

Information Technology: Some Implications for Thailand

Chanin Mephokee

1. INTRODUCTION

The IT Revolution has been progressing on a global scale with the rapid advancement of computer and communications technologies. The IT Revolution, like the industrial revolution in the 18th century starting in England, has changed world society. While the industrial revolution changed agricultural society to industrial society, the IT Revolution is going to change society into a 'knowledge-emergent society.' Advancements in information technologies, primarily the Internet, will change the quality of information exchanges and revolutionize relationships between individuals, between individuals and organizations, and between individuals and society, by drastically reducing the costs and time for information distribution. Geographical differences will cease to be a burden for people to communicate as everyone in the world will be living under an identical IT network.

Current IT innovations can be divided into those in information processing technology and those in information transmission technology. In terms of the former, the processing capacity of semiconductors has increased by more than 10,000 times over the last 30 years. Information processing technology innovation has opened the way for miniaturization, major price reductions and staggering advances in performance, causing an explosive global-scale expansion in information-related

equipment hardware and software markets. In the case of information transmission technology, innovations allowing the high-speed, low-cost transmission of high-volume processed information are also creating new possibilities. The spread of Internet technology and fiber optic-based WDM technology means that large amounts of information can be exchanged among a wide range of people, making possible multilateral business activities on a global scale.

In historical perspective, the Internet has diffused at a faster rate than earlier generations of communications technology. From 1990 to early 2000, the estimated number of Internet users grew more than tenfold to roughly 300 million, affecting the way in which people communicate with each other, acquire information, learn, do business, and interact culturally. In Asia alone, it is expected that by 2003 Asia's B2B e-commerce will top US\$272 billion and the number of Internet users will be 228 million by 2005.

Thailand has always adopted a policy to open itself to the global economy. As a small developing country, Thailand has played two roles in the IT Revolution era. First, Thailand plays the role of the IT consumer who adopts this new technology for both consumption and production, to improve the quality of life of the people and to improve productivity. Thailand also plays the role of an IT producer. The country has been successful in attracting foreign direct investment in IT industry. As an IT user, Thailand realizes that IT is an effective tool to raise the competitiveness of the country. According to the National Economic and Social Development Board (NESDB) and the World Bank, many Thai industries are losing competitiveness, compared to their competitors. Most Thai industries have much lower margins because of a lower level of skilled labor, lower product quality, and higher material costs due to higher reject rates and poor material yields.

Once IT is introduced into the production process, it can reduce the cost of procurement, marketing and administration. In the supply chain, IT can lower the cost of procuring materials and reduce cash-to-cash cycle time. IT also increases efficiency in managing customer relations and raises customer satisfaction (demand chain). Thus introducing IT, including e-commerce and B2B e-commerce, into the Thai manufacturing sectors is one of the most pressing issues for maintaining Thai competitiveness.

As an IT producer, Thailand is one of the IT production bases for IT-related MNCs. Since labor cost is no longer a Thai advantage, in order to

lure FDI, Thailand has to upgrade its production process to a high technology process that requires higher labor skills. Therefore IT investment in Thailand would increase demand for skilled labor and decrease demand for unskilled labor. Of course a shortage of skilled labor will exist in some fields, while simultaneously unemployment will rise in some sectors.

Approximately 200,000 workers are working in IT-related industry in Thailand, which accounts for 5 percent of total manufactured labor. Obviously, any change in employment patterns will affect them directly. Moreover, workers as a whole will be affected indirectly due to IT. When IT is in use, manufacturing will be able to produce with less employment. This decline in employment is the unavoidable result of the IT Revolution. On the other hand, rapid growth in new markets such as the service sector will create new jobs. This will change the labor patterns in job creation, job destruction, and job switching in the Thai labor market.

This paper examines the current status of IT use in Thailand. To understand the impacts of the IT Revolution in Thailand, the paper will investigate the current status of IT in Thailand for both the IT user and the IT producer. Then the impacts on firms and employment will be discussed. Finally, the paper will provide some policy issues for promoting IT-literacy in Thailand.

2. CURRENT IT STATUS

2.1. Internet in Thailand

In Thailand the first Internet workshop started up at Asian Institute of Technology (AIT) in 1991 on the formation of an informal Internet Special Interest Group. After that, in 1992, six academic and research institutions were online using the Internet on a full-time basis. The Thai Social/Scientific, Academic and Research Network (ThaiSarn) is set up to be the Inter-University Network. In 1994, ThaiSarn reached 27 institutes at 34 sites.

The Internet became commercialized in 1995. Internet Thailand or INET-TH was the first that was granted an ISP (Internet Service Provider) license by the Communications Authority of Thailand (CAT) in 1994 and started commercial operation in 1995. Internet Thailand is a joint venture between the National Science and Technology Development Agency (NSTDA), CAT, and the Telephone Organization of Thailand (TOT), which have shareholdings of 34 percent, 33 percent,

and 33 percent respectively. Internet Thailand commercial service is administered by the National Electronics and Computer Technology Center (NECTEC).

Currently Thailand has 18 commercial ISPs, 4 non-commercial Internet hubs, and 2 domestic Internet exchanges operating nationwide with 642Mbps total international bandwidth (into Thailand) and 526.5 Mbps total international bandwidth (out from Thailand). There are 2,300,000 Internet users, 71,995 Internet hosts under **.th** top-level domain and 6,282 Internet domains under **.th**.

Among 18 commercial ISPs, the three largest are the Internet Thailand Company, KSC Comnet and the Loxinfo Company. In order to be granted ISP license from CAT, the new entity must be a joint venture with CAT and CAT will get 35 percent of the total equity for free (33 percent to CAT and 2 percent to CAT's staff). The new entity must buy leased circuits to the Internet through or from CAT. CAT also reserves the right to send its personnel to work in the ISP and has the right to veto the decisions made by the board of directors. Moreover, CAT also sets up guideline pricing for how much an ISP can charge its customers.

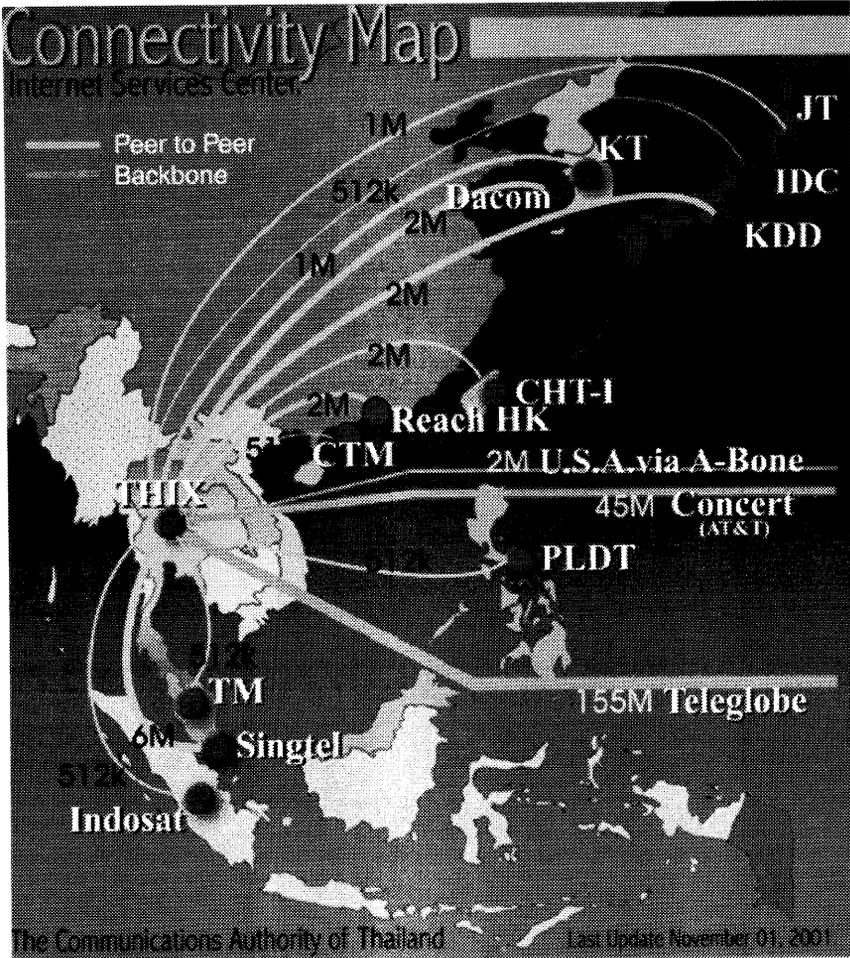
CAT (National Internet Exchange: NIX) and NECTEC (Internet Information Research: IIR) are the two domestic Internet exchanges in

Table 7.1: Monthly Charge by International Internet Gateway in US\$

Speed (Kbps)	1 year	3 years	5 years
64	1,000	900	800
128	1,280	1,160	1,030
192	1,550	1,390	1,240
256	1,800	1,620	1,440
384	2,290	2,060	1,840
512	2,780	2,500	2,220
768	3,740	3,360	2,990
1,024	4,720	4,240	3,770
1,536	6,750	6,080	5,400
2 Mbps	8,920	8,020	7,130
4 Mbps	14,580	13,130	11,660
6 Mbps	19,990	18,000	15,990
8 Mbps	24,000	21,600	19,210
16 Mbps	43,190	38,870	34,560
34 Mbps	81,010	72,910	64,810
45 Mbps	95,000	84,910	75,470

Source: CAT, 2001.

Figure 7.1: Internet Connectivity in Thailand



Sources: <http://www.cat.net.th/iig.html>.

Thailand. Therefore the domestic ISPs do not have to link internationally. They are characterized as a low hop-count, fat pipe conducts to all major commercial ISPs and major academic/research/government hubs (Figure 7.1).

CAT (International Internet Gateway: IIG) is the only international Internet gateway, connecting domestic Internet networks to the global Internet network. The total international bandwidth backbone is 202 Mbps and the total international bandwidth peer to peer is 15Mbps. The

international Internet providers include AT&T (US), Dacom (Korea), Nacsis (Japan), NTT (Japan), Reach (Hong Kong), Singtel (Singapore), and Teleglobe (US), for example (Figure 7.2).

2.2. As the IT Consumer

2.2.1. The Use of IT in Thailand

(a) The number of computer users and Internet subscribers

According to the Association of the Thai Computer Industry (ATCI), the number of personal computers (PCs) sold has been increasing over time. In 1995, there were 271,300 units of PCs sold in Thailand and this number jumped to 479,300 units in 2000 which is a 76.6 percent increase.

Table 7.2: Numbers of PCs Sold in Thailand

Year	PC (unit)	Monitor (unit)
1995	271,300	938,000
1996	312,540	119,000
1997	289,000	101,000
1998	174,000	70,000
1999	300,600	160,000
2000	479,300	263,000
2001e	580,090	315,600

Source: ATCI, 2001.

The National Statistic Office (NSO) conducted the survey on IT used by households during January-March 2001, it was found that there are 812,565 households having and using computers, or 5.04 percent of total households. However there were 927,875 units of PCs being used that accounted for 5.75 units per 100 households or 1.48 units per 100 people. This ratio is considered low because, according to the WTO, the PC ratio per 100 inhabitants is 18 for high-income countries, 2.3 for medium-income and 0.1 for low-income.

There were 2,277,046 households having access to the Internet, accounting for 14.11 percent of total households in the whole kingdom. However, there were only 3.04 percent of total households having Internet access at home, with the remaining 11.07 percent using the Internet from other sources, e.g., schools, work places, and Internet shops. Some 3,536,001 persons only have ever logged onto the Internet which is 5.64

percent of the total population. This penetration rate is relatively low compared to countries in the same region. The penetration rate in Hong Kong is 56.5 percent while these rates are 54.3 percent in Korea, 51.3 percent in Taiwan, 51.2 percent in Singapore, and 36.8 percent in Japan. The world's highest penetration rate is the US rate which is 58.1 percent. Considering this indicator, Thailand is far behind the world's leading Internet users.

Not only the low Internet population ratio, but Thailand also faces the problem of inappropriate use of the Internet. Most of the Internet population are in their 20s or teenagers and they mainly use the Internet for entertainment such as playing games or entering 'chat rooms,' and use less for education or getting information.

The high price of IT equipment is the main explanation of this low use of the Internet. Therefore this low rate of IT utilization has left firms unable to prepare for IT network globalization. Moreover Thai workers have little opportunity to learn how to command information technology in order to fit into this new type of industry.

(b) The use of e-commerce

Due to the low penetration of PCs and the Internet, e-commerce in Thailand is still in the early stage. The National Electronic and Computer Technology Center (NECTEC) in 1999 showed that more than 81.6 percent of Internet users in Thailand have no experience in joining B2C e-commerce as buyers of online goods and services. For B2C e-commerce, by comparing the ratio of Web servers with secured socket layer protocol to 1 million persons, it was found that in 1998, this ratio for Thailand was 0.42 units per 1 million persons, compared to 19.82 in Singapore and 1.94 in Malaysia. This shows that the development of B2C e-commerce is very low, compared to countries in the same region.

Table 7.3: B2C E-Commerce Used, 1998

Country	B2C E-Commerce per Million Persons
Singapore	19.82
Japan	10.73
Hong Kong	10.32
Taiwan	4.94
Korea	3.80
Malaysia	1.94
Thailand	0.42
Philippines	0.10
Indonesia	0.05

Source: TDRI.

2.2.2. Digital Divide

According to the ILO, World Employment Report 2001, technological change always favors the prepared. The different speeds of change and different stages of preparedness mean that there exist differences in IT use, the so called 'digital divides.' IT infrastructure and activities are highly concentrated in a few countries, especially the US. Currently, approximately 85 percent of world e-commerce Websites are US-based. Within countries, the digital divide often has common characteristics. Use of the Internet is more common among younger than older people, men than women, the more rather than less educated, urban rather than rural dwellers, and those with higher incomes than those with lower incomes. The most significant factors are the level of education and the level of income. The ILO reports that only 6 percent of the world population has access to the Internet, and 85 to 90 percent of them are in the industrialized countries.

There are also great divides among Asian countries. In terms of Internet host penetration, for example, Thailand is considered less wired than Hong Kong, Singapore, Japan, Korea and Malaysia, but more advanced than the Philippines and Indonesia.

Table 7.4: Number of Internet Hosts per 1,000 Population in Some Selected Asian Countries, 1999

Countries	Number of Internet Hosts per 1,000 Persons
Hong Kong	66.4
Singapore	22.19
Japan	16.6
Korea	6.03
Malaysia	2.8
Thailand	0.49
Philippines	0.23
Indonesia	0.18

Source: S. Tangkitvanich, *TDRI Quarterly Review*, Mar. 2001.

In Thailand, there also exists a digital divide among regions. According to the National Statistics Office (NSO), there are differences in numbers of households using PCs among regions. As expected, the households having PCs at home are concentrated in the municipal areas (78.9 percent) and the rest, 21.1 percent, are outside municipal areas. Inside the

municipal areas, 12.27 percent of total municipal households have PCs at home while only 1.57 percent of total households living outside the municipal areas have PCs at home. Among households having PCs at home, there are 48.2 percent living in Bangkok, where we find the lowest share of population (12.3 percent) but the highest income level. The second highest share of households having PCs at home is in the Central region, accounting for 22.7 percent. Only 1.93 percent of the PC population is living in the Northeast region where we find the lowest household income level but the highest share of population (33.37 percent) in the country (see Table 7.5).

Table 7.5: Percentages of Households Having PCs at Home by Regions, 2001

Region	Number of Households	Percentage	Per 100 Households	Population
1. Whole Kingdom	812,565	100.0	5.04	100.0
- Municipal area	640,852	78.9	12.27	32.5
- Non-Municipal	171,713	21.1	1.57	67.5
2. Bangkok	391,188	48.2	19.77	12.3
3. Central	184,593	22.7	5.07	22.6
4. North	88,015	10.8	2.77	18.0
5. Northeast	103,064	12.7	1.93	33.7
6. South	45,705	5.6	2.16	13.4

Source: National Statistic Office, 2001b.

Internet use in Thailand as shown in Table 7.6 clearly highlights the existence of a digital divide among regions. In 2001, the NSO found that there were 2.277 million households with access to the Internet, 61.7 percent of them living in the municipal area and only 2.82 percent living outside the municipal area. There were 29.9 percent of households having access to the Internet living in Bangkok, compare to 24.9 percent residing in the Central region, 16.7 percent living in the North, 16.9 percent living in the Northeast, and 11.6 percent living in the South. As a ratio of the Internet population to 100 persons, 16 percent of the population in Bangkok have logged on to the Internet, while only 2.64 percent of the population in the Northeast have access to the Internet.

According to the NSO, the use of IT is concentrated in Bangkok, and the Central and South regions. The digital divide can be explained by the differences in monthly household incomes. By the NSO survey, in 2000,

Table 7.6: Percentages of Households Having Access to the Internet by Regions, 2001

Region	Number of households	Percentages	Per 100 population
1. Whole Kingdom	2,277,048	100.0	5.64
- Municipal	1,404,654	61.7	11.50
- Non-Municipal	872,392	38.3	2.82
2. Bangkok	680,297	29.9	16.00
3. Central	566,795	24.9	5.85
4. North	380,267	16.7	4.57
5. Northeast	384,169	16.9	2.64
6. South	265,518	11.6	4.72

Source: National Statistic Office, 2001b.

households living in Greater Bangkok (including Nonthaburi, Pathumthani, and Samut Prakran) had the highest incomes of 24,690 Baht per household or 7,716 Baht per person. Households living in the Central region were the second highest in monthly income per household with 13,301 Baht or 3,800 Baht per person. The Southern households were ranked third with monthly income of 11,407 Baht or 3,002 Baht per person. The ranking in monthly household income is compatible to the ranking of IT use by households. Therefore it may be concluded that the inequality in income distribution among regions is one major factors creating regional digital divides in Thailand (see Table 7.7).

Table 7.7: Average Monthly Income per Household by District, 2000

Region	Per Household (Baht)	Per Person (Baht)
Whole Kingdom	12,167	3,386
Greater Bangkok	24,690	7,716
Central	13,301	3,800
North	8,649	2,544
Northeast	7,853	2,014
South	11,407	3,002

Source: NSO, 2001a.

In the supply side, the inequality in telecommunication infrastructure among regions is also the factor of regional digital divides. The phones per 100 people ratio in Greater Bangkok is almost 5 times higher than

Table 7.8: Telephones per 100 People Ratio

Year	Whole Kingdom	Greater Bangkok	Provinces
1992	5.45	26.70	1.66
1993	6.41	30.77	2.29
1994	7.50	35.00	2.62
1995	8.67	39.05	3.45
1996	9.99	43.10	4.26
1997	11.43	46.66	5.31
1998	12.95	49.66	6.53
1999	14.55	52.45	6.02
2000	16.46	54.52	9.77
2001	16.45	55.05	11.76

Source: TOT.

the ratio in provinces. However after TOT authorized private companies to install telephone lines throughout the country, the telecommunication infrastructure in provinces has been improved significantly.

In the same region digital divides can be found as well. The NECTEC in 1999 found the existence of digital divides among age groups and between genders. About 57.5 percent of users were in their 20s, 22.5 percent were in their 30s, and 11 percent were teenagers. In terms of gender, it was found that 65 percent of users were male.

There also exists the digital divides between large firms and small firms. For Thai industry, the high cost of leased-lines makes it difficult for small- and medium-sized enterprises (SMEs) to adopt an e-commerce model that requires an always-on connection. Concerning B2B e-commerce application, few SMEs can afford to use application software provided by Application Service Providers (APS), which requires a costly high-speed leased-line to function smoothly. The high leased-line price also hinders SMEs from connecting with suppliers and logistic operators, a prerequisite for managing supply chains. For the same reason, B2C e-commerce operators cannot provide a real-time response for an inquiry from a customer. Therefore there exists a difference in IT use between large firms and SMEs, and this difference leads to the difference in their performance (intra-industrial digital divides).

It is believed that education level is a main factor for digital divides in Thailand as well. Unfortunately, there is no data to prove this belief.

2.3. As the IT Producer

2.3.1. Firms

Thailand is one of the host countries for investing in IT industry. Many multinational firms, especially Japanese and American firms, have been investing in Thailand since the 1960s. In the early 1960s, Japan's Matsushita Corporation set up a company under the name 'National Thai' to produce radio and television sets for the domestic market. After that most Japanese home electronics appliance firms, such as Mitsubishi, Toshiba, Sanyo, and Hitachi, began direct investment in the latter half of the 1960s. In this period, the only non-Japanese foreign affiliated firm was the one set up by ITT to produce telephone receivers and electronics parts.

The 1970s was the development stage for integrated circuits (ICs) in Thailand, characterized by the direct investment of major IC producers such as National Semiconductor, Signetics, and Data-General. In the early 1970s, the main purpose of FDI in Thailand changed to an export-oriented one.

The 1980s was the period of expansion and diversification of the IT industry. A new Thailand investment policy encouraged whole-foreign ownership for direct investment projects that were export-oriented. During 1982-1986, there were 27 investors with 13,950 million Baht invested, generating 18,776 jobs. Most of them were American and Japanese companies. Minebea, a Japanese bearing producer, established three wholly-owned subsidiaries to produce mini-bearings, keyboards, plastic parts, and other items for export. Seagate Technology, an American firm, also started to produce some parts for its computer hard disk assembly plant in Singapore. Fujikura, a Japanese firm, invested in production plants for keyboards, ICs and other electronics parts. AT&T Microelectronics (Thailand) started producing PCBs for export as well.

Currently, the main IT products produced in Thailand are computer peripherals (such as monitors, printers, keyboards, HDDs and parts, and PCBs) and integrated circuits (ICs). Since the Thai market is relatively small, 80 percent of products are for export. The main producers, all foreign companies, are ADI (Thailand) for monitors, Canon for printers, Fujitsu for printers and HDDs, Minebea for keyboards and HDD parts, Seagate for Head Gimbal Assembly (HGA) and Head Stack Assembly (HAS), and IBM for HDDs. As a result, for the past 10 years, computers

Table 7.9: Export Share Five of Thailand's Major Export Items

(Unit: %)

	1997	1998	1999	2000	2001 (Jan.-Sept.)
Computers and parts	12.2	14.3	13.8	12.4	11.9
ICs	4.2	4.2	5.0	6.5	5.5
Vehicles and parts	2.7	3.1	4.1	4.4	4.8
Garments	5.4	5.5	5.0	4.5	4.5
Shrimp	2.6	2.6	2.2	2.2	3.3
Total Export (\$billion)	58.3	54.5	58.5	69.9	49.3

Source: Ministry of Commerce.

and parts and ICs have become the two most important exporting items for Thailand, accounting for approximately 18 percent of total export value.

Normally, the production process in Thailand is an assembling process that requires all the important components from abroad and the products are low-end products. For example, Canon produces mainly dot matrix printers while Fujitsu produces HDDs mainly desktop drives. Both are low-end products. Therefore the technology used in Thai IT industry is low technology and labor-intensive requiring less labor skills. Since the production process is on downstream industry and products are for export, there does not exist a forward and backward linkage in the Thai IT industry. Even some components that the foreign affiliates purchase domestically are produced by the foreign affiliates. For example,

Table 7.10: Summary of FDI in IT Industry in Thailand, 1990-2000

Year	Investors	Investment (Million Baht)	Thai Labor (Persons)
1990	49	11,563	8,917
1991	30	6,323	7,770
1992	56	14,119	19,220
1993	44	5,776	14,001
1994	74	13,159	21,009
1995	138	40,982	75,417
1996	149	68,712	55,932
1997	117	66,372	46,872
1998	116	53,100	45,971
1999	111	21,723	55,431
2000	185	63,091	73,646

Source: Board of Investment, 2001.

Nidec, the biggest producer of spindle motors, set up its facilities in 1990 and 50 percent of its products are used domestically by other foreign affiliates. Local IT firms play a small subcontracting role supplying minor components for foreign firms in the IT industry and there is no positive condition for technology transfer.

However it is undeniable that for the past 10 years the amount of FDI in the Thai IT industry has been increasing significantly from 11.56 billion Baht in 1990 to 63.09 billion Baht in 2000. This 10 years of FDI in the IT industry has created more than 200,000 jobs for Thai workers.

2.3.2. Workers

There are 31.39 million employed persons working in Thailand. Among them 12.6 million work in the agricultural and fishing sector and 5 million work in the manufacturing sector, accounting for 40.14 percent and 15.93 percent of the workforce, respectively. By age, 30 percent or about 9 million, are 40 years old or older and 13 million.

Therefore, 30 percent of Thai workers are considered too old to be reeducated in new technology. Furthermore, more than half of them attained an insufficient education to learn new technology. According to the Labor Force Survey 2001, conducted by the NSO, 65 percent of the workforce has elementary or lower formal education. This figure may fair better if we only consider those employed in IT-related industry, as they are considered to have one of the highest education levels among manufacturing worker groups. However, Thai workers in general have low levels of education and lack basic knowledge in both English and mathematics.

Table 7.11: Workforce by Level of Educational Attainment, 2001

Level of Education	Workforce (Thousands)	Percentages
Total	31,388.20	100.00
None	1,089.70	3.47
Less than Elementary	12,432.80	39.61
Elementary	7,003.80	22.31
Lower Secondary	4,036.30	12.86
Upper Secondary	3,160.40	10.07
Higher level	3,576.80	11.40
Others	88.40	0.28

Source: National Statistic Office, *Labor Force Survey*, 2001c.

Similarly, more than 50 percent of those unemployed only have a formal education of elementary or lower. For this group, with a poor education and no income, it is almost impossible to attain new skills without help from the government. And, needless to say, without new skills they cannot reenter the job market. They were the first to suffer from the 1997 Thai financial crisis and they will be the first to suffer from the IT Revolution in the near future.

Table 7.12: Unemployed by Level of Educational Attainment, 2001

Level of Education	Unemployed (Thousands)	Percentages
Total	1188.4	100.000
None	13.5	1.135
Less than Elementary	282.1	23.738
Elementary	372.1	31.311
Lower Secondary	193.2	16.257
Upper Secondary	167.4	14.086
Higher Level	159.0	13.379
Others	1.1	0.093

Source: National Statistic Office, *Labor Force Survey*, 2001c.

Therefore the hurdles facing the Thai workforce are great, for not only do they not have enough basic education to learn new technology, but the lack of industry linkage, the high cost of IT, and the high mobility of job changes also conspire against them. Indeed, this lack of favorable conditions for Thai workers is a more serious problem than the low levels of education.

2.3.3. Telecommunications Infrastructure

Like most nations, Thailand's telecommunications development is under the direction of the government. At present, telecommunications infrastructure development is carried out by three organizations: the Post and Telegraph Department (PTD), the Telephone Organization of Thailand (TOT) and the Communication Authority of Thailand (CAT).

The PTD was first established in 1883. It is a government department headed by a director general and directed by the Ministry of Transport and Communication. PTD is primarily responsible for policy rules and regulations and at present is charged to manage and control radio frequencies and to regulate and coordinate domestic communications via

satellite through integrated ground stations. PTD is also responsible for studying application of advanced telecommunication technologies and preparing proposals for government consideration.

TOT, a state-owned enterprise under the Ministry of Transport and Communications, was established in 1954. Since then, TOT's main objectives have been to operate and develop national telephone services and to carry out all business relating to telephone activities. TOT is responsible for domestic services, international services to Laos and Malaysia and leased circuits for domestic point-to-point transmission of voice, telegraph, radio and television. Recently TOT has introduced many new services, including Special SPC Exchange System Services, Toll-Free Call 088 services, NMT 470MHz and 900MHz mobile phone services, Paging services and Data Transmission Network services (DATANET).

CAT, a state-owned enterprise under the Ministry of Transport and Communications, was established in 1976. CAT's main objectives are to operate and improve the activities of the posts and telecommunication system under the CAT ACT, 1976. CAT is responsible for the postal, telegraph, telex, telephoto and facsimile services, domestic radio-links, and international leased circuits. Recently CAT began providing international database access (IDAR) services, mobile telephone 800MHz and paging service, and also offering circuits to telex subscribers to use teleprinters to send and receive domestic and international telegraph messages.

It can be seen that both monopoly state enterprises, CAT and TOT, are not strongly delineated, especially in value-added services, such as mobile phone services. To prepare Thailand for the new era of IT Revolution, the Telecommunications Master Plan 1997-2006 has been proposed. One of the goals of the Master Plan is to increase the competitiveness of the industry by abolishing existing state enterprise monopolies and open markets to competition under the regulation of an independent National Communications Committee (NCC). The NCC will regulate the pricing structure and the price levels in the markets. More importantly, both TOT and CAT have to be privatized and the companies' shares will be registered for public offerings on the stock exchange. In the process of privatization, both TOT and CAT will be broken up into two separate entities; whereby two will compete in local and value-added services, while the other two will compete in long-distance services (domestic and international). As it was international pressure, mainly

from the US, that initiated the Plan, so far the Master Plan has not been implemented.

3. IMPACT ON FIRMS AND EMPLOYMENT IN THAILAND

3.1. Impact on Firms

Though the developed countries account for most IT production (about 77 percent in 1995), developing countries have also increased their share through FDI. Developing countries produce 46 percent of the world's consumer electronics (*Yearbook of World Electronics Data* [1995]). Consumer electronics have been shifted to lower-wage economies with a relatively skilled workforce, while the producer countries move on to concentrate on products with higher value-added, such as software and sophisticated components. This shift first happened from Japan to Korea, and later from Korea to second-tier newly industrializing countries, such as Malaysia and Thailand. Currently, large emerging economies such as China and India have taken on much of the world production of electronic consumer goods. Therefore the IT Revolution will shift some IT production from Thailand to other countries such as China. In order to lure FDI, Thailand has to increase her IT environment to be able to produce higher-technology and medium-skilled labor products, instead.

With e-commerce growth in developing countries, one obvious sector to benefit is the IT industry, both hardware and software. On the other hand, this could mean a faster transfer of technology, but equally, it could also mean that existing IT multinational firms alone gain benefit if the local industry is weak. Some developing countries like Thailand have followed a policy of initially protecting local industry by encouraging joint ventures with multinationals while keeping the duty on component imports lower than on the import of computer equipment, thus encouraging local assembly and production. So far, however, the policy has not created strong industrial linkage in Thailand because of the weak domestic industry.

IT can also be used as a tool in other industries. Here are at least four different channels through which e-commerce may impact on Thai firms. First, IT makes it easier for firms to access B2C world markets. Secondly, IT can facilitate activity on the global market for Thai traditional products, such as handicrafts and processed food. IT allows local

firms to tap into the B2B (and B2G, maybe) supply chains. Finally, IT allows service-providing firms to operate more efficiently and to provide certain services directly to customers anywhere in the world.

In Thailand, with the low-level of basic skills of workers and lack of industrial linkage, Thai industry underutilizes the benefit from IT globalization. However, there is some evidence proving IT can improve small business performance in Thailand. For example, one rural community producing processed food products could not sell its products, but after introducing e-commerce in its marketing strategy, can now sell products overseas. In Thailand, so many cases show that community businesses failed because of their isolation from markets. At the same time, wealthy consumers willing to buy those products at a high price could not find suppliers. This case shows that e-commerce is the most cost-effective way to conduct marketing worldwide for SMEs in Thailand. Moreover, there is some evidence showing that SMEs can gain benefits from the Internet, unfortunately, the few successful cases documented show that the SMEs involved received strong support from NGOs.

The Samnuk-Rakbankerd Foundation, supported by the Thai telecommunication company United Communication Industry (UCOM), promotes mutual cooperation among village enterprises. Recently the foundation set up a Website called Rakbankerd. Com as a cyber-marketplace to benefit village enterprises. The foundation also helps village enterprises set up their own online facilities. Members not only offer their products for sale or search for intermediate products in this cyber market, but they also exchange products and technology information, including working experiences among members. For example, one village enterprise in the northern province of Kampangetch exchanged rice grain for seafood products from another village enterprise in the southern province of Ranong, without a middleman through the Internet. Also through the Internet they have been able to send their members to learn how to process seafood products at a fishing cooperative in the eastern province of Samut Songkram. By this way, they can sell products at higher prices and buy intermediate products at lower prices than before. Moreover, the technology exchanges can improve both their productivity and their managerial skills. These long-distance friendly relations between village enterprises could not be possible without IT.

Not only are SMEs with a Web presence more likely to be discovered than those without, but Internet savvy may also itself be a signal to potential customers of a certain level of technical and commercial

sophistication. A typical global supply chain involves multiple transactions: if at any point an electronic interface is not present, then the time and cost advantages of e-commerce is dissipated. Thus, international companies are unlikely to go to the expense of dealing with a non-Internet-capable supplier unless there is significant other cost advantages in doing so.

There are still some arguments saying that since SMEs in Thailand serve mainly local markets and rely mostly on locally generated information, the benefit from having Internet may be less than the costs of having it. This may be true in the short term, but in the long term when all economies merge to the world market, local marketing alone will not be a win-win solution for SMEs.

3.2. Impact on Thai Labor

3.2.1. Changes in Structure of Labor Demand

Global information networks have made it possible for different processes in the production chain to be linked worldwide, resulting in sharp declines in transaction costs and changes in employment structure. The introduction of IT to businesses leads to a rise in skill and educational requirements. Computers are taking on much of the work done by low-skilled workers in many firms and jobs are disappearing. In Thai manufacturing industry, the need for blue-collar workers to be more educated has grown with the rising intensity of capital formation. As many traditional production processes previously carried out by labor are displaced by machines, there has been a fall in employment of production workers. This has been accompanied by a redefining of much production work, as the introduction of new technology and new forms of work organization requires production workers to be more skilled and knowledgeable. Here demand for skilled labor increases while demand for low-skilled labor declines. Meanwhile the development of e-commerce promotes outsourcing, which again leads to more employment for office workers and less employment on production lines.

IT is expected to continue to diffuse rapidly over the next decade. The fast and continuously changing character of IT implies that today's skills may become obsolete tomorrow. It is not always that higher skills are required, but different skills definitely are. To keep up with these fast-changing skill requirements needs continuous retraining.

3.2.2. *Less Numbers of Workers*

Use of the Internet is nevertheless associated with new patterns of job creation and job loss. IT replaces old tasks and occupations through automation, such as the telephone switchboard operator and information provider in travel agents. But IT also creates new tasks and occupations, such as Webpage designers and software programmers.

It is difficult to say in advance the effect of IT on employment. However, after adopting IT firms require less workers. For example, Amazon.com had only 614 employees for sales of US\$148 million in 1998, or US\$267,000 of revenue per employee, compared to the largest US bookstore, Barnes and Noble, which had a sales force of 27,200 for sales of 2.8 billion, or US\$103,000 of revenue per employee. Once an economy applies IT at full speed large numbers of workers may lose their jobs. Here again, the least educated and lowest skilled workers will be the first to go. Furthermore, for country's like Thailand where access to training in new technologies is difficult for poorly educated workers, another problem that arises is that multinationals may switch investments to other countries that have workforces more capable of using IT, and many Thai workers would lose their jobs. The first to lose their jobs will be older workers with low levels of education and training and working in traditional industries or SMEs. These workers are those who do not have the basic education needed to learn IT or who are in an IT unfriendly environment. Therefore they face a two-pronged attack on their livelihoods; directly from the relocation of multinationals and indirectly from being replaced by new technology.

3.2.3. *Job Relocation*

One effect of IT is that working pattern is becoming independent of location and this will change management practices, the nature of the employment contract, and the quality of work.

The IT Revolution creates a relocation of jobs from industrialized countries to developing countries, such as back-office staff located in call centers, data entry processing, and software development. Work that is independent of location has a growing share of employment in industrialized countries. For example, almost one-fourth of the workforce in the UK now carries out at least some of its work at home. By 2003 there will be an estimated 1.3 million employed in call centers in the European

Union, up from an estimated 670,000 in 2001. Moreover, up to 5 percent of all service-sector jobs in industrialized countries could be relocated to developing countries. This would mean that about 12 million jobs could be moved to developing countries (ILO [2001]).

4. SOME POLICY ISSUES

As mentioned above, IT generates benefits for those who are prepared and harms those who are not, both firms and workers. The main problem that Thailand faces is the lack of an IT friendly environment. There are two main issues that Thailand needs to address immediately in order to create this environment, one is the competitive environment and the second is the IT literate society. The second one is the policy aimed at nurturing high-quality human resources for the global IT network.

4.1. Liberalizing Telecommunication Markets

In order to develop Thai workers to cope with the IT regime, liberalizing the telecommunication market is a necessary condition.

Telecommunication is an indispensable infrastructure for e-commerce. In many developing countries, monopoly of the sector is the hurdle preventing countries from entering the IT globalized network. In Thailand, although the retail Internet access market is quite competitive with 15 companies operating as ISPs, the whole market for international access is still monopolized by CAT. This monopoly creates many problems concerning the adoption of IT in Thailand.

First, the cost of Internet access in Thailand is significantly higher than in many other Asian countries. The higher cost leads to a lower number of Internet hosts, the computers connected to the Internet. Second, the state monopoly also imposes higher costs on users. CAT requires that every ISP hand over one-third of its user fee in return for the concession to operate. This leads to higher charges for IT users.

A country's readiness for e-commerce depends fundamentally on network infrastructure, including narrowband and broadband, and on costs for Internet access. The quality and range of services available depends on the emergence of innovative ISPs. Therefore, telecommunications reform has been a major determining factor in the emergence of the new global network economy (new economy). Faster and more reliable network infrastructure, associated with new ways of pricing, both for con-

sumers and for the leased-lines used in B2B transactions, have led to increased Internet connections to homes and businesses. Low access costs are an important factor driving uptake, while competition among infrastructure providers and among ISPs has led to innovative pricing structures.

Telecommunications deregulation has been gaining momentum in developing countries. More than 90 developing economies opened their telecommunications sector to competition between 1990 and 1998, transferring to the private sector more than 500 projects (OECD [2001]). Telecommunication reform can be a positive-sum game in which customers, existing and new operators, employees, domestic and foreign investors, and governments all gain. Competition should lead to lower prices and higher quality. However, poor performance by regulatory agencies may limit the benefits of reform.

Beyond the physical infrastructure, providing wide Internet access requires the emergence of local Internet Service Providers, low-cost connection to the Web, development of sites with local language content, and the offering of a range of other services demanded by local Internet users. For example, it should be possible to offer access to most users at local call rates and an ISP can lease a high-capacity line from the telecom service provider at a competitive rate. Just as in telecom services, competition needs to be fostered in the ISP market.

To promote the use of the Internet and e-commerce, Thailand needs to promote competition in the telecommunication market by allowing new firms to enter the market, both domestic and foreign. In particular, the telecommunication regulations have to be on the basis of consumer interests on the guidelines of the WTO's Basic Telecommunications Agreement.

4.2. Human Resource Development

As mentioned above, human development is another important factor to improve the digital divide among countries and within Thailand. As the economy gradually adopts e-commerce, skilled IT workers will be in increasing demand. Since there exists a brain drain of IT personnel from low pay industry to high pay industry and from less IT advanced countries to more IT advanced ones, there is no incentive for firms to invest in human resource development. Moreover, there exists a digital divide between new and traditional industries, large firms and SMEs, and cities

and rural areas. Since human resource is a public good that creates positive externalities, we face the problem of market failure. The Thai government has to play an important role as a main investor in IT human resource development. Not only by emphasizing the teaching of IT in schools but also by fostering an IT friendly environment. The main target is 'IT for All,' which implies that Thai people at any age, at any income level, and in any location, are able to learn and get access to new technology equally.

4.2.1. Regional Cooperation

For Thailand, building human resource cannot be achieved without technical assistance from abroad. In particular, the Japanese government announced an assistance package consisting of ODA (Official Development Assistance) public funding and non-ODA or OOF (Other Official Flows) with the view to extending a total of US\$15 billion over five years to Asian countries. The goal of the package is to bridge the digital divide between and within Asian countries. The funding will be used for:

- (a) Raising awareness of IT opportunities and contributing intellectually to policy and institutional building.
- (b) Developing and training human resources. In particular, Japan will provide assistance, mainly in the form of technical cooperation, for the training over 10,000 individuals during the next five years.
- (c) Building IT infrastructure and providing assistance for network establishment.
- (d) Promoting the use of IT in development assistance. In particular, the package will promote the use of IT in distance training, distance learning and the provision of medical care. During the first phase, Japan will establish 30 core IT centers.

In the case of Thailand, the assistance could be effectively used to provide computer and Internet access to schools, which is estimated to cost between 12.1 and 12.7 billion Baht a year. It can also be used to develop an effective program to raise awareness in the private sector and train human resources. In order to utilize this fund, Thailand should design the specified development program by herself and should use the loan projects carefully.

The World Bank also has a program concerning the digital divide.

The establishment of telecenters seems to be a favored investment for the World Bank, and various UN agencies, and regional development banks. UNDP, for example, has begun pilot projects aimed at the creation of electronic community centers as a platform for access and connectivity in rural areas. They will also serve as centers for capacity building, skills enhancement, training, communications and content development. SMEs are encouraged to utilize these facilities and they will be assisted in the creation of Websites, digital Web management and the conduct of e-commerce. In India, the USAID project provided telecenters to low-income women handicraft-producer groups, equipping and training them to use digital cameras and the Internet to market their wares while showcasing their cultural richness.

In the case of Thailand, this program will be very useful if we can combine this project with the project provided by the government on the village fund and the business-in-village project, the so called 'One product for One Tamboon.' The main problem facing community businesses is the lack of marketing skills and use of the Internet can solve this problem.

4.2.2. Role of Government

(a) Formal Education

In order to eliminate the digital divide in Thailand, the government should provide facilities for Internet access to schools nationwide, from elementary to junior and senior high schools. IT-driven lessons should be promoted, and instruction on IT-related ethics and manners should be introduced. English, the basic language in the Internet era, should be enriched. Besides, more importance should be placed on such subjects as mathematics and science to foster the ability of thinking logically. The environment to encourage schools to interact with other schools both inside and outside Thailand via the Internet to promote knowledge exchange should be fostered by the government. One problem the country faces is that at present people mainly use the Internet for entertainment and do not utilize this technology for human development. The proper use of the Internet in schools can set an important guideline for both teachers and students for the use of the Internet in the future.

However, Thai schools also face the problem of IT personnel shortage. Therefore, school teachers should be given more opportunities for IT training, and a registration and dispatch system of IT instructors

should be introduced, so that human resources in businesses and colleges can be utilized as IT instructors.

College system should be reviewed and actively reformed to the new IT society. Market mechanism should be introduced to adjust the supply of labor to the new demand for labor. Therefore, colleges should be able to exercise more autonomous management, including authority over personnel and budgetary matters, establishment of faculties, department and curriculum, and exchange of researchers with private businesses. The cooperation between educational institutes and business sectors is very important to develop human resource in Thailand.

Furthermore, an IT-related certification system should be standardized internationally.

(b) Training Program

IT is the tool that is used to increase productivity and reduce costs in almost all business sectors. However, this technology keeps changing over time. In order to keep up with technology changes, training for new skills is unavoidable. The ability of Thailand to attract successfully, absorb and benefit from FDI in IT industry and the transfer of technology, which it may bring, depends to a large extent on its own technological capabilities, of which the skills and technical knowledge of its workforce are critical components. The FDI linkage that has not been developed in Thailand can be achieved through a successful training program. The national training program can be realized under the strong support of the government. Singapore provides a good example of how the government anticipated training programs. The Economic Development Board (EDB), which ensures that inward investment is forthcoming to provide the necessary capital and know-how for the new industries, is also in charge of the human resource requirements for those industries. The EDB has to ensure that the education and training system is capable of producing the right type of skills required by new industries. As a result, both the Ministry of Trade and Industry and the EDB provide this information to the Council for Professional and Technical Education, the main decision-making body for determining the output of the education and training system. On vocational training, targets for on-the-job and work-based training and for the level of investment in training by employers are set by the Singapore Productivity and Standard Board. Training programs run by the Board are targeted to meet the demands of existing and new industries.

Human resource development is however far more than just training. It is a continuous learning process. Therefore, the government should provide a training program for adults who are beginners and who want to catch up with the new technology.

5. CONCLUSIONS

The use of information technology in Thailand is still in the early stages. On the consumer's side, the percentage of people using the Internet or having computers is still low, compared to several other countries in the region. Only 5.64 per 100 persons logged on to the Internet in the year 2001. Furthermore, this figure hides internal digital divides among regions. The paper showed that IT use is concentrated in the regions with high-income levels, such as Bangkok. The digital divides also exist among age groups, between genders, and between large firms and SMEs. The use of the Internet is heavily biased toward entertainment rather than business or knowledge exchange. There are more than 81.6 percent of the Internet population having no experience in buying online goods and services. As for business use, only a few domestic firms are able to apply IT to their business needs.

On the producer side, Thailand is an export-base for IT-related products. Mainly foreign firms produce IT products in Thailand by importing the main components from abroad and using low-skilled labor for the assembly process. Domestic firms play a minor role as subcontractors for labor-intensive components. There is neither forward nor backward linkage in the Thai IT industry. Therefore, technology transfer does not exist. Consequently, since the Thai IT industry is weak, foreign firms earn most of the benefits from the IT Revolution.

The main problem for Thailand concerning the IT Revolution is the digital divide. This digital divide exists in all aspects for IT consumers and IT users. Only small groups of high-income households and a few large firms enjoy the benefits received from applying IT. There are at least two main reasons to explain the Thai digital divide, one is the high price of utilizing IT and the other the lack of IT human resources.

The paper showed that if Thailand as a developing country could use the Internet and e-commerce fully, it would benefit all consumers and businesses, including SMEs, to obtain easy access to the global network. In order to reduce this digital divide and create a literate IT society, the paper recommends the government liberalize the telecommunications

market, to allow more competition from new entrants domestic and foreign. Currently, the Minister of Transportation and Communications tightly controls the telecommunications market. A few oligopolistic enterprises are in a position to extract high profits and forestall competition. Market liberalization has been included in the Telecommunications Master Plan 1997-2006, however, it has not shown any progress yet. The other recommendation is on IT human resource development throughout the country. This includes formal education from elementary schools to colleges, both hardware (equipment) and software (personnel), and informal education for workers and people of all ages, under the slogan 'IT for All.'

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