The Internet in South East Asia. 21-23 November 2001. Bangkok. http://www.itu.int/asean2001/documents/pdf/Document-7.pdf.

[34] Statistics on credit cards are available on the Bank of Thailand web site <www.bot.or.th>.

[35] See http://www.siia.net/piracy/pubs/piracy2000.pdf.

[36] http://scoop.bangkokpost.co.th/bkkpost/2001/august2001/bp20010817/business/17aug2001_biz52.html.

[37] A tambon —of which there are some 7'400 in Thailand— is an administrative unit that groups around ten villages.

5. Conclusions

5.1 State of the Internet

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 values ranging from zero (non-existent) to four (highly developed). The dimensions are as follow:

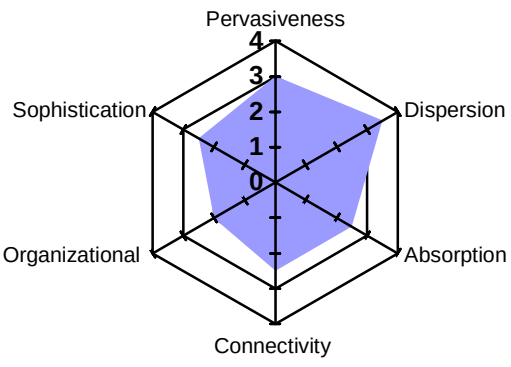
- **pervasiveness:** a measure based on users per capita and the degree to which non-technicians are using the Internet.
- **geographic dispersion**: a measure of the concentration of the Internet within a nation, from none or a single city to nationwide availability.
- **sectoral absorption**: a measure 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 Internet Service Provider (ISP) industry and market conditions.
- **sophistication of use**: a measure characterizing usage from conventional to highly sophisticated and driving innovation.

Thai values for these dimensions are shown in Figure 5.1.

Pervasiveness is rated at level 3, *Common*. At December 2000, there were approximately 2.3 million Internet users in the country or 3.8 per cent of the population.

Figure 5.1: State of the Internet in Thailand

Dimension	Value
Pervasiveness	3
Geographic Dispersion	3.5
Sectoral Absorption	2.5
Connectivity Infrastructure	2.5
Organizational Infrastructure	2
Sophistication of Use	2
TOTAL	**15.5**



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

Geographic Dispersion is rated at level 3.5, between *Highly dispersed and Nationwide.* Some ISPs provide Internet access from all provinces for the price of a local call.[38] Thus all provinces have local ISP access. However there is a feeling that rural infrastructure for accessing the Internet is not widespread.

Sectoral Absorption is rated at level 2.5 between *Moderate* and *Common.* This ranking is a function of the type of connectivity in education, government, health care and business. All universities are online. In June 2000, 21 per cent of secondary schools had Internet access. There were 177 government agencies with web sites in June 2000. Thai companies connected to the Internet account for around 22 per cent of GDP. There are thousands of Internet users in the health ministry, a number of hospitals are connected and there have been promising projects in telemedicine using distance learning to spread health education.

The **Connectivity Infrastructure** is at level 2.5, between *Expanded* and *Broad*. International connectivity at August 2001 was 546 Mbps in and 418 Mbps out. There are nationwide fibre/microwave/satellite backbones that operates at various speeds. There are two Internet exchanges. Broadband local access through Asynchronous Digital Subscriber Line (ADSL) and cable modem technology was introduced commercially in 2001.

The **Organizational Infrastructure** is at level 2, *Controlled*. There are 18 licensed ISPs. No ISPs licenses have been issued for over a year pending the formation of a new telecommunication regulator. ISPs can neither directly provide their own international or domestic infrastructure but must go through one international gateway provider and several domestic data network providers. There are two national Internet traffic exchanges to which all ISPs are connected.

Sophistication of Use is at level 2, *Conventional*. The most popular applications are e-mail and information retrieval. However there are projects in place to develop online government applications. E-commerce is growing.

5.2 Recommendations

Thailand occupies a unique position in South East Asia. Economically, the country is not as wealthy as Singapore or Malaysia but is richer than the remaining economies in the region. Linguistically, the Kingdom has a distinct language with its own character set, a barrier in an English dominated ICT world.

One barrier Thailand faces is a clear and cohesive regulatory and policy direction for Internet development. The existing infocommunication regulatory situation is confused. The incumbent international telecommunication operator, the Communication Authority of Thailand (CAT), has assumed de facto regulation of the Internet market. CAT controls the international gateway and requires all ISPs to provide it with around a third of their shares. The market has been frozen pending the creation of a new regulatory authority that has taken longer than expected to establish. Restrictions in Thai law effectively limits what ISPs can do essentially making them nothing more than 'resellers.'

Considering its relatively low level of income compared to developed countries, its linguistic disadvantage, and the constrained regulatory situation, Thailand has achieved a respectable level of Internet access. It is arguably the largest Internet market in the region with up to 3.5 million users and a penetration of over five per cent of the population. If the barriers it faces were reduced, Thailand could go considerably further towards bringing the nation online. However it needs to act quickly. Sector reform has been stalled for several years and there is some evidence that the nation is falling behind in e-readiness. For example, according to one ranking, it dropped from 28th out of 60 countries in May 2000 to 46th in May 2001 (see Table 5.1).

Table 5.1: Falling behind

e-readiness rankings

Country	Rank 2000	Rank 2001	Δ
Singapore	8	7	+1
Malaysia	32	33	-1
Philippines	46	39	+7
Thailand	**28**	**46**	**-18**
Indonesia	38	54	-16
Vietnam	54	58	-4

Note: Total of 60 countries.
Source: ITU adapted from EIU.

Recommendations for spurring Internet development in the Kingdom include:

5.2.1 Liberate the Internet market

In many ways, Thailand's ISPs are providing a resale service. They cannot provide their own infrastructure and depend on CAT and the Telephone Organization of Thailand (TOT) for international and national lines. All ISPs should be allowed to construct and manage their own networks using whatever technology they want.

CAT should equally sell the ownership that it holds in most of the ISPs. Alternatively, CAT should pay for the shares that it was provided and be required to contribute to capital increases in ISPs.

The National Telecommunication Commission (NTC) should be established as an independent regulator as soon as possible. The ISP market has been frozen pending the launching of the ISP with serious consequences for the development of the Thai Internet market.

5.2.2 Internet talking

The use of Voice over Internet Protocol (VoIP) has been a positive experience with consumers benefiting from lower prices. Thailand should open up the VoIP market by allowing other operators besides CAT and TOT to offer VoIP (while at the same time allowing the incumbent operators to offer VoIP for both domestic and international long distance). This can be done by licensing VoIP and having licensees contribute to universal access by paying a license fee.

5.2.3 Who is in charge?

The Thai government is divided into a large amount of Ministries, agencies and departments and it is not always clear which administrative body is responsible for which matters. For example in the area of Information and Communication Technology, there are at least five relevant government organizations including the Ministry of Transport and Communications; the Post and Telegraph Department; the Ministry of Science, Technology and the Environment; the National Science and Technology Development Agency; and the National Electronics and Computer Technology Centre (NECTEC). Contrast this with Singapore, where the converged regulator, the Infocomm Development Agency, takes the lead on all ICT matters. It might be more efficient for Thailand to re-group these different organizations, reduce their number, clearly define their responsibilities and perhaps charge one as a super ICT tsar.

With regard to the Internet, NECTEC has taken over most IT related issues within the government. Consequently, the Ministry of Education, for example, has a very limited role with regard to e-education. While NECTEC should have the role of a coordinator, the different Ministries should lead and oversee those IT-related projects that directly affect their area of responsibility.

5.2.4 Keep it cheap

The relatively low telephone charge has had a positive influence on Internet access costs in Thailand. It is therefore important that the local telephone charge remain at three Baht per call. Alternatively, if local call charges are raised as a part of a rebalancing exercise, then dial-up

calls for Internet access should remain at three Baht per call or even be eliminated.

In contrast, Thailand has some of the highest leased line prices in the region. These arise because of the restricted number of suppliers and the fact that ISPs cannot directly provide their own leased lines. Leased lines thus pass through an additional layer of resale, increasing their price. This has detrimental consequences for the development of the Internet, particularly for large volume users such as business and schools. These types of organizations are those that would be major users and developers of sophisticated applications. Thus high leased line prices are inhibiting the development of more mature use of the Internet. High leased line prices are also delaying the introduction and raising the price of consumer broadband access since leased line providers do not want to cannibalise their lucrative market. The remedy is to open up the leased line market and to have regulatory oversight of the cable modem and ADSL markets to make sure infrastructure suppliers are providing wholesale pricing to ISPs at close to costs.

5.2.5 Relevant content

The government should encourage more production of local content. A minority of Thais speak English. Thus if the Internet is to expand, more locally relevant content in the Thai language must be developed. One area is to develop e-government applications that will drive citizens to use the Internet to avoid delays. These might include moving tax payments, applications for identify cards, and other government forms and process online. Another area is to develop a central e-government portal. At the same time the private sector can be encouraged to develop local content through incentives such as a reduction in tax payments. A particular emphasis should be placed on applications that are relevant to local communities in rural areas where the majority of Thais reside.

5.2.6 English

There is no avoiding the fact that if Thailand is to emerge as a competitive ICT player and a knowledge-based society it must improve its English language skills. This is less of an issue for user access as more locally relevant content in Thai language is developed. However, it is another story for software development where most tools, documentation and training courses are in the English language. In addition, major markets for to which software development could be exported are English-speaking. It is estimated that less than five per cent of the Thai population speaks English. English language courses and teaching must be required at least at the secondary level. Programs to provide ICT professional certification should have a strong English language element.

5.2.7 Mobile Internet

The number of mobile handsets (3.4 million at December 2000) in the country exceeds the number of computers (2.3 million) and the gap is rapidly increasing as the mobile market grows. Thus it seems logical that an attractive access point for the Internet and data applications is via mobile. Yet thus far mobile data application take-up in Thailand has been lukewarm. Though Wireless Application Protocol (WAP) has been launched, acceptance has been tepid. Thailand's Short Messaging Service (SMS) use is low compared to other South East Nations. This is partly due to relatively high SMS pricing as well as the lack of Thai language support on mobile handsets.

A number of steps can be taken to improve the situation. The government should charge NECTEC with investigating the problem with Thai language mobile handsets and propose a solution. SMS pricing should be brought down and operators might even consider bundling a number of free SMS messages with subscriptions as is done in other countries to encourage take-up. The government

should also begin thinking about 3rd generation mobile with a view to having it launched in Thailand as soon as possible. This includes ensuring that adequate spectrum is available and designing a licensing process—in collaboration with industry—as soon as practical.

5.2.8 Market information

In some areas, Thailand has excellent market information about its ICT sector. NECTEC compiles the amount of international Internet bandwidth on a monthly basis. Its annual Internet User Survey is an excellent source of Thai Internet user demographics and behaviour. However in other areas, there is a lack of key indicators upon which to gauge market development and base policy decisions. For example, the number of Internet subscribers is not compiled nor are there regular methodologically acceptable surveys regarding the number of users. The National Statistical Office (NSO) produces excellent statistics. Among South East Asian national statistics agencies, the NSO provides a rich amount of demographic and economic data in a timely and clear way on its web site. However apart from statistics about household telephone and television penetration, it has not traditionally provided ICT indicators. The Post and Telegraph Department, the nominal telecommunication regulator does not compile any statistics, a serious shortcoming in a diversified market like Thailand where there are over a dozen telecommunication operators.

One breakthrough in the area of ICT statistics was a joint NECTEC / NSO household survey carried out in the first quarter of 2001. For the first time a methodologically sound assessment was made of the number of Internet users in the country. This exercise should be repeated on a regular basis, at least annually but preferably semi-annually or even quarterly considering the degree to which the Internet market changes. Furthermore the survey should be extended to include other items such as households with a PC and mobile phone. The PTD or its successor organization to be responsible for the telecommunication organization must compile aggregated statistics for the telecom sector if it is to convincingly fulfil its mission of monitoring the telecommunication sector. Regulators in Malaysia and Singapore regularly compile this type of information on their web sites and serve as an example.

[38] "CS Internet provides Internet access to 76 provinces in Thailand … The service at the cost of 3 baht/min. nationwide …. This allows our subscribers to login to their account anywhere in the world at the cost of a local call." http://www.cscoms.com/en/geninfo/.

Annex 1: List of meetings

No.	ORGANIZATION	DATE	TIME
1	Post and Telegraph Department (PTD)	Monday, 20 August	10:00 a.m.
2	Telephone Organisation of Thailand (TOT)	Monday, 20 August	01:30 p.m.
3	Communication Authority of Thailand (CAT)	Tuesday, 21 August	10:00 a.m.
4	NECTEC	Tuesday, 21 August	02:00 p.m.
5	AIS (Mobile)	Wednesday, 22 August	10:00 a.m.
6	Loxley Information Services (ISP)	Thursday, 23 August	08:45 a.m.
7	CS Communication (ISP)	Thursday, 23 August	10:00 a.m.
8	CP Orange (Mobile)	Thursday, 23 August	01:00 p.m.
9	Internet (Thailand) (ISP)	Thursday, 23 August	03:00 p.m.
10	e-ASEAN	Thursday, 23 August	08:00 p.m.
11	TDRI	Friday, 24 August	09:00 a.m.
12	Ministry of Health	Friday, 24 August	11:00 a.m.
13	TAC (Mobile)	Friday, 24 August	02:00 p.m.
14	Internet Knowledge Service Center (KSP) (ISP)	Friday, 24 August	02:00 p.m.

Annex 2: Acronyms and abbreviations

ADSL	Asynchronous Digital Subscriber Line
AIS	Advanced Information Systems Public Company Limited
AIT	Asian Institute of Technology
ASEAN	Association Of South East Asian Nations
Baht	The Thai currency. In July 2001 Baht 45.6 equalled one US$
BTO	Build-Transfer-Operate agreements
CA	Certification Authority
ccTLD	Country code top-level domain
CAT	Communications Authority of Thailand
CEO	Chief Executive Officer
DTAC	See TAC
ECRC	Electronic Commerce Resource Center
ECTI	Electronic, Computer, Telecommunication and Information Technologies
FDA	Food and Drug Administration
GDP/GNP	Gross Domestic Product/Gross National Product
GINet	Government Information Network
GITS	Government Information Technology Services
GSM	Global System for Mobile Communication
ICT	Information and Communication Technology
IIG	International Internet Gateway
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IT	Information Technology
MCOT	Mass Communications Organization of Thailand
MoE	Ministry of Education
MoI	Ministry of Interior
MOTC	Ministry of Transport and Communications
MoPH	Ministry of Public Health
MTC	Ministry of Transport and Communications
NSO	National Statistical Office
NITC	National Information Technology Committee
NSTDA	National Science and Technology Development Agency
NTC	National Telecommunications Commission
OCSC	Office of the Civil Service Commission
PIE	Public Internet Exchange
PRD	Public Relations Department of Thailand
PTD	Post and Telegraph Department

R&D	Research and Development
SMS	Short Messaging Service
SOE	State-owned enterprise
TDRI	Thailand Development Research Institute
TAC	Total Access Communication
ThaiSARN	Thai Social/Scientific, Academic and Research Network
THIX	Thailand Internet Exchange Service
THNIC	Thailand Network Information Centre
TOT	Telephone Organization of Thailand
TT&T	Thai Telephone and Telecommunication Public Company Limited
UIH	United Information Highway Company Limited
UNDP	United Nations Development Programme
UBC	United Broadcasting Corporation
VAT	Value Added Taxes
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network
WAN	Wide Area Network
WAP	Wireless Application Protocol
WLL	Wireless Local Loop
WTO	World Trade Organization

Annex 3: Useful links

Organization	Website
Main government-related ICT organizations	
Communications Authority of Thailand	www.cat.or.th
Telephone Organization of Thailand	www.tot.or.th
Post and Telegraph Department	www.ptd.go.th
NECTEC	www.nectec.or.th
Main ICT providers	
TelecomAsia	www.telecomasia.co.th
Shin Corporation	www.shincorps.com
Thai Telephone & Telecommunications (TT&T)	www.ttt.co.th
Advanced Information System (AIS)	www.ais900.com/e/home.shtml
Total Access Communications (TAC)	www.dtac.co.th/Eng/index.htm
Internet Thailand	www.inet.co.th
A Net	www.anet.net.th/default.htm
Loxley Information Services	www.loxinfo.co.th/html/about.shtml
CS Communication	www.cscoms.com/index_en.html
Mass media	
Mass Communications Organization of Thailand	www.mcot.or.th
Pubic Relations Department of Thailand	www.prd.go.th
The Bangkok Post	www.bangkokpost.com
United Broadcasting Corporation	www.ubctv.com
Academic	
Ministry of Education	www.moe.go.th
SchoolNet Thailand	www.school.net.th
Kanchanapisek Network (Golden Jubilee)	www.goldenjubilee.or.th
ThaiSARN	ntl.nectec.or.th/thaisarn/
Intern-University Network	www.uni.net.th
Health	
Ministry of Public Health	www.moph.go.th (English version: eng.moph.go.th)
Electronic commerce	
Electronic Commerce Resource Center (ECRC)	www.ecommerce.or.th
Portals	
Public Relations Department	www.prd.go.th/prdnew_e1.asp
Thailand's Official Information Center	www1.thaimain.org/en/
Other	
National Statistical Office	www.nso.go.th/index.htm
Internet Information Research Center	ntl.nectec.or.th/internet/
Tourism Authority of Thailand	www.tat.or.th

Annex 4: Framework dimensions

Table 1: Pervasiveness of the Internet	
Level 0	*Non-existent*: 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	*Embryonic*: 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	*Established*: 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	*Common*: 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	*Pervasive*: 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).

Table 2: Geographic Dispersion of the Internet	
Level 0	*Non-existent*. 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	*Single location*: Internet points-of-presence are confined to one major population centre.
Level 2	*Moderately dispersed*: Internet points-of-presence are located in at least half of the first-tier political subdivisions of the country.
Level 3	*Highly dispersed*: Internet points-of-presence are located in at least three-quarters of the first-tier political subdivisions of the country.
Level 4	*Nationwide*: 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.

Table 3a: Sectoral Use of the Internet			
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

Table 3b: The Sectoral Absorption of the Internet		
Sectoral point total	**Absorption dimension rating**	
0	Level 0	*Non-existent*
1-4	Level 1	*Rare*
5-7	Level 2	*Moderate*
8-9	Level 3	*Common*
10-12	Level 4	*Widely used*

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

Table 5: The Organizational Infrastructure of the Internet	
Level 0	*None*: The Internet is not present in this country.
Level 1	*Single*: 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	*Controlled*: 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	*Competitive*: 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	*Robust*: 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	*None*: The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	*Minimal*: The small user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	*Conventional*: 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	*Transforming*: 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-engineeering to take advantage of the Internet, is that a significant number (over 5%) of Web sites, both government and business, are interactive.
Level 4	*Innovating*: 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.

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