

Technology Leapfrogging in Thailand: Issues for the Support of eCommerce Infrastructure

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Abstract

We look at the difficulties and benefits of the implementation of newest technology in Thailand by the method of leapfrogging. In the investigation we find that a variety of issues influence the uptake of a new technology; namely the extent of the cultural shift, Government support and initiatives and the take up of these initiatives by the education and private sector in terms of R&D and training. We also examine and define areas fundamental to the preparedness of a nation for the introduction of electronic commerce; that is, telecommunications, Internet penetration & development, and technology Parks. We conclude with a recommendation to initiate a study of Information Technology education take-up in universities to support technology leapfrogging initiatives implemented by the Thai Government, identifying a number of questions that need to be addressed. Further, a strategy to encourage small communities and businesses through community education programs is suggested, including a pilot project recommendation to test the successful implementation of this strategy in a community in Chiang Mai Thailand, that would also document the issues identified, including Government and cultural impacts, in order to establish a model that could be replicated and implemented in communities at large throughout developing countries.

Keywords. Technology, Telecommunications, Leapfrogging.

1 INTRODUCTION

Technology Leapfrogging describes the phenomenon that is being seriously and widely considered in the developing world with countries such as Egypt, Malaysia, Thailand, Canada, Bangladesh, etc, having gone or going through the experience at the moment (Davison et al., 2000). The possibility of developing countries leapfrogging has come about through the increasingly lower cost of technologies and the user friendliness that is allowing the development and implementation of systems that would otherwise be unavailable to them (Weiss, 1994). Further, "economic and social progress has forged in South East Asia (SEA) a perception of growth previously unparalleled in human history" (Lander, 2000). There is an inevitability in SEA that eCommerce expansion simply will occur because of the size of the population, "which is young, well educated and with rising incomes" (Lander, 2000). It can be further suggested that the expanding market and the use of high tech devices are interpreted as cultural systems that are used in the construction of modernity and that the economic and social focus of the South East Asian nations is on market corporatism, market socialism and high tech developmentalism" (Boyd, 2002). Policies are being written and working groups and think tanks have been engaging in a discussion of what is the best approach for developing countries to move forward in an age of mounting information processing needs, fast paced change, and high turnover of information processing technologies. In addition there is the well-justified perception that barriers to entry in the world of eCommerce revolve around the uneven distribution of ICT between the rich and the

poor of the world (the digital divide) (Boyd, 2002). Since these issues were raised the Asian Tiger countries have been pursuing a number of projects that use Technology Leapfrogging to surge forward in this development and economic race, to rescind the ever-growing gap between the developed and developing countries. Availability of funds in the region's favour certainly seem to be there. Whereas the MENA (Middle East and North Africa) region has attracted \$2,645 million in foreign direct investment (1.6% of total FDI) the South Asian region attracted \$4,196 million (2.5% of total FDI) (Saidi and Yared, 2002). However, it is unclear how many countries fully appreciate the need for a coordinated effort across all sectors in terms of the implementation of an eCommerce strategy. Such an implementation represents a considerable challenge requiring integration of technology, law, policy, business processes and skilled people (Keretho and Limstitt, 2002). But that's not all, a major problem facing developing nations is the lack of a sound telecommunication infrastructure which forms part of the basic building block for an eCommerce infrastructure (Davison et al., 2000).

In September 1997, Ascent Technology Magazine published an extract from the Australian Government's publication "The Global Information Economy *The Way Ahead*" (Williamson, 1997) an article that identified "Seven key challenges in information industries strategy". Those strategies were:

- Recognising the size, impact and strategic importance of the information industries
- National leadership
- Proactive investment attraction
- Going global
- Enabling and empowering users
- Enhancing skills, education and training
- Enhancing research and development (R&D) and innovation.

These key challenges were identified as global challenges that should be addressed by all countries planning and or implementing future technology and infrastructure developments.

Since this report was published the Federal and State Governments of Australia have initiated a number of programs and projects to surge ahead in the electronic enablement and development race. But Australia is not alone in the Asian-Pacific surge for technology development and enablement of the nation. Thailand is also actively pursuing a technology development strategy.

Using the recommendations of the report as a backdrop we look at how Thailand is handling the introduction of technology through Leapfrogging, identifying some specific issues that Thailand face in their future development strategies.

2 THAILAND: A CASE OF TECHNOLOGY LEAPFROGGING WITH CARE

For developing countries intending to adopt ICT, there is an advantage in following the leader; they can avoid costly mistakes and gain the benefits of experience. Also on the positive side, the implementation of broadband technology is now feasible even with small budgets. Therefore, political stability, financial robustness, government policies and their enforceability assume a more important role in the success of the implementation (Saidi and Yared, 2002). At the risk of paraphrasing Charles Dickens, Thailand's present is indeed "the best of times, ...the worst of times". Thailand has everything before it and nothing before it. The future of its economic prosperity, in terms of contemporary issues, could be argued on how well it will tackle issues of Technology Innovation, Transfer, and Commercialisation (ITC).

A well-executed ITC plan has been recognised as significant in terms of the integration, participation, and leadership in a global economy (Jackson, 1999). Although global ITC strategies have been identified and each nation is addressing these with their own political agendas in mind there are a number of issues that, though highlighted as requirements, need to be addressed more specifically from a national and cultural perspective. ITC strategies of implementation therefore have their own unique flavours in terms of the cultural setting. These issues are initially identified in two specific areas:

- Enhancing skills, education and training.
- Enhancing Research and Development (R&D) and innovation.

The Thai culture has differing views on old hierarchies. Unlike most western cultures it does not tolerate failure and has a difficulty in accepting ideas from the younger generation. Although these, from the outset, do not seem to be significant enough to effect the implementation of electronic economy developments, we note that this oversight has impacted other Asian Tiger countries such as Malaysia's Multimedia Super Corridor. It is therefore prudent and important, in order to have these new technologies accepted by the community at large, that the cultural implications of such a move be addressed, not only in terms of acceptance but also in terms of effects on the traditional cultural behaviour.

The success of technology leapfrogging relies not only on the broad initiatives of the Government but the take-up, implementation and investment of Government initiated projects and research and development by educational and private sector institutions. Without this support the electronic economy development and technology innovation of Thailand could fall even further behind in the electronic enablement and development race.

Through studies of industry initiatives and encouragement, Governments should be able to support, guide and educate their nations without adding hype to achieve take-up of their initiatives. This means addressing the education of the up and coming generations to be able to support the current infrastructure and innovation developments of Government and build on these through training and employment programs within industry and the community.

This paper looks specifically at those technologies that need to be in place to enable electronic commerce, the direction of the "New Economy".

3 TECHNOLOGY PROGRESSION IN THAILAND

We begin by identifying three significant areas of information Technology and Telecommunications (IT&T) that are fundamental to the preparedness of a nation for electronic commerce. Namely:

- Telecommunications.
- Internet development.
- Technology parks that encourage and support research and development.

We will look at these areas separately.

3.1 Telecommunications

In the early 1980's there were two state enterprises managing Thailand's telecommunications, the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT) providing just 2 telephones per 100 people (ATIP95.25, 1995). The Asian Technology Information Program (ATIP) on IT&T in South East Asia conference 1995,

reported "Thailand has critical telecommunications infrastructure needs", indicating Thailand's national plan to add 8 million telecommunications lines by 2001 with a further goal to increase the lines per 100 people from 2 to 20 early in the new century. They estimated the growth demand at 600,000 lines per year (ATIP95.25, 1995). In 1996, TOT estimated demand would rise to 800,000 lines per year (Palasri et al., 1999). In Table 1 below, projected estimates for telecommunications installations were high, though this was significantly negatively affected by the economic crash in 1997.

Table 1: Telephone Statistics, Thailand (Palasri et al., 1999)

Year	Bangkok and Surroundings		Provinces		Thailand		BKK: Province Ratio	Annual Increase in Installations
	No. of Phones	Phones per 100 People	No. of Phones	Phones per 100 People	No. of Phones	Phones per 100 People		
1992	2,226,462	26.70	935,643	1.66	3,146,125	5.46	2.38:1	
1993	2,617,591	30.77	1,152,251	2.29	3,768,642	6.41	2.27:1	622,517
1994	3,007,120	35.00	1,435,126	2.62	4,473,246	7.50	2.11:1	704,604
1995	3,457,105	39.06	1,764,695	3.45	5,242,001	8.67	1.94:1	768,755
1996	3,662,654	43.10	2,237,042	4.26	6,110,906	9.99	1.74:1	868,905
1997	4,262,650	46.68	2,604,176	5.31	7,067,026	11.43	1.53:1	956,120
1998	4,651,164	49.66	3,491,939	6.53	8,143,103	12.96	1.33:1	1,076,077
1999	4,677,167	52.45	4,341,157	8.02	9,316,344	14.65	1.15:1	1,173,241
2000	5,252,714	54.52	5,343,205	9.77	10,305,920	18.46	0.88:1	989,576
2001	5,507,252	56.06	6,515,319	11.78	12,022,517	18.46	0.85:1	1,716,651

Koanantakool (2000) referred to telecommunications as fixed line and mobile without giving a breakdown of these two components separately. This has the potential for distorting the installation figures indicated, showing inflated figures that would ultimately hinder Internet access by users, including businesses. Landlines are more suitable for businesses enablement into electronic commerce and future preparation for technology leapfrogging. A new, clearer picture of the split between landlines and mobile lines is now emerging, though it is hard to keep track of the exact status as Thailand is currently engaged in an exercise of telecommunication privatisation due to culminate in 2006. Statistics obtained from the UK Trade and Investment department currently place the total number of landlines at 7.66 million, roughly split 3:2:1 between TOT, TA and TT&T. There are currently 23 million mobile lines split between 9 significant operators (<http://www.tradepartners.gov.uk>), (Hammond, 2003).

Apart from the traditional landline services that can provide, at best, 56 Kbps without conditioning at an affordable price, September 2002 statistics (www.point-topic.com) showed very little DSL activity noting an uptake of only 9300 lines. Rather than availability of service, although it's a factor, cost is also an issue for private individuals with a once-off cost of 10,400 bahts for a basic 256/56Kbps service and a monthly fee of 625 bahts (www.telecomasia.co.th).

However, there is one significant resource that is being continuously developed in the form of the Thai satellite system. With such a system Thailand is not only able to reach into its remote areas but also sell its services abroad. The Shin Satellite Public Company was established in 1991 and is a subsidiary of Shin Corporations also operating in Cambodia and Laos as different companies. It now has four satellites in geo-stationary orbit and is engaged by various bodies for television broadcasts, Internet connections and communication links. Its satellites have a collective footprint that covers Asia, Australia, Africa, The Middle East,

and most of Europe. Figure 1 shows the iPSTAR footprint, the newest satellite put in orbit by the Shin Corporation.



Figure 1: iPSTAR footprint (www.thaicom.net)

The iPSTAR is a Broadband satellite that is an enabler across a multitude of internet applications including the Last Mile portion (Figure 2), a problematic situation in Thailand, and for that matter, a good portion of countries including Australia, since a great proportion of the cost is the establishment of household points of access (POAs) in low density remote areas.

Corben (2003) states that Thailand will target the Australian market with its new iPSTAR satellite offering telephony and broadband services to up to one million homes by early 2004. The satellite will provide services to urban and rural Australia. Corben (2003) notes the service's main strengths in the areas of video conferencing, telemedicine, and long-distance learning. The receiving gateways are to be located at Broken Hill and Kalgoorlie.

Another development at the forefront of telecommunication technology innovation is the introduction of Wi-Fi hotspots (Bangkok Post, 2003) around business centres and exploitable point-of-access places such as hotels, airports, condominiums, etc. INET, one of the major Internet and eCommerce infrastructure providers in Thailand, is offering a wireless high-speed product called Wireless Zone working on the 802.11b wireless protocol. Currently the service is provided on the 1st and 2nd floor of the CRC Building of All Seasons Place, 1st and 2nd floors of Ital-Thai Tower and at KTC Boutique (UBC 2 Building) (www.inet.co.th). There are other companies also exploiting this potential market, with a number of hotels, restaurants, shopping malls and resorts installing Wi-Fi in the hope of gaining some competitive advantage.

iPSTAR Broadband Platform Structure

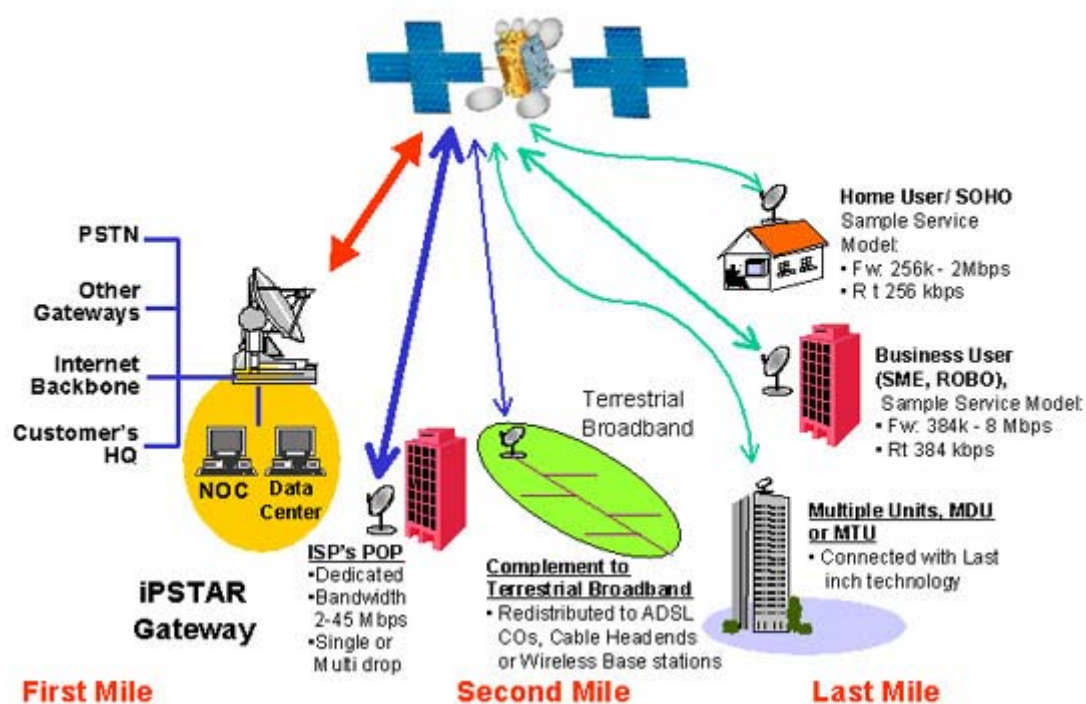


Figure 2: iPSTAR Broadband Connectivity (www.thaicom.net).

The use and promotion of Wireless Fidelity (Wi-Fi) hotspots is seen as enabling the knowledge management function, and therefore is deemed to be attractive to the corporate sector. There are also initiatives by managed resorts to install Wi-Fi facilities in order to attract people with a certain disposable income. One such example is the Long Beach Village at Ko Lanta, offering luxury beach homes for wired workers (www.dialuphell.com).

3.2 Internet

In the early 1980's computers were visible but not widely used as they were expensive and incomprehensible for most Thais, due to the lack of Thai language software and the lack of computer standardisation (Palasri et al., 1999). In early 1988, the Australian International Development Plan (IDP) assisted the Prince of Songkla University (PSU), the Asian Institute of Technology (AIT) and Chulalonghorn University (CU) to set up the first email computer network in Thailand (Palasri et al., 1999).

Initially the Thai Government was very slow to acknowledge the importance of the Internet and reacted to the country's shortage of human resources by limiting the access to the Internet to state academic institutions and Government agencies (Palasri et al., 1999). But in recent years the Thai Government, working through the IT-2000 project (the Telecommunications Master Plan), with NECTEC and TOT, telecommunications and Internet providers, has demonstrated its intent to provide networking to every school in the country for free (Palasri et al., 1999). This will provide access for schools and communities to utilise the Internet for informational and educational purposes. As of February 1998, more than 350,000 individuals in Thailand were using the Internet (Thansetti et al., 1998), the growth is impressive compared to the early 1990's when email was used by only 100 Thai researchers (Palasri et al., 1999).

At a presentation in Singapore in 2000, Koanantakool (2000) provided evidence of significant growth in the IT&T market. Tables 2 and 3 below indicate the growth of both IT

businesses and PC peripherals in Thailand. These statistics only considered Baht spent, and units sold, and only go a small way to indicating the total usage of IT across Thailand. These figures also show the effect of the economic crash on 1997.

Table 2: eCommerce Support Commodities, Thailand

Category	1997		1998		1999		2000 estimates	
	Value	% Inc	Value	% Inc	Value	% Inc	Value	% Inc
Systems	4,093	34%	2,465	(40%)	2,704	10%	2,612	(3%)
PCs & WS	23,503	9%	11,132	(53%)	17,406	56%	20,573	19%
Packaged S/W	6,861	22%	5,126	(25%)	6,289	23%	7,744	23%
Services	8,200	24%	7,229	(12%)	8,738	21%	9,384	7%
Total	42,657		25,952		35,137		40,313	

Table 3: eCommerce Support Commodities, Thailand

Category	1997		1998		1999		2000 estimates	
	Units	Value	Units	Value	Units	Value	Units	Value
PCs	289,000	13,988	174,000	7,522	300,600	12,373	363,950	14,700
Monitors	101,000	708	70,000	415	160,000	919	192,000	1,080
Printers	304,500	4,680	129,000	1,630	189,600	1,757	225,520	1,960
Data Storage	222,000	1,941	700,000	508	160,000	848	192,000	960
Services	135,000	350	81,300	195	156,600	425	193,400	512
Total		21,667		10,270		16,323		19,212

Palasri et al. (1999) and Abdulsomad (1999) both indicate the limitations that industries face in the support of growth and eventual international and local competitiveness in each area. Abdulsomad (1999) highlights that there were few policy instruments to support the growth of local parts and components firms, while Palasri et al. (1999) list several obstacles that hinder further development of the Internet in Thailand such as, PTO monopoly, political instability, language barriers, insufficient Thai language software, a lack of well-trained engineers, and a general human resource shortage of IT professionals.

Statistics taken in 1993 show an international bandwidth to and from Thailand of only 0.13 Mbps, the first available data for domestic exchange bandwidth found dates back to October 1997 consisting of 222.563 Mbps throughput (<http://www.ntl.nectec.or.th/>). Figure 3 gives a comprehensive view of the state of the Internet in Thailand in mid 1995.

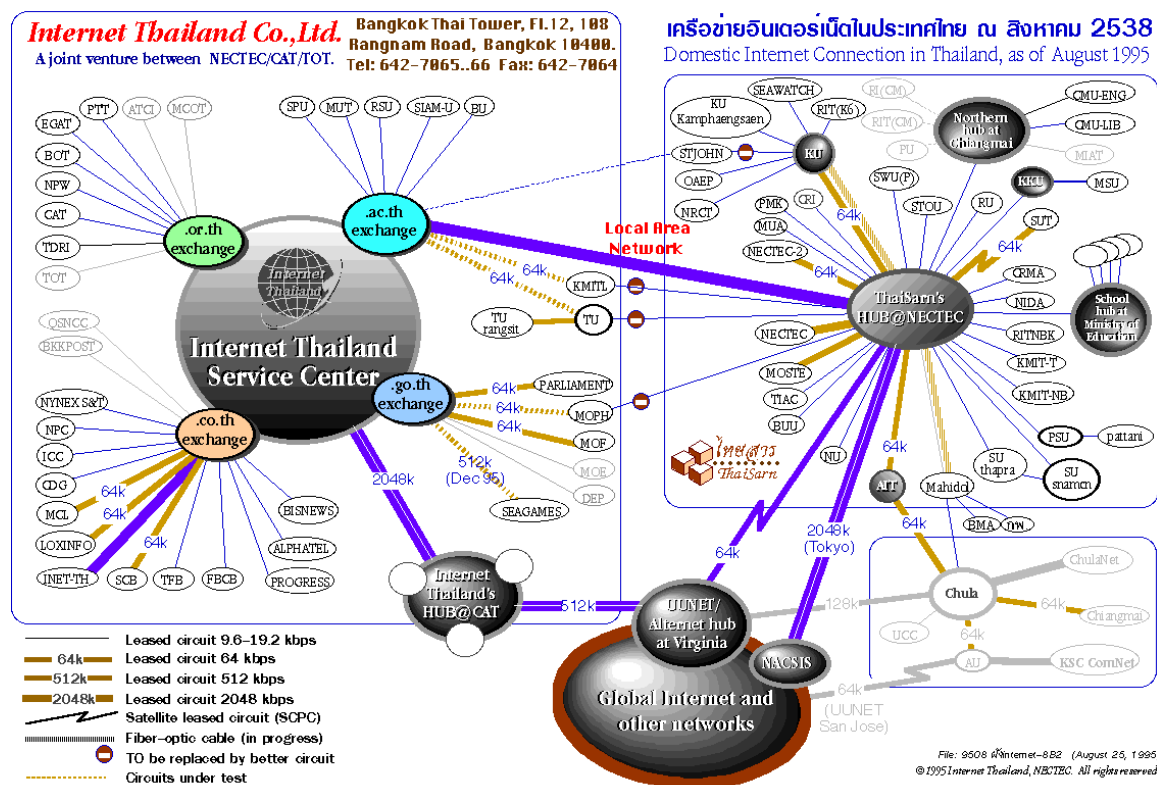


Figure 3: Internet Connectivities in Thailand (August 1995)

However, the growth has been considerable, see Figure 4, with evidence that Internet growth in Thailand is moving towards an exponential path. Recent statistics, taken in September 2003, show an international bandwidth to and from Thailand of 1364.125 Mbps and a total domestic exchange bandwidth of 7985.5 Mbps, enabled by at least the following infrastructure (www.nlt.nectec.or.th):

- 19 Commercial Internet service providers.
- 7 Non-commercial internet hubs (PubNet, SchoolNet, ThaiSarn, UniNet, etc).
- 2 Domestic Internet exchanges (NECTEC-IIR, CAT-N IX).
- 27 International providers (Reach, Teleglobe, Hutchison, Intelsat, etc).
- 1 International Internet Gateway.

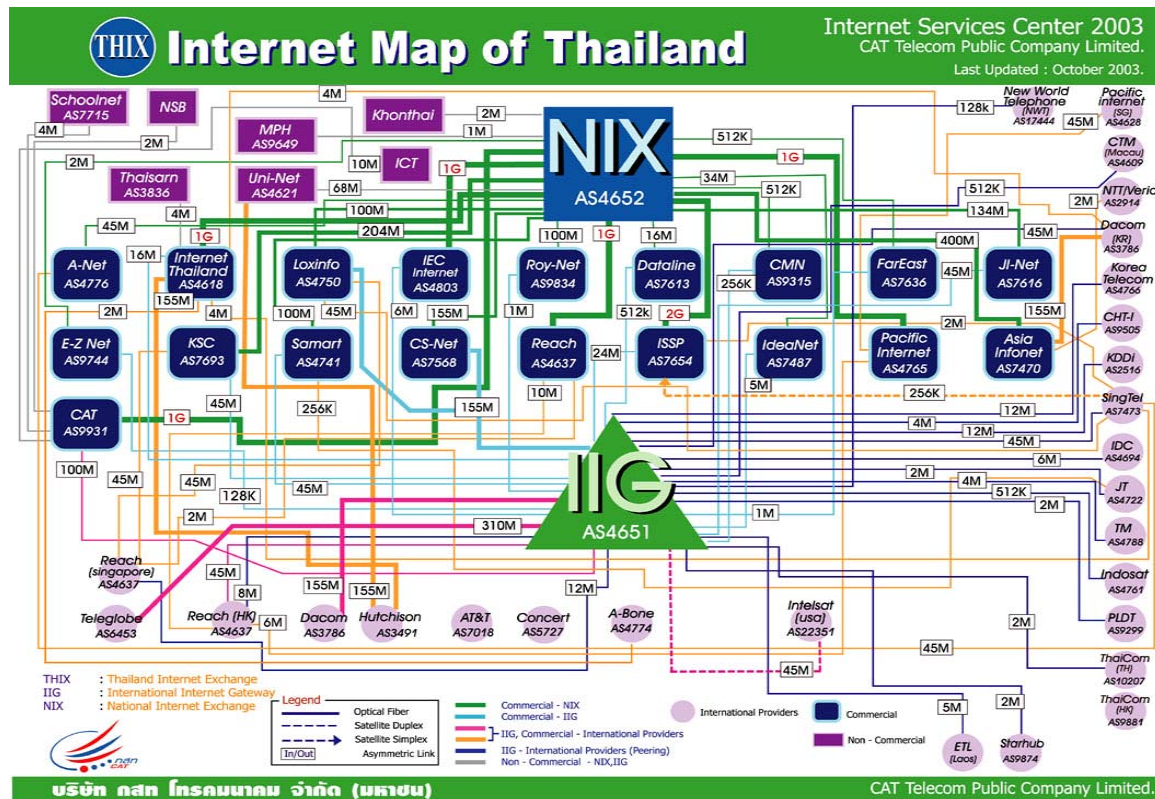


Figure 4: Internet Connectivities in Thailand (October 2003)

With an ICT market growth at 15%+ there are now over 6 million Internet users with Thai PC brands holding 75% of the market share and selling for less than 20,000 baht. The PC market has almost doubled since 2000 with 910,000 PCs sold in 2003 compared with 496,000 sold in 2000. We note that Koanantakool’s (2000) estimates (Tables 2 and 3) were conservative. Users are becoming more confident in the technology using it ever more for billing, CRM, VoIP, etc (www.metro systems.co.th).

3.3 Technology Parks

The 4th World Conference on Science and Research Parks held in Beijing in 1995 (ATIP95.88, 1995) reported that most Asian countries did not have any Science Parks until recently but indicated that Thailand had one Science Park. The Conference also recognised that underlying the enthusiasm for science parks is the general belief that science parks represent a new mechanism to spur technological innovation and economic growth, create and sustain the capability of developing new products and processes, which can compete in the international market. For many developing countries in Asia, the mission of promoting high-tech industries is particularly important since the relative importance of traditional labour-intensive industries, which have been the engines of past growth, is declining. There has been an urgent need to raise the level of technological sophistication of local industries, promote industrial R&D, and facilitate the transition from a labour intensive economy to a knowledge intensive one. VI Developing science parks has become an important strategy in achieving these objectives.

Software and Technology Research and Development Park Thailand (<http://www.swpark.or.th>), initiated by NECTEC/NITC and supported by the Thai Board of Investment, is the first successful government project with a unique infrastructure. ATIP98.031 (1998) highlighted the objectives of the science park as having "three thrusts,

building an equitable national information infrastructure, investing in people, enhancing Government services and forging a strong information industry". The park was designed to promote industrial R&D with the possibility of limited light production offering Government incentives including permission to own land, bring in non-Thai technicians and experts, unrestricted foreign ownership, tax incentives and exemptions ATIP98.031 (1998). The report then went on further to say that the commitment to three major projects for the technology park, a software park, government information network and, a separate network for social/scientific, academic and research users, were on hold or seriously delayed.

On March 2, 2001 the NSTDA announced a new Technology Park to be developed in Chiang Mai (Northern Thailand) (Phoosuphanusorn, 2001). In order for this project to be a successful venture, Thailand will have to look closely to the current status of their first technology park and the Multimedia Super Corridor project in Malaysia and address the issues that were over looked, being financial investment, current business take-up and education.

Although there are some Government initiatives being undertaken to progress Thailand's Information Technology initiatives, the ATIP98.031 report on Computational Science and Engineering in Thailand indicated, concern that "there did not appear to be any conference participation from Thai industry". It also went on to say, "high tech companies in Thailand are almost all assembly or manufacturing arms of multinationals. However there is a thriving cottage industry of storefront PC assemblers, and a very small software industry which mainly supports local needs".

4 PROACTIVE INITIATIVES

Although the telecommunications, internet and technology parks previously discussed indicated a number of areas that require more development, several initiatives have been undertaken to address these through financial investment, international joint programs and developing policy approaches to support these and future initiatives.

4.1 Thai Government

In 1996 the Thai Government approved a Bt4.2 Billion budget for three projects that encompassed the 8th National Economic and Social Development Plan called IT-2000 aimed at developing a national IT infrastructure, human resources, and enhancing government services using computer networks (Phoosuphanusorn, 2001).

After the success enjoyed by that plan the government approved the IT2010 policy framework on the 19th of March 2002. Subsequently NECTEC and NESDB were asked develop the ICT master plan for 2002-2006. The plan is to be developed in accordance with the IT-2010 policy master plan and the 9th National and Social Development Plan (2002-2006). The plan was approved by Thailand's cabinet on the 25th of September 2002.

The vision for ICT development stemming from the national master plan proclaims the following:

Thailand is to become the regional centre for ICT development and ICT business, particularly software. Thailand is to have a strong and competitive economy and a knowledge-based society thereby allowing entrepreneurs and the public at large to access information.

With the following objectives:

1. Economic competitiveness using ICT as a driver.
2. Development of a knowledge-based society through ICT.
3. Sustainable development through ICT diffusion
4. Drive and increase ICT industry locally.

Three interesting observations can be made from the proposal. The first is that it shows a certain amount of maturity in terms of IT development awareness for the strategic direction of government policies as a whole. The second, although ambitious from a regional political sense, shows that Thailand possesses the necessary know-how to fulfil the plan and the confidence to do it. Thirdly, the development is mindful of the whole of society working across regional and cultural boundaries (APEC, 2003).

In October 2002, under the Bureaucratic Restructuring Act, The Post and Telegraph Department (PTD), The Communications Authority of Thailand (CAT), and the TOT Corporation Public Company Limited were brought under the auspices of the new Ministry of Information and Communication Technology (MICT) whose designated responsibilities are to formulate ICT policies and plans, promote and develop ICT activities and the implementation of national ICT projects. Laws pertaining to eCommerce, computer crime, privacy (in a limited way) and information infrastructure are being considered by the Thai government. These are:

- The Electronic Transaction Law
- Electronic Signatures Law
- Electronic Funds Transfer Law
- Computer Crime Law
- Data Protection Law
- National Information Infrastructure Law.

The Electronic Transactions Law and the Electronic Signatures Law, were combined later into the Electronic Transaction Act 2001, and were implemented on April 3rd, 2002. The others in the form of bills are now being considered.

4.1.1 Primary, Secondary and Tertiary Education

Although the secondary sector is not directly linked to eCommerce as a primary enabler, secondary education can and should be seen as a precursor for the establishment of an indigenous workforce, for the support and establishment of a sustainable eCommerce infrastructure. There are currently 4,794 schools on line and 1470 have a web presence. Given that in late 1999, 991 schools were on line and only 306 had a web presence it is not a bad achievement (www.school.net.th). However, the program seems to be slowing down after an initial burst although there is plan for 10,000 schools to be on line by the end of 2003 (www.metroSystems.co.th). In terms of the distribution of resources on a regional basis, it seems to be about even considering population density and regional area. The distribution of the 1470 schools with a web presence is as follows:

- 310 schools on line in the North
- 336 schools on line in the Northeast
- 494 schools on line in the Central
- 126 schools on line in the East

- 204 schools on line in the South

This number is changing almost daily as new schools assume a web presence.



Figure 5: SchoolNet distribution in Thailand's regions

UniNet was established in 1997 under the auspice of the Ministry of University Affairs. It is managed by, the Office of Information Technology Administration for Educational Development. Its charter (UniNet) is to provide national and international network services to support R&D activities for the tertiary sector. UniNet objectives are as follows:

- To set up information technology infrastructure to connect all universities/institutions and campuses over the country.
- To develop self-study centres by providing electronic library databases, Internet, multimedia, video on demand, and other self-study material.
- To develop social-learning and lifelong-learning systems by creating multimedia courseware, and providing knowledge databases and distance learning systems.
- To train teachers and assistants to be able to apply IT for educational development

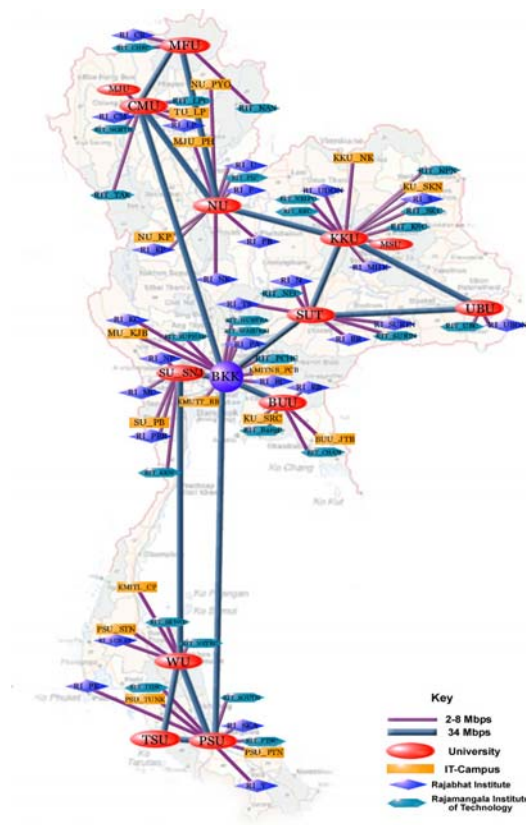


Figure 6: UniNet distribution in Thailand's regions

As can be noted from Figure 4, the backbone consists of a 34 Mbps link with 3 to 8 Mbps links to satellite sites. Such a network is consistent with UniNets aim to provide VCS and distance education facilities throughout the regions with a total of 83 campuses/institutes currently covered (www.uni.net.th).

Going one step further, Kasetsart University in cooperation with Cisco has built the largest academic Wi-Fi network in South East Asia, using Cisco's Aironet Wireless LAN technology. The network covers 43 buildings and 800,000 square metres of the university's Bangkhen Campus. The network is called KUWiN and the university has begun to extend the service to its other campuses with a view to have all of its campuses eventually wired.

4.2 eCommerce Incubators

Recognising the importance of ICT and its ability and viability to support a broad spectrum of commercial activities, SEA countries including Thailand reacted quickly to prepare, support and include as part of their economic activities nation-wide eCommerce infrastructures. Aside from the obvious supporting technologies and infrastructures however, there is also need for guidance. The setting up, conversion to, or addition of the eCommerce function to a business needs to be supervised, as the cost of the technology and the possibility of failure, for a variety of reasons including customer acceptance, can be costly. It is also not surprising that out of vested interest, software and hardware suppliers, always looking for new markets and with product turnover priorities, see the need to educate in order to ensure the successful implementation of their products. Hence through the common interest of both, the national governments and vendor, eCommerce incubator were set up in Thailand in order to ensure as much as possible a successful transition to a digital economy.

There are a few examples of eCommerce incubators in Thailand. However, the more significant ones are the Oracle incubators set up in 2000. These were ADventure, NewThailand.com, Software Park, ThaiIncubator.com and Thaipan1.com. These incubators benefited from “Oracle’s software, technology and know-how, training and education and marketing support”, boasting expedition of time-to-market and successful Internet competitiveness.

Another important initiative was/is the Asia eCommerce Incubator Project initially proposed by Thammasat University, “considered as one of the high impact projects under the e-ASEAN Framework Agreement”. The initiative allows for the support of new entrepreneurs and the support of business structures oriented towards eCommerce trade (Poomchusri, 2002).

At present a great number of ISPs in Thailand provide either eBusiness or eCommerce facilities or both. As part of the package most of them include incubators of some form in order to attract clients. This need is readily recognised, as the expertise for a transition or establishment of an eBusiness is in limited supply.

4.3 World Bank

Through an initiative with the World Bank, the Thai Government has launched a "Development Marketplace - Thailand Innovation Day" to promote innovation in development as a crucial component in Thailand's efforts towards poverty alleviation. This initiative is encouraging individuals and or enterprises to partner with a rural community, school or hospital to bring Information Technology into rural Thailand to improve the "Quality of Life in Rural Thailand" (World Bank, 2001). This initiative could have far reaching effects if driven carefully and could be the catalyst to a much stronger network infrastructure throughout Thailand.

The World Bank is a sponsor of Thairuralnet.com, an initiative manpowered by local university students in order to bring, expose and exploit the Internet for the benefit of rural Thailand. There are other initiatives, in the form of projects, currently supported/sponsored by the world bank that have bearing on the development of Thailand’s ICT infrastructure, although some more directly than others. These are:

- The Thai rural information empowerment project.
- The university science and engineering education project.
- The distribution and reliability improvement project.
- The social development project

5. POLICY APPROACHES

Significant moves by the Thai Government in the past two years have highlighted their preparedness to address the obstacles in initiatives announced by Thaweesak Koanantakool Director for, National Electronics and Computer Technology Center, National Science and Technology Development Agency, Ministry of Science, Technology and Environment, Thailand

Koanantakool (2000) has provided evidence of significant growth in the IT&T market, although these statistics only considered Baht spent, and units sold, this growth seems encouraging. This presentation included information about further Government initiatives noting that the Thai Government has provided NECTEC/NSTDA with funding to speed up its Research and Development (R&D) of wireless local loop, with a vision that this technology can be applied to rural telephones and fixed terminals for the home. Further research is also being considered in secure mobile commerce using Thai language in areas

such as keyboard, display panels, short messages and Wireless Application Protocols. Phoosuphanusorn (2001) identifies other R&D programs including 3G mobile phones, computer-telephone integration and call centres, further stating:

"We see a lot of activities, which are driving Thailand into the "New Economy", an economic system, which is driven by knowledge, good management, computer networks and electronic commerce. In this regard, many things will happen before the end of year 2000, as summarized below:

- The end of the telecommunications monopoly by Communications Authority of Thailand (CAT) and the Telephone Organization of Thailand (TOT) in March 2000.
- An increase in telephone availability from around 13 lines per 100 people to about 18, due to the proliferation of mobile phones.
- The internet business will perform without previous restricted growth following an end of 30% of CAT golden shares in every ISP, expected to materialize around mid-2000.
- The electronic transaction will be supported by legal infrastructure following the enforcement of the new Acts in the near future.
- Wider access to the Internet as the local call access will be available nationwide.
- Increase in the number of schools connected to the free Internet from currently 1,500 schools to the target of 5,000 schools.
- Better focus on the optimization of the use of computer in schools, not just computer availability.
- A Possibility of free Internet.
- Less of "digital divide" between the 'haves' and the 'have nots' as a results of action programs and drafts of universal access law.
- The price of PC will dropped further due to local manufacturing and low price PC project by NECTEC.
- Mobile phones are expected to be cheaper as a result of increase competition from PCT and new mobile operator".

These initiatives were further supported by the recently elected Prime Minister Thaksin Shinawatra in Thailand, when the future of Telecommunications and Information Technology and the direction of the nation as a whole were highlighted in his Delivery to the Thai National Assembly. In this address H.E. Prime Minister Thaksin Shinawatra, highlighted four policies, which were to be his Governments focus for Thailand.

1. Expedite the development of personnel in the areas of science and technology at every level so that there is a sufficient number in terms of both quantity and quality. This will help support sustainable national development and prepare the country for entering the New Economy.
2. Promote science and technology in the area of research and development by providing support to agencies in both the public and private sectors to benefit the management and production of small- and medium-sized enterprises. Science and technology should be used to help resolve economic, social and environmental problems as well as the selection of the appropriate skills suitable to improve the

potential, expertise and proficiency of Thais. This will help increase the capacity for production for export and domestic consumption, both in the industrial and agricultural areas.

3. Promote the use of technology, particularly information technology, for modern administration and management in order to respond to the needs of national economic and social development. The technology chosen should be appropriate, inexpensive, and can be developed and expanded in a sustainable manner.
4. Revise and amend the laws dealing with science and technology so that they may benefit scientific and technological development as well as protect intellectual property rights." (Shinawatra, 2001)

Although these are broad statements (they are inclusive of a number of areas) there are a number of areas that demonstrate the move forward that Thailand have engaged.

6. THE CULTURAL FACTOR

Underlying all the projects, initiatives and the uptake of technology leapfrogging in Thailand is the cultural impact on daily working life and business management approaches. In their study "Cultural Context and its Impact on Requirements Elicitation in Thailand, Thanasankit and Corbitt (2000) demonstrated, through interviews, the difficulty that Thais felt in decision making. As "trust and relationships with others are the basis of the Thai culture, relationship oriented behaviour happens more commonly than work-orientated behaviour in Thai society and it's organisations" (Sorod, 1991). Thai decision-making is commonly not a team approach as in western countries. Subordinates in Thai organisations accept that their superiors make decisions in an authoritarian way (Holmes, 1995). Thai culture does not encourage subordinates to dare to make mistakes, or to take initiatives (Thanasankit, 2000).

"Hofstede (1991) argues that Thai culture is one with high power distance where there is considerable dependence on subordination to bosses and where "subordinates respond by either preferring such dependence (in the form of an autocratic or paternalistic boss), or rejecting it entirely. In psychology, this concept is termed counter dependence: that is dependence, but with a negative sign ... the emotional distance between subordinates and their bosses is large; subordinates are unlikely to approach and contradict their bosses directly'. High power distance creates tall organizational structures for most Thai organisations. The power-oriented culture in Thailand usually tends to create respect for the leader as the father figure of the Organisation. Rohitratana (1998) suggested, "Due to paternalism and dependence, the concept of a 'flat structure' in an Organisation, which entails speedy decisions cannot effectively take place. The reason is that only those at the top can possibly make decisions; that is their obligation, to operate as 'fathers'". Thais perceive the role of 'leader' as a controller rather than a colleague. This may be called 'superior-inferior' concept, which is dominant in Thailand." (Thanasankit, 2002).

The Danish Research Unit for Industrial Dynamics (DRUID) identifies two models for developing countries (Ernst and Lundvall, 1996) to follow that would address part of the

technology leapfrogging issue facing Thailand, which is also supported by Jomo, Felker and Rasiah, 1999 (Abdulsomad, 1999), but then go on to say "for the majority of developing countries, the main concern is to create the necessary institutions that provide incentives for and externalities necessary for domestic learning." Further highlighting the "need to develop hybrid forms of institutions that combine the advantages of both models in a way that is appropriate to their idiosyncratic needs and capabilities."

There is no doubt that the socio-cultural landscape of Thailand presents a contrasting cross-section. This landscape ranges in diversity and technological exposure from the bustling modern Bangkok to the scattered rural communities living by the most basic means. It goes to the credit of a most caring government that the leapfrog of the WHOLE of Thailand into the digital economy is occurring in the most even and appropriate way that its economy can allow. We note in this leapfrog the care that the various players took to ensure, under government legislation and the auspice of the Royal Family (Thanasankit, 2002), that the social, cultural and economic factors affected by the introduction of a digital economy were properly balanced for the benefit of the country as a single endemic entity with a desire to participate as an equal, even as a leader.

Arguably technologies used in the digital economy are, for the most part, a product of cultures different from the ones found in SE Asia, mainly originating from Western Europe and North America (Davison et al., 2000). Hofstede (1991), in his well-known model gives a good cultural cross-section of the globe making useful remarks on traits associated with various cultures. Having said this, however, we also note, as Corbitt and Thanasankit (2002a) point out, that individuals and organizations tend to "recontextualise" information, processes and models by adapting them into their cultural norms and values. This trait can be good and bad at the same time. It can be good because it gives the technology a 'foot in the door', but it can also lead to potential problems in terms of the purpose of the adoption.

Nevertheless ICT, if properly deployed, can be of great benefit across a variety of sectors due to its capacity to deliver on demand, processed information quickly, but nearly always limited in its value by the sophistication of the user's request. Thailand is very much aware, and has been for sometime, of the economic and social benefits to be had from a balanced introduction of the technology in terms of outreach and sees great possibilities in communication, education, health, eGovernment, eCommerce, rural development, a more even distribution of wealth, etc. (Corbitt, 1999).

With foresight, in 1987 Thailand established the National Information Technology Committee chartering it with the responsibility to oversee IT development. More to the point this committee was created to oversee policy aspects of IT development and Deployment in Thailand. Realising that the leapfrog into the digital economy demands a degree of technological sophistication and preparedness that requires broad cooperation to realize, the NITC launched calls for voluntary participation across a variety of sectors. These included government agencies, the private sector, educational institutes, and independent research centers in order to form as wider front as possible for the launch into the digital age. Under its charter the NITC has/had responsibility for overseeing 18 subcommittees including 3 that directly affect eCommerce development, an EDI subcommittee, six Law subcommittees and the electronic commerce taskforce. Thus the NITC put itself at a good vantage point from where to begin drafting IT technical recommendations and standards (Koanantakool, 1999).

Within these opening remarks lie, we believe, the reasons and concerns that shaped the form of the leapfrog into the digital age that occurred in Thailand. In other words, a well planned approach that is benefiting a variety of sectors across the country.

From a cultural stand some of the most important decisions regarding Thailand's IT infrastructure came about in the early '90s with the establishment of IT standards allowing for the retention of Thailand's cultural identity, namely:

- Thai Industry Standard TIS 620-2533 (1990) Standard for Thai Character Codes for Computers.
- Thai Industry Standard TIS 988-2533 (1990) Recommendation for Thai Combined Character Codes and Symbols for Line Graphics for Dot-Matrix Printers.
- Thai Industry Standard TIS 1074-2535 (1992) Standard for 6-Bit Teletype Codes.
- Thai Industry Standard TIS 1075-2535 (1992) Standard for Conversion Between Computer Codes and 6-Bit Teletype Codes.
- Thai Industry Standard TIS 1099-2535 (1992) Standard for Province Identification Codes for Data Interchange .
- Thai Industry Standard TIS 1111-2535 (1992) Standard for Representation of Dates and Times.
- Thai Industry Standard TIS 820-2538 (1995) Layout of Thai Character Keys on Computer Keyboards.

www.nectec.or.th

With the development and subsequent realization of these Standards an important cultural and practical barrier was potentially lifted, thus setting the stage that would eventually allow a much broader section of the community to explore the digital landscape, if they so desired.

These steps, taken towards addressing the problem by creating a sense of ownership, although important, only go part of the way in addressing acceptance. While it can be safely argued that major commercial hubs, such as Bangkok, will jump on the digital bandwagon out of sheer necessity, rural areas present a greater obstacle in terms of penetration. However, we maintain that a country never truly leapfrogs unless it treats the leapfrog holistically that is, in terms of physical coverage, ethnic coverage and socio-economic coverage. So while urban coverage is easily justifiable in terms of economic hub activities, rural areas present a problem that needs to be worked but not less worthwhile.

The issues facing rural communities are mainly, as a study by Pringle and David (2002) suggests, issues of awareness, skills and access. Once these are overcome the study suggests that people welcome the experience and can benefit from it at a variety of levels, ranging from personal to enhanced business opportunities.

Thailand's planned penetration into rural communities mainly occurred, initially at least, through the introduction of networked computing facilities in secondary schools. However, the lack of necessary infrastructure in rural areas meant an inevitable time lag in the introduction of the technology, as compared to their urban counterparts.

These remarks made by Mr. Jemal-ud-din Kassum in a speech at Thailand's Innovation Day (June 11, 2001) are well suited to convey the gulf that lied between dreams and reality in Thailand two years ago:

'There are only two telephone lines for every 100 people in Thailand's poorest region, the north-east. There are only five lines for every 100 people in the north, and seven lines for every 100 people in the central region. This compares with 36 lines per 100 people in Bangkok. Roughly 10,000 of Thailand's 70,000 villages still have no telephone access at all. This is not just a question of universal access. The truth is that these regions are those that need to do the most to reduce poverty.'....'While the teledensity figures are striking, the distribution of Internet access is even more so. Fully 91% of Internet users are urban, and

only 9% are rural.'....'It is also clear that as part of this drive for success in the 21st Century we have to do more to incorporate the poor and disadvantaged into the growth and prosperity process'...'Innovation in rural communities can spearhead this inclusive approach to the growing challenges of development. It can unleash the full potential of an individual or of a community. But in so doing it can also reduce the growth of urbanization and the drift towards towns and cities. It can hold families and small rural communities together'....'It can help to reduce environmental pressures. It can improve everyone's standard of living.'

(<http://web.worldbank.org>)

However, with the help of sensible/sensitive government policies a group comprising International Authorities, Private Sector Elements, Government Elements, NGOs, and a group of advisers, sponsored what is known today as Thairuralnet.org. Thai RuralNet's charter in a nutshell is the maximization of Thailand's rural sector entrepreneurial capabilities using digital technologies as a driver. It has three main objectives:

- To achieve ICT-driven sustainable rural community development aligned with the demands of the communities.
- To raise the level of awareness among youth groups in terms of rural development issues
- To establish consultants specialized in ICT solutions for the rural sector.

The introduction of ICT driven initiatives in Thailand's rural community does not present a difficult problem in terms of manpower. Thai universities have a history of participation in rural development activities through their students. Because of this cheap source of manpower Thai RuralNet sees itself as a cost effective body, with optimal rural penetration, well placed at the core of an ongoing rural development 'value chain' consisting of a variety of projects in need of management and coordination.

Thai RuralNet has four proposed solutions that it has implemented in order to achieve its stated objectives and ultimately the realization of its goal, these are:

- E-Chaoban Rural-ICT Suite: Strategic information Systems for rural-ICT basic needs. A system that would enable rural communities to access product specific information such as produce prices, costs of supplies, etc. The system also enables the transfer to storage of local practical and cultural knowledge.
- Community based tourism project. To help local communities preserve their cultural heritage through community-based tourism driven by ICT.
- Young eTrader for rural development program. Educate and produce young eTraders to trade rural products locally and internationally via electronic commerce
- Youth network development cluster.

Although these programs have an element of practicality embedded in them, their main function at this stage is to raise the level of awareness in rural communities of ICT opportunities. The use of students for the introduction of ICT means that the exposure to innovation in rural areas is achieved using familiar methods and therefore more likely to succeed.

ThaiTambon.com is another initiative founded in 1999 by Dr. Thaksin Shinawatra, now Prime Minister of Thailand, for the development of rural areas. In terms of granularity it operates at the sub-district level (tambon) with the purpose to provide encouragement and opportunities for rural people to access the internet. ThaiTambon.com went online on June 24, 2000. Its main charter is to provide at the sub-district level a comprehensive database holding information about transport, government public service, local products and industry information sharing, tourism, hotels and restaurant. In addition the website is used to promote local products for every Tambon and act as a commercial hub for trading the products, hopefully leading to an eventual exploitation of the eCommerce facilities provided on the website. Another goal of this venture is to facilitate the introduction of ICT to the villages, to promote and encourage tourism at the Tambon level, to act as an information/ideas exchange hub, and improve communication across the Tambon milieu.

Since in conception ThaiTambon is showing good progress with data in 2002 showing information about:

- 7,270 tambon being posted (about 98% of Thailand's tambon).
- 21,000 items/goods listed.
- 67 rural groups with 1,750 items/goods participating in eCommerce activities
- The encouragement of the use of English text for eCommerce products with the cooperation of the Department of Export Promotion.
- A system to that will allow data of SME to be entered into ThaiTambon database with links to the SME homepage. This will allow searchers a much wider scope of products.

www.ThaiTambon.com

Below is a diagram (extracted from the ThaiTambon website) showing the development plan for ThaiTambon in 2003 (now drawing to a close). As can be seen these plans include the addition of more eCommerce products, the addition of more districts, and sub-districts in the Bangkok area, dramatically increase the number of linkages to SME to about 6,000 companies, and the promotion of ThaiTambon at the international level.

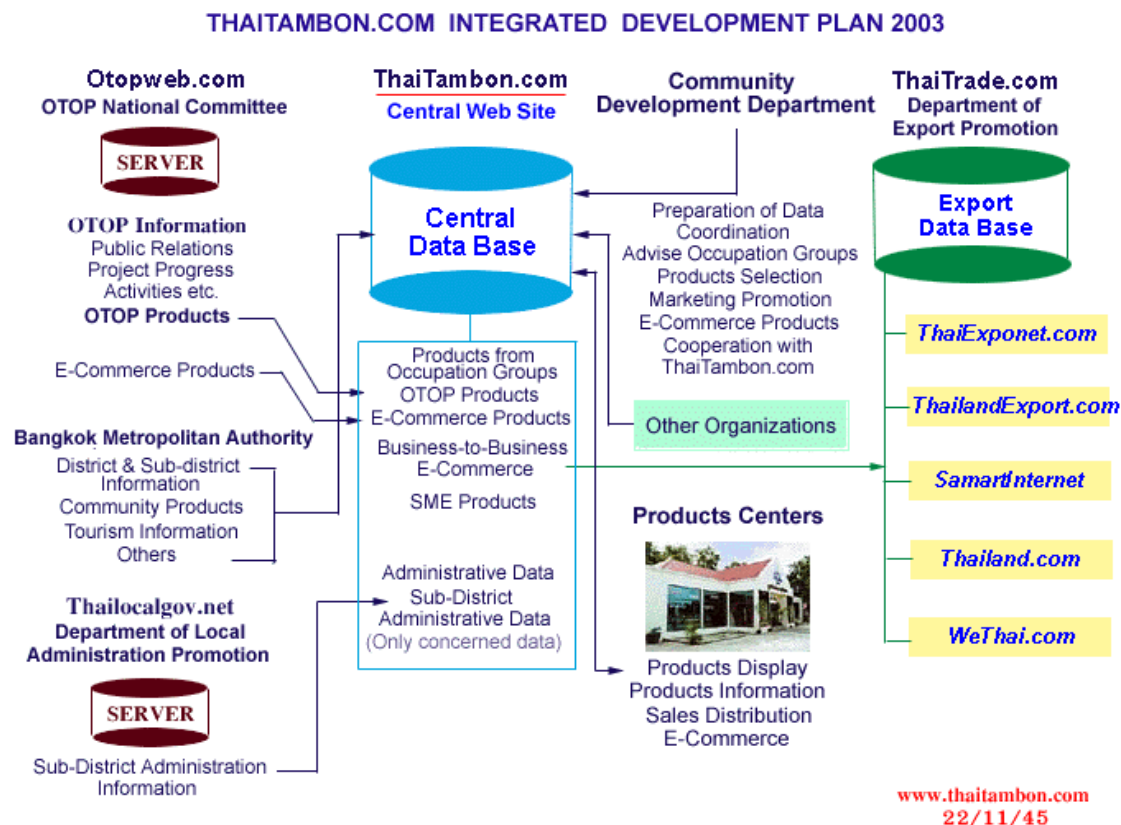


Figure 7: ThaiTambon.com Integrated Development Plan 2003

It is interesting to note that observations made by the implementers of the systems in these supposedly 'virgin waters' are very much in line with implementation policies resulting from observations made in Western cultures.

These are:

Local participation is the key in the success of the information system's planning, implementation and usage. The community must help design the structure, content and the interface of the systems in order for them to totally make efficient use of the systems and having a sense of ownership of the systems.

User requirement research and analysis is very important. Communities rarely use components of the systems they did not really want at the first place. Some minor problems with planning and implementing the information systems at Tah-Nat is that the project offer to many solutions which the community doesn't really need at their first stage of learning to use ICTs for their benefits. However, as they learned the basic, they started to develop new needs that are more complex. Therefore, the building and implementing of rural information systems should be done in a step-by-step manner. Only give them more complex component when they need it in order to prevent them from losing focus and interest resulted from giving out too much at the same time. Hence, the systems engineers and staff must be very patient in implementing different stages of information systems.

(www.thairuralnet.org)

So while one may argue 'cultural differences' from a technology leapfrog point of view, it would seem that as long as the people belonging to the culture are implementing the more traditional implementation problems that occur at the implementer/user boundary emerge.

In summing up the section, we believe that a major technological leapfrog has occurred in Thailand's urban areas over the past 15 years, and that a similar leapfrog is now occurring in its rural areas. We also believe that Thailand is going about the introduction of ICT in a responsible way, ensuring as far as possible that the emancipatory effects of such a move reach as many of its citizens as humanly possible. If one considers that the first email from Thailand's Prince of Songkhla University was sent to Melbourne University on June 2nd, 1988 (Palasri et al., 1999), and that by early 2003 (just 15 years later) Thailand had 6,000,000 people on-line (www.ntl.nectec.or.th), the growth has been staggering. Such a growth could not have been sustained using 1988 copper-based technology and associated infrastructure even in an enhanced form, but could only have occurred through a well planned remarkable leapfrog in technology. Thailand has made remarkable progress in a short time and has become a leader in ICT and related products in SEA and beyond, to the point in fact where it is now selling its services abroad (Corben, 2003).

7. CONCLUSION

The paper has discussed specifically those technologies and initiatives that need to be in place for a successful transition to electronic commerce in Thailand, thus supporting the direction of the "New Economy". Initiatives such as telecommunication infrastructure, government legislation, pro-active Internet initiatives, technology parks, incubators, etc. have been put in place with good progression since the early 1980's and more significantly the 1990's. The Financial crash of 1997 has significantly impacted the progression of all these areas and placed the Thai Governments projected plans on hold or at the very least behind their original proposals. With the take up of mobile phones the proposed telecommunications rollout figures also seem to be somewhat confusing.

The Thai Government and educators are compelled to pursue technology leapfrogging to build their economy. The Thai population is demanding the services of the "New Economy" and Thai industry are still grappling with the enormous task ahead and the recovery of the financial crash on 1997. Through all these areas the cultural impact, which has been researched in detail by Hofstede (1991), Thanasankit (2000), Rohitratana (1998), Sorod (1991) and Corbitt and Thanasankit (2002b) to name a few, has not been truly taken into consideration and could slow the progress of technology development in Thailand even further. "How do you change cultural impacts on technology developments?" seems to be the real and imposing question here. As the acceptance of risk and the tolerance of failure are not part of the culture there are significant cultural changes to be made. These can only be accomplished through education, starting with communities and universities. One approach could be the focus on customer relationship management across these areas that would bolster acceptance of the new technologies while continuing the cultural relationship building that the Thais are accustomed to.

Through initiatives such as technology parks and research and development, Thailand are progressing forward, but further joint international initiatives with Government, Education and Industry could be the quickest route to e-enable Thailand in the near future. The World Bank has taken a significant interest in initiating the Thailand Innovation Day, with the Thai Government and other Governments such as Australia are working on joint programs, such as the Australia/Thailand Higher Education Network Service, to support the sharing of information, resources and education (Goldsworthy, 1997).

Appendix A suggests a study of Information Technology education take-up in universities to support technology-leapfrogging initiatives implemented by the Thai Government, identifying a number of questions that need to be addressed. A further strategy to encourage small communities and businesses through community education programs is

suggested in Appendix B, that includes a pilot project recommendation to test the successful implementation of this strategy in a community in Chiang Mai Thailand, that would also document the issues identified, including Government and cultural impacts, in order to establish a model that could be replicated and implemented in communities throughout developing countries.

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APPENDIX A

Statistical Research Recommendation

The e-enablement of small to medium enterprises, those companies employing 1-99 employees, (these should be grouped as: 1-4 persons, 5-19 persons and 20-99 persons. Those enterprises with 100+ persons are considered large enterprises). The required analysis should include these significant sources of information:

1. Do they use Computers in their business?
2. Do they have Internet access from their work place?
3. Do they have a Website/home page?
4. Do they use the Internet/Website to receive orders for goods or services?
5. Do they use the Internet/Website to order goods or services?
6. What is the value of Internet Commerce as a proportion of their total operating revenue/sales?'

It is monitoring these three elements that will give a basic understanding of e-enablement. This information can then be compared with the same information collected about other countries (this information is usually available from the Bureau of Statistics in the relevant countries).

I recommend following these three basic enablement steps for the e-enablement of an enterprise or community:

1) The enterprise, community should be using computers in their daily activities. If enabling an enterprise they should have a computer that they conduct their business on. This should be in the form of administration (file) communications (letters) finance (invoicing and managing finances - using an off the shelf product is the easiest and most acceptable approach). If enabling a community the community should have computers that the community can access either at a school or library. These should be linked to the Internet for searching the World Wide Web for information and should provide each user with:

- An email address for community and Internet communications,
- A word processing and printing facility, and
- User training.

There should also be access to a community support person where further training and the purchase of PC's and software are available. Another community could provide this if the community is too small to support a single community provider. Business training classes could also be conducted through the community centre to support community enablement. These classes should be conducted in products that can be supported and purchased by businesses within the community.

2) Once Computers are in use the e-enablement of the enterprise/community is stage 2 of the program. In both cases this means:

Establishing an Internet Service Provider (ISP) that can support the community with low cost Internet Access Services.

Establishing a financial, cabling, software and hardware infrastructure to support the services being provided including 24 hours a day, 7 days a week support.

3) Final stage in e-enablement is the creation of Websites/home pages for the enterprise/community.

This then gives the presence on the World Wide Web of the enterprise/community. An enterprise should be engaged, if it does not already exist, that provides Websites/home pages development and support for each enterprise/community and should be able to maintain and update these Websites/home. As industries grow and develop they may wish to employ a full time developer or Website maintenance officer in which case training should then be available to provide the skills required to maintain these sites. This training could be held in community classes or conducted by the enterprise that originally provided the development and maintenance. These three steps are acknowledged as significant in the e-enablement of communities and businesses. There is a further stage that would provide an e-commerce capability that would place the enterprise/community at the leading edge of e-enablement. This is the Business-to-Business (B2B) electronic communications of selling, purchasing, invoicing and receiving payments electronically. This is a significant stage in the electronic development of any enterprise/community and would be the expected progression from the three previous stages.

Project Recommendation:

Engage a small community as a pilot project to test the above three-stage methodology.

Stage One is the most important stage which includes provision of PC's, cabling, training with enterprise/community support in order to succeed (this community support would have to include community funding for the purchase of any equipment with the payment of training being paid for by individuals receiving the training although in some instances the community may wish to supplement a community members training).

Stage Two should include engaging the local ISP to provide Internet Access to the community (funding could be on a user pays model as utilised by Internet Cafés globally).

Stage Three would require engaging a Webpage hosting company that could also provide technical and training support, a website developer and maintainer, these being funded by fees paid by the community.

From this information a project plan including all costs, risks, cultural and Government impacts, identified and further requirements should be prepared and the community consulted for feed back on the project before implementing this in further communities.

As these communities are not affluent costs will play a significant part in the acceptance and initiation of the projects. Time frames will also be extremely important if the projects are being funded by other organisations or interested parties.