# Chapter 5

# TOWARD A KNOWLEDGE-BASED ECONOMY: NORTHERN THAILAND

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## 1. THE NEW ECONOMICS OF INFORMATION AND GOVERNMENT EFFORTS FOR ICT DEVELOPMENT

### 1.1 Introduction

Globalization and the rapid change of technological innovations have created profound transformations of industry structures that are affecting global markets and economies, as well as business relationships. The introduction of information and communication technology presents a wholly new development path and visible economic benefits. Knowledge is recognized as the foundation of competitive advantage, and the changes in global business are occurring in parallel with the increasing use of information technology. Economic, social and political reformation are characteristic of the transition from the industrialized economy to the knowledge-based economy.

A knowledge-based economy is one in which the creation, distribution and utilization of knowledge perform a predominant role in the generation of wealth. The advances in software and hardware, technology innovations and the improvements in communications technologies have made information the most important basis for creating value in the economy. Many developed industrial economies worldwide are moving fast to KBE. It has been predicted that by year 2006, almost half of the workforce in the United States (US) will be employed by industries that are either major producers or intensive users of IT products and services. It is estimated that more than 50 percent of GDP in the major OECD economies is now knowledge-based. The high technology share of OECD manufacturing production and exports has more than doubled to 20-25 percent (Makishima, 2002).

The development of a knowledge-based economy in Singapore and Malaysia reflects the transition that is taking place in the Southeast Asia region. Thailand is among other developing economies in the region that are attempting to increase their national capabilities and competitiveness to accommodate the global competitions.

In February 1996, Thailand embarked on its first national IT development plan, IT-2000. Programmes were available to introduce and promote ICT culture to community centres. Since then, the Government has begun to add ICT to its civil services, and there have been large investments in the development of basic ICT infrastructure on a national scale. In October 2001, the National Information Technology Committee, chaired by the Prime Minister of Thailand, endorsed the second national strategic plan, IT-2010, which is the framework for IT development. The objectives of the IT-2010 plan are 1) to improve and enhance efficiency and effectiveness of public services to citizens by using ICT and 2) to improve and enhance efficiency and effectiveness of the public administration process with tools, such as common computer software.

## What is Knowledge?

Knowledge is becoming recognized as the foundation of competitive advantage. Once knowledge is learned and made available to the public, there is zero cost to sharing it with other users. Information, transformed into shared knowledge and intellectual capital, is changing education, economic and industrial structures. Businesses equipped with people with the right knowledge and essential skills will be crucial to achieving high and sustainable levels of competitiveness in the new economy.

There are different types of knowledge that can be distinguished. An organized economy may produce a growing knowledge intensity of goods and services in the arrangement of codified knowledge or tacit knowledge. Codified knowledge refers to the knowledge that can be documented and stored or converted into a retrievable format and can be distributed, transmitted or replicated for later use. Tacit knowledge often refers to knowledge that is accumulated through experiences rather than by formal education and training, and it may not be easily transferred.

Information and communications technology is considered a major contributor to new service-based and knowledge-based industries that provide incentives for increasing access to information. Wealth creation in the new economy often depends on the capacity to add value using ICT products and services. Information and communications technology alone may not be very useful, but it helps to facilitate timely access to the valuable information people need in their individual situations.

Often the capacity to utilize the knowledge economy of a nation depends largely on its capability to learn and not merely use new technology to access information. The increasing use of information and knowledge in business activity implies that the term "knowledge" often refers to the ability to learn, create, share innovation and add value to the production process and services to the business and the economy. Thus, a modern version of formal education may need to focus more on teaching people how to learn and become less about passing on information only. Knowledge-driven organizations need to build a continuous learning process that promotes a cycle of learning and a sharing of tacit knowledge within the organization.

## 1.2 Government Efforts in the Region

Although Thailand is not among the first countries to take the route toward a knowledge-driven economy, the formation of its national IT development plan demonstrates that the Thai Government undoubtedly has the appreciation for the expanding opportunities offered by the information technology revolution. To meet the expanding opportunities, the Government will have to raise awareness of the benefits of a knowledge-driven economy in the community and in the business sector. The Government needs to encourage the building of better information technology infrastructure to allow all Thais access to the advanced services that support the Internet.

In the past 15 years, Northern Thailand's agricultural population has declined and regional businesses have changed their focus and increased their reliance on manufacturing and service-related industries.

There are a number of efforts that have been coordinated by regional government institutions, including the National Economic and Social

Development Board's (NESDB) Northern Development Centre and the National Science and the Technology Development Agency's (NSTDA) Northern Network. The coordination efforts are intended to implement a national awareness programme to accelerate the adoption of new technologies in the northern region. For instance, NSTDA offers several training programmes for using software productivity tools, encourages the establishment of a regional "Software Park" and seeks ICT-using businesses to locate there.

With the intention to stimulate the development of knowledge-intensive economies at the regional level, there are a number of commitments to deliver appropriate support policies from regional government institutions, such as the NESDB's Northern Development Centre and NSTDA's Northern Network that are coordinated and regulated by their head offices in Bangkok.

## 1.3 The Key Development Strategies

The development strategies in the northern region echo plans in other regions of the country. Local government agencies are to provide services to ensure that all key government services in the northern region are heading in appropriate directions of development. The regional strategies include the development of "electronic government", or e-government, that are designed to computerize all primary government services in the northern region and put them online within the next few years. The policies also aim to develop a software industry and promote awareness and use of ICT.

Specific implementations of the e-government project include the following:
• Multi-Application Smart Card
• e-Government Institute
• Government e-Procurement
• Inter-Operatability Guide
• Government Data Exchange
• GIS Clearing House, or a National Spatial Data Initiative

The Government also has to ensure a stable and conducive economic environment for the continuing innovation in information technologies, since the strength of the knowledge economy is grounded in IT-producing industries – the firms that supply the goods and services that support IT-enabled

business practices across the economy. The key strategic development of a software industry includes the following:

- Software Industry Promotion Agency and Software Industry Promotion Board
- ICT professional training programmes
- Knowledge-worker development programmes
- Excellent Centres
- Software park clustering and chaining
- Government and public application services programmes

In recent years, NSTDA's Northern Network has been promoting the growth of electronic commerce. For instance, several e-commerce Web sites have been initiated, such as ThaiTradePoint.com, to encourage local businesses to explore new opportunities.

NSTDA's Northern Network organized Web Expo '98 to encourage local entrepreneurs to seek out options for computerizing their business practices, to participate in and develop online marketplaces and to expand their use of network systems to improve business operations. Ways to promote awareness and the use of ICT among local SMEs include the following:

- SMEs back office system
- A goods and services network in the local region
- Automotive industry supply chain
- ICT for a multi-modal transportation system

There are a few other local government initiatives that represent a certain level of serious government support in the northern region. For instance, in the past two years, NSTDA's Northern Network has promoted the innovative use of ICT among SMEs. Its efforts include providing training on how to use software-productivity tools, such as Computer Aid Design applications and statistical analysis applications. Also, the Northern Network has offered local business owners and managers an introduction to software tools for a range of tasks related to operating a business, such as accounting, order-processing and inventory management.

There are supported policies and programmes that make these tools available to SMEs in the northern region, such as the development of Groupware applications and point of sale applications that are based on the use of Open Source software and Linux TLE (Thai Language Extension).

## 1.4 Software Park, Chiang Mai

The city of Chiang Mai is considered the business centre of Thailand's upper northern region. Because of its physical infrastructure and communications infrastructure – radio, television, cable TV, satellite, microwave, wireless and landline services, it is recognized as having great potential for a Software Park initiative. In addition, there are a number of educational institutions producing ICT-educated graduates, which is a critical factor in developing a knowledge-based economy. These institutions provide access to human resources who are affordable, reliable and highly competent to help upgrade the existing knowledge and skills of workforces.

IT industries currently account for a relatively small share of the regional economy's total output. The Government recognizes that establishing a Software Park in the North is one of several structural adjustments required to develop an information industry.

Other factors that make Chiang Mai a favourable location include: The city environment, which enables people to move away from overcrowded cities to a more preferred lifestyle in a rural area while still enjoying convenient access to quality and reliable education, employment, health, housing and transport services.

- The people in Chiang Mai have an openness to new ideas and realize that information technology offers a distinctive competitive edge to the region.
- The city's broadband infrastructure of high-capacity networks provides hub services for businesses in the upper northern region.
- There is an increasing number of low-cost manufacturing firms that have educated and qualified workers. These firms often have the potential of delivering sophisticated goods and services.
- Chiang Mai is recognized by the BOI incentive programme as an official Investment Zone 3.
- In addition, the recent deregulation on taxation and tariffs on R&D in production may promote continual learning and innovation. It will significantly boost investment in research and development activities.

- Both public and private sectors are aware of the opportunities for the local economic growth that the establishment of a Software Park could provide to them and the community. However, there are several issues that first need to be addressed, such as determining the appropriate level of government involvement in the project. The Software Park project could be initiated and run by the Government or it could be entirely controlled by private firms.

Some level of collaboration could be established between the Government, education institutions and the private sector through an information network. A high level of government involvement can bring together investors and researchers who provide a more stable and confident business environment.

So far, local entrepreneurs have been hesitant to invest in the Software Park project. The challenges include the following:

- The Thai Government still lacks clear regulation regarding software businesses.
- The qualifications of locally available human resources often fail to satisfy the requirements needed.
- The existing education and training programmes are often carried out with different quality standards.
- The process for qualified non-Thai workforces to obtain work permits and work in Chiang Mai remains complicated.

Nonetheless, there have been three separate efforts to establish the Software Park in Chiang Mai by several private firms and entrepreneurs. Most have adopted a common approach and focused primarily on establishing service and support centres for local businesses. At the time of this writing, all projects have not yet been developed, except the project called Cyber Media Park for e-Gravity (CMPEG).

### i. Software Park Prame Tinasulanon Foundation

This projected is located at Mae Rim district, Chiang Mai province and is closely linked with the Software Park in Bangkok. The key components of the project include the following:

- Business centre
- Sales office

- Service and support centre
- Training centre
- Incubation centre
- International software production

*Status of the project:* The project has not yet been developed.

## ii.  Chiang Mai Software and Technology Park

Chiang Mai Software and Technology Park Company supports this project. Its components include:
- Network application service
- Service centre
- Business centre
- Incubation centre
- Venture capital

*Status of the project:*  The project has not yet been developed.

## iii.  Cyber Media Park for e-Gravity (CMPEG)

This project is located at Tumbon Sansri district in Prao, Chiang Mai province, which is 100 km north of Chiang Mai city.  The AKIRA Group of Companies with offices in United Kingdom, Hungary, New Zealand and Thailand supports this project. According to company brochures, the CMPEG's main goal is to become a leading developer for new and existing hardware.  The project has been granted approval and privileges from the BOI, the Federation of Thai Industries (FTI) and the Association of Thai Software Industry (ATSI).

The project's components include:
- International Internet incubation (3iC)
- Information service centre
- Other cooperative business-development functions

*Status of the project:* Some of its buildings are operational.  Other buildings and factories should be completed in the next two to four years.

**Northern Thailand SchoolNet**

Connecting every school and library in Northern Thailand and the rest of the country is a Government priority. Providing computers to schools and connecting them to the Internet will enhance the learning process by giving students and teachers access to information and materials from around the world. Without computer networks, Thai schoolchildren will lack the necessary computer skills to compete in the 21st century.

The new national programme SchoolNet@1509, introduced in February 1998, allows both public and private primary and secondary school levels to participate. Dialling the number "1509" from any location in the country can access the network. To access SchoolNet@1509 costs only the price of a local telephone call – 3 baht. The implementation of SchoolNet@1509 has been achieved through the cooperation between the private sector and four government agencies: NECTEC, the Telephone Organization of Thailand, the Communication Authority of Thailand (CAT) and the Ministry of Education (MOE). The private-sector participation has involved Cisco, Microsoft, Compaq, Intel and Powell Computer.

In Chiang Mai, there are 111 schools registered to SchoolNet@1509 (Table1.1). However, schools in Northern Thailand still have a long way to go before they can provide a properly equipped system to their students. Distribution of computers remains uneven throughout the region and the density of computers in comparison to the number of potential student users remains small. According to SchoolNet Thailand (2001):

- There are approximately 7,562 public and private schools in Northern Thailand and about 1,140 schools, or 15 percent, are registered to the SchoolNet programme. (Tables 1.2 and 1.3)
- There are 4,470 schools in Thailand online with SchoolNet, of which 1,140 schools, or 25 percent, are located in Northern Thailand.
- There are approximately 261 schools, or 22 percent of total members, that have their own educational Web sites.

Apparently, reliable technical resources and ICT support are needed for the teachers as well. Even though there is no official evidence for the number of teachers per computer in Northern Thailand, it is estimated that a very small number of teaching staff in the region, particularly in rural areas, have any access to computers – let alone any type of network. There are many occupations that require basic computer knowledge; but the education sector lags behind other types of education in terms of ICT knowledge because there have not been any requirements for teachers to be ICT-competent.

**Table 1.1: Number of Schools Registered to SchoolNet in Northern Provinces of Thailand**

| Northern Thailand provinces | Number of schools registered to SchoolNet |
|---|---|
| Chiang Mai | 111 |
| Chiang Rai | 64 |
| Kamphaeng Phet | 67 |
| Lampang | 87 |
| Lamphun | 49 |
| Mae Hong Son | 25 |
| Nakhon Sawan | 169 |
| Nan | 78 |
| Phayao | 52 |
| Phetchabun | 56 |
| Phichit | 33 |
| Phitsanulok | 91 |
| Phrae | 39 |
| Tak | 48 |
| Sukhothai | 92 |
| Uttaradit | 59 |

Source: http://user.school.net.th/school-zone/Zone8.html
http://user.school.net.th/school-zone/Zone7html

**Table 1.2: Number of Schools in Northern Provinces That Have Their Own Educational Web Sites to Participate in the Contents Creation Activity in SchoolNet Thailand**

<div align="right">unit: percent</div>

| Northern Thailand provinces | Schools registered to SchoolNet | Schools that have educational Web sites | % |
|---|---|---|---|
| Chiang Mai | 111 | 39 | 35 |
| Chiang Rai | 64 | 19 | 30 |
| Kamphaeng Phet | 67 | 12 | 18 |
| Lampang | 87 | 21 | 24 |
| Lamphun | 49 | 14 | 29 |
| Mae Hong Son | 25 | 12 | 48 |
| Nakhon Sawan | 169 | 14 | 8 |
| Nan78 | 11 | 14 | |
| Phayao | 52 | 9 | 17 |
| Phetchabun | 56 | 24 | 43 |
| Phichit | 33 | 5 | 15 |
| Phitsanulok | 91 | 20 | 22 |
| Phrae | 39 | 13 | 33 |
| Tak | 48 | 7 | 15 |
| Sukhothai | 92 | 13 | 14 |
| Uthaitani | N/A | 19 | N/A |
| Uttaradit | 59 | 9 | 15 |

Source: http://user.school.net.th/

**Table 1.3: Number of Public and Private Schools in Northern Thailand in 2002**

<div align="right">unit: schools</div>

|  | Upper North | Lower North | Total |
|---|---|---|---|
| Primary schools | 3,630 | 3,423 | 7,053 |
| Secondary or high schools | 226 | 283 | 509 |
| Northern Thailand Total | 3,856 | 3,706 | 7,562 |

Source: NESDB – NDC 2002

## 2. PROFILE OF NORTHERN THAILAND

### 2.1 Introduction

**Geography**

Northern Thailand covers an area of 170,000 sq km, or 33 percent of the total land area of the country. It consists of 17 administrative provinces. Geographic and economic factors divide Northern Thailand into the upper North and the lower North.

The upper North covers an area of 100,474 square km, or 59 percent of the total North. The mountains and elevations of more than 600 m above sea level rise over half of the area and are distinct characteristics of the upper North. The four tributaries of the Chao Phraya river – Ping, Wang, Yom and Nan – originate in this area. Its small highland valleys are occupied by human settlements and their agriculture. The upper North consists of nine provinces: Chiang Rai, Chiang Mai, Lampang, Lamphun, Mae Hong Son, Nan, Phayao, Phrae and Tak. Chiang Mai has emerged as the economic centre of the upper North.

The lower North covers an area of 69,532 sq km, or 41 percent of the North. Most of the area is flood plain with economies and social characteristics similar to those of the central region. The lower North consists of eight provinces: Kamphaeng Phet, Nakhon Sawan, Phetchabun, Phichit, Phisanulok, Sukhothai, Uthai Thani and Uttaradit. Phitsanulok is the economic centre of the lower North.

## 2.2 Population and Labour Force

The North is the largest region in Thailand in terms of area.  Since the upper North was formerly a separate kingdom, the population living in this sub-region has its own culture and traditions.  In the mountainous areas there are several ethnic minority groups, which have migrated there for both permanent and temporary residence settlements, such as the Hmong, Lisu, Karen and the Yunnan Chinese.

In 2000, the population in the North totalled approximately 11.4 million, or 18.8 percent of the country's total population. This makes the northern population the third largest in the country.  The northeast and the central regions have greater populations of 20.8 million and 14.1 million, respectively (Table 2.2).  In terms of population density, the North has the lowest among all regions with 67 persons per square kilometre; the central region, excluding the Bangkok metropolitan area, numbered 137.8 persons per square kilometre in 2000

The majority of the Thai workforce is no longer in the agricultural sector. As shown in Table 2.1, about 60 percent of the workforce is either in the production sector or in wholesale and retail industries. However, approximately 50 percent of the current workforce of Northern Thailand is in the agricultural sector. The majority of the northern population lives outside suburban areas; only 14 percent reside within the city.  The equivalent numbers (50 percent) of the workforce are in the non-agricultural sector.  Most of the Northern Thailand workforce is in the non-agricultural sector, in the wholesale and retailing industry.  Less than one percent of employees work in the international cooperation sector.

## 2.3 INFRASTRUCTURE

### Transportation

Transportation is one of the most important factors supporting the northern region's economic development.  For decades, people in Northern Thailand used various transportation means – roads, trains, waterways (especially the Mekong River) and airplanes – to commute and trade.

Transportation systems in the northern region encourage international trade and freight to cross borders.

## Telecommunications

The telecommunications system extensively covers almost the whole northern region. There are main telephone stations, which are responsible for the operation and maintenance of telephone lines, located in every province. Among all the provinces in the North, Chiang Mai has the most line capacity and authorized telephone numbers, while Uthai Thani has the least.

## Electricity

The Electricity Generating Authority of Thailand is responsible for almost all the electricity supplied in the country. The total capacity of all power plants in the northern region is 3,880 mw, which provides 25.3 percent of the electricity generated in Thailand. As of 1999, there were 11 power plants in the northern region. Five of them are in Chiang Mai, while the rest are in Kamphaeng Phet, Lampang, Mae Hong Son, Phetchaboon, Tak and Uttaradit. In terms of power plant type, six power plants are generated by hydro energy, two by renewable energy, one by gas turbine, one by thermal-steam turbine and one by diesel. The biggest power plant is the Mae Moh power plant in Lampang province. It has a capacity of 2,625 mw, which accounts for 94 percent of all electricity produced in the North. Other major power providers are the Bhumibol power plant in Tak province (731.2 mw, producing 26 percent of the North's total) and the Sirikit power plant in Uttaradit province (500 mw, producing 18 percent of the North's total).

In terms of electricity accessibility, 96 percent of all villages in the North had electricity in 1999. However, this number is probably underestimated, as only 70 percent of all villages in Tak could access the electricity. And this number is exceptionally low compared to that of all other provinces. Provinces where nearly 100 percent of villages have access to electricity are Nakhorn Sawan, Phichit, Phitsanulok, Sukhothai, Uttaradit and Uthai Thani.

**Water**

Various bodies of water originate in the North and serve agricultural, manufacturing and basic consumption purposes. Major rivers in the northern region are the Ping, Wang, Yom and Nan – the four tributaries of the great Chao Phraya river.

The Metropolitan Waterworks Authority of Thailand has a responsibility to provide potable tap water in the country, and this is available throughout the North. In 1999, the amount of total water production in the region was 518,730 cubic metres per day. Water consumption is largest in Chiang Mai province, accounting for 16 percent (82,560 cubic metres) of all water produced in the region. Uttaradit province consumes the least amount at only 2,400 cubic metres per day, or about 0.4 percent of all tap water produced in the northern region.

**2.4 Structure of the Economy**

Northern Thailand encompasses the mountain ranges of the upper part of the country as well as the upper part of the flat central plateau and constitutes about one third of the total area of the country. Although the region is predominantly mountainous, agriculture is still the most important income-producing sector of the northern economy. The North produces the highest volume of agricultural products of any region in Thailand.

The importance of agriculture in the North has been successively increasing during the past decade. The proportion of agriculture to total gross regional product (GRP) was 17.8 percent in 1993, increasing to 19.4 percent in 2000 (Tables 2.3 and 2.4). This ascending pattern is mostly due to the increase in crop production; other sub-sectors appear to have only minimal changes.

The second most important economic segment in the North is the services sector, contributing 18.7 percent to GRP in 2000, which was a rise from 15.6 percent in 1993. The wholesale and retail trade sector's GRP contribution was about 16.6 percent in 2000, a decline from 17.7 percent in 1993. Manufacturing's contribution to the GRP has remained at about 12-14 percent. There was a considerable decrease in the construction sector:

dropping from 10.8 percent in 1996 to 4.5 percent in 2000. The fall of manufacturing is due to the country's financial crisis that began in 1997.

In summary, the economic structure of Northern Thailand is different from that of the whole country. Agriculture is a major income-generating sector, followed by the services and trade sectors. While manufacturing constitutes most of Thailand's GDP, agriculture holds the major share of GRP in the North. Therefore, the economic situation in the northern region does not necessarily impact upon Thailand's economy.

**Gross Regional Product and Economic Growth**

The gross regional product of the North increased from 294,527 million baht (at market prices) in 1993 to 440,948 million baht in 2000. The proportion of northern GRP to the national GDP, however, remained in a range of 9-9.5 percent during 1993-2000. That situation implies that the expansion of Northern Thailand's economy has been at about the same rate as that of the whole country (Tables 2.5 and 2.6).

Table 2.7 shows gross provincial product (GPP) in the North during 1993-2000. The distribution of GPP in different provinces in the North is shown in Table 2.8. In 2000, Chiang Mai contributed the highest proportion of GPP to the North at 18.5 percent. The next highest proportions came from Nakhon Sawan (9.6 percent), Chiang Rai (7.8 percent), Phitsanulok (7.5 percent) and Lampang (7.3 percent).

**Per Capita Income**

The average per capita income in the North increased from 26,795 baht in 1993 to 39,188 baht in 2000 (Table 2.9). The average per capita income of the North was second lowest after that of the Northeast; and it was much lower than the average for the entire country of 54,563 baht in 1993 and 78,591 baht in 2000.

Lamphun had the highest per capita income of the northern provinces. The average annual per capita income in Lamphun was 43,472 baht in 1993 and 68,859 baht in 2000. A major proportion of GPP in Lamphun derives from manufacturing as the province is home to the Northern Industrial Estate.

Phrae ranked as the lowest average per capita income in the North during 1993-2000 with 25,497 baht. Petchabun and Phayao had the second and third lowest average per capita incomes of 28,723 baht and 29,110 baht, respectively.

Indices of average per capita income at market prices in the North during 1993-2000 (1993 = 100) indicate that the average per capita income in the North had been growing at about the same rate as that of the whole country. Though the country experienced the Asian economic crisis in 1997, the indices of average per capita income in the period of 1997-1998 did not decline (Table 2.10).

The provinces that experienced high growth rates of per capita income during 1993-2000 were Uthai Thani (78 percent), Kamphaeng Phet (66 percent) and Phichit (62 percent). The provinces that experienced a slow increase in the average per capita income in the North were Tak (22 percent), Lampang (27 percent) and Chiang Rai (32 percent).

**Financial Institutions**

Various financial institutions are established in the North where there exists sizable economic development. The most important financial institutions in the North are the commercial banks. In 2000, there were 509 commercial bank branches in the region (Table 2.11). The number was a decrease from 524 in 1999, representing a 2.86 percent decrease over the year. This is also a consequence of Thailand's financial crisis. In 1999, the amount of commercial

bank loans in the northern region was about 204,034.4 million baht. The amount dropped to 176,875.8 million (or 13.3 percent) in 2000. The falling rate was slightly smaller than that of the entire country. This decline in loans permitted by commercial banks was also due to the financial crisis impact. The North, however, suffered the least economic damages in Thailand. This is because the bulk of the crisis hit the country's manufacturing sector; as already mentioned, manufacturing is a small segment of the northern economy with agriculture continuing to be the primary economic constituent.

In terms of loan distribution by economic sector, the majority of commercial bank loans went to the commerce sector, with about 30 percent of total loans. Personal consumption was second with about a 20 percent share. Between 1999 and 2000, each of the economic sectors experienced the same declining pattern of commercial bank loans.

There are other types of financial institutions in the North, such as finance and securities companies. In 2000, there were two companies operating with nine offices.

## Table 2.1:  Growth Rate and Density by Region 1990 and 2000

| Region | 1990 | | 2000 | | Total Area (sq km) | Population density (per sq km) | Compound annual growth rate 1990-2000 |
|---|---|---|---|---|---|---|---|
| | Million | Percent | Million | Percent | | | |
| North | 10,584,443 | 19.4 | 11,367,826 | 18.8 | 169,644.3 | 67.01 | 0.71 |
| Northeast | 19,038,497 | 34.9 | 20,759,899 | 34.3 | 168,855.3 | 122.94 | 0.87 |
| South | 6,966,455 | 12.8 | 8,057,5181 | 3.3 | 70,715.2 | 113.94 | 1.45 |
| Central | 12,076,724 | 22.1 | 14,101,530 | 23.3 | 102,336.0 | 137.8 | 1.55 |
| Bangkok | 5,882,411 | 10.8 | 6,320,174 | 10.4 | 1,568.7 | 4,028.92 | 0.72 |
| Thailand | 54,548,530 | 100.0 | 60,606,947 | 100.0 | 513,119.5 | 118.11 | 1.05 |

Note: Central = All provinces in the central region, excluding the metropolitan Bangkok area

Bangkok = Bangkok metropolitan area

Source: Department of Local Administration, Ministry of Interior

# Table 2.2: Percentage of the Workforce Classified by Industry, Region and Suburban Area, May 2002

<div style="text-align:right">unit: percent</div>

| Industry | Kingdom | | | Central Region | | | Northern Region | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Suburban area | Outside suburban area | Total | Suburban area | Outside suburban area | Total | Suburban area | Outside suburban area |
| 1. Agriculture | 39.0 | 8.1 | 54.5 | 28.7 | 7.1 | 39.7 | 50.4 | 14.7 | 59.3 |
| 1) Agriculture hunting and forestry | 37.4 | 7.3 | 52.5 | 26.6 | 5.9 | 37.2 | 50.0 | 14.5 | 58.9 |
| 2) Fishing | 1.6 | 0.8 | 2.0 | 2.1 | 1.2 | 2.5 | 0.4 | 0.2 | 0.4 |
| 2. Non-agriculture | 61.0 | 91.9 | 45.5 | 71.3 | 92.9 | 60.3 | 49.6 | 85.3 | 40.7 |
| 1) Mining and quarrying | 0.2 | 0.2 | 0.2 | 0.4 | 0.2 | 0.5 | 0.2 | 0.2 | 0.2 |
| 2) Manufacturing | 16.4 | 21.8 | 13.7 | 26.5 | 31.5 | 24.0 | 9.8 | 11.9 | 9.2 |
| 3) Electricity, gas and water supply | 0.2 | 0.5 | 0.1 | 0.4 | 0.8 | 0.2 | 0.3 | 0.9 | 0.2 |
| 4) Construction | 6.1 | 5.5 | 6.4 | 5.3 | 4.6 | 5.7 | 6.9 | 7.0 | 6.9 |
| 5) Wholesale and resale trade Repair of motor vehicle motorcycle and household goods | 15.4 | 23.3 | 11.4 | 15.6 | 22.1 | 12.3 | 14.2 | 23.9 | 11.8 |
| 6) Hotel and restaurants | 6.6 | 11.1 | 4.4 | 7.2 | 10.7 | 5.4 | 5.0 | 12.1 | 3.2 |
| 7) Transport, storage and communications | 3.0 | 5.5 | 1.7 | 3.8 | 4.8 | 3.4 | 1.4 | 2.7 | 1.1 |
| 8) Financial intermediation | 1.0 | 2.5 | 0.3 | 0.8 | 1.3 | 0.6 | 0.9 | 2.5 | 0.5 |
| 9) Real estate, renting and business activity | 1.6 | 3.5 | 0.7 | 1.5 | 2.4 | 1.1 | 0.9 | 2.2 | 0.5 |
| 10) Public administration, defence and compulsory social security | 3.1 | 5.3 | 2.0 | 2.8 | 4.5 | 1.9 | 2.5 | 5.7 | 1.8 |
| 11) Education | 2.9 | 4.7 | 2.0 | 3.0 | 4.1 | 2.4 | 2.8 | 5.6 | 2.1 |
| 12) Health and social work | 1.5 | 2.6 | 1.0 | 1.3 | 2.3 | 0.7 | 1.9 | 4.6 | 1.3 |
| 13) Other community, social and personal service activity | 2.0 | 3.4 | 1.3 | 2.0 | 2.9 | 1.5 | 2.2 | 4.3 | 1.7 |
| 14) Private households with employed persons | 0.8 | 1.8 | 0.3 | 0.7 | 0.8 | 0.6 | 0.6 | 1.7 | 0.3 |
| 15) Extraterritorial and bodies | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 16) Unknown | 0.0 | 0.1 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 |

Source: National Statistics Office, 2002

## Table 2.3: Gross Regional Product at Current Market Prices, 1993-2000

<div align="right">unit: million baht</div>

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| Agriculture | 52,374 | 61,298 | 71,653 | 88,535 | 88,735 | 99,905 | 88,366 | 85,417 |
| Crops | 36,618 | 45,119 | 53,488 | 69,091 | 69,163 | 80,513 | 66,754 | 64,539 |
| Livestock | 6,625 | 6,204 | 6,833 | 5,963 | 6,567 | 6,008 | 7,804 | 6,917 |
| Fisheries | 1,248 | 1,487 | 1,394 | 1,936 | 1,879 | 2,249 | 2,398 | 2,384 |
| Forestry | 138 | 273 | 528 | 658 | 550 | 948 | 892 | 1,358 |
| Agricultural services | 2,949 | 3,375 | 3,372 | 3,655 | 3,504 | 3,762 | 3,711 | 3,317 |
| Simple agri.processing products | 4,796 | 4,840 | 6,038 | 7,232 | 7,072 | 6,425 | 6,807 | 6,902 |
| Mining and quarrying | 13,698 | 14,263 | 13,818 | 15,446 | 17,558 | 15,823 | 16,040 | 17,895 |
| Manufacturing | 33,580 | 41,166 | 46,185 | 49,863 | 51,607 | 53,149 | 56,862 | 61,079 |
| Construction | 24,721 | 33,606 | 39,434 | 46,066 | 32,033 | 20,401 | 21,803 | 19,955 |
| Electricity and water supply | 5,892 | 6,490 | 7,606 | 7,449 | 8,572 | 10,120 | 9,149 | 9,622 |
| Transportation and communication | 15,618 | 17,835 | 19,873 | 21,595 | 23,078 | 20,696 | 20,496 | 21,054 |
| Wholesale and retail trade | 52,011 | 58,055 | 64,224 | 68,209 | 71,655 | 68,779 | 69,431 | 73,064 |
| Banking,insurance and real estate | 15,383 | 17,444 | 20,021 | 22,634 | 22,806 | 27,804 | 16,025 | 14,854 |
| Ownership of dwellings | 14,748 | 15,871 | 16,827 | 17,414 | 17,531 | 18,730 | 19,309 | 19,455 |
| Public administration and defence | 20,516 | 21,397 | 26,340 | 28,526 | 30,307 | 32,686 | 34,301 | 35,971 |
| Services | 45,985 | 47,718 | 55,817 | 61,430 | 66,614 | 71,430 | 78,071 | 82,582 |
| | | | | | | | | |
| G R P. | 294,527 | 335,142 | 381,798 | 427,167 | 430,495 | 439,523 | 429,853 | 440,948 |
| Per capita GRP.(Baht) | 26,795 | 30,310 | 34,331 | 38,314 | 38,537 | 39,243 | 38,332 | 39,188 |
| Population (1,000 persons) | 10,992 | 11,057 | 11,121 | 11,149 | 11,171 | 11,200 | 11,214 | 11,252 |

Note: p is preliminary estimate
Source:  National Economic and Social Development Board

**Table 2.4:  Percent Share of GRP of the Northern Region at**
**Market Prices, 1993-2000**

unit: percent

| Industrial Origin | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| Agriculture | 17.8 | 18.3 | 18.8 | 20.7 | 20.6 | 22.7 | 20.6 | 19.4 |
| Crops | 12.4 | 13.5 | 14.0 | 16.2 | 16.1 | 18.3 | 15.5 | 14.6 |
| Livestock | 2.2 | 1.9 | 1.8 | 1.4 | 1.5 | 1.4 | 1.8 | 1.6 |
| Fisheries | 0.4 | 0.4 | 0.4 | 0.5 | 0.4 | 0.5 | 0.6 | 0.5 |
| Forestry | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 |
| Agricultural services | 1.0 | 1.0 | 0.9 | 0.9 | 0.8 | 0.9 | 0.9 | 0.8 |
| Simple agri. processing products | 1.6 | 1.4 | 1.6 | 1.7 | 1.6 | 1.5 | 1.6 | 1.6 |
| Mining and quarrying | 4.7 | 4.3 | 3.6 | 3.6 | 4.1 | 3.6 | 3.7 | 4.1 |
| Manufacturing | 11.4 | 12.3 | 12.1 | 11.7 | 12.0 | 12.1 | 13.2 | 13.9 |
| Construction | 8.4 | 10.0 | 10.3 | 10.8 | 7.4 | 4.6 | 5.1 | 4.5 |
| Electricity and water supply | 2.0 | 1.9 | 2.0 | 1.7 | 2.0 | 2.3 | 2.1 | 2.2 |
| Transportation and communication | 5.3 | 5.3 | 5.2 | 5.1 | 5.4 | 4.7 | 4.8 | 4.8 |
| Wholesale and retail trade | 17.7 | 17.3 | 16.8 | 16.0 | 16.6 | 15.6 | 16.2 | 16.6 |
| Banking,insurance and real estate | 5.2 | 5.2 | 5.2 | 5.3 | 5.3 | 6.3 | 3.7 | 3.4 |
| Ownership of dwellings | 5.0 | 4.7 | 4.4 | 4.1 | 4.1 | 4.3 | 4.5 | 4.4 |
| Public administration and defence | 7.0 | 6.4 | 6.9 | 6.7 | 7.0 | 7.4 | 8.0 | 8.2 |
| Services | 15.6 | 14.2 | 14.6 | 14.4 | 15.5 | 16.3 | 18.2 | 18.7 |
| | | | | | | | | |
| G R P. | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Note: p is preliminary estimate
Source: National Economic and Social Development Board

## Table 2.5: Gross Regional Product by Region at Market Prices, 1993-2000

unit: million baht

| Region/Thailand | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| North | 294,527.06 | 335,142.41 | 381,798.21 | 427,167.48 | 430,495.42 | 439,522.73 | 429,852.7 | 440,948.4 |
| Northeast | 350,167.39 | 411,709.15 | 487,677.69 | 541,180.1 | 546,532.95 | 544,752.09 | 537,661.7 | 554,449.5 |
| South | 269,680.16 | 319,767.01 | 386,114.92 | 418,900.77 | 424,106.13 | 446,167.74 | 418,661 | 448,753.6 |
| East | 289,500.26 | 345,305.75 | 418,209.18 | 493,744.63 | 553,425.07 | 588,916.88 | 587,550.6 | 665,362.6 |
| West | 133,930.80 | 152,559.67 | 176,763.47 | 192,723.16 | 196,307.72 | 197,638.76 | 196,839.9 | 206,788.2 |
| Central | 131,575.88 | 157,794.23 | 183,345.62 | 210,568.79 | 215,146.59 | 210,574.54 | 209,413.9 | 221,248.0 |
| Bangkok | 169,5804.80 | 1,907,056.70 | 2,152,295.5 | 2,326,751.4 | 2,366,595.2 | 2,198,866.7 | 2,252,155 | 2,367,181.0 |
| Thailand | 3,165,186 | 3,629,335 | 4,186,205 | 4,611,036 | 4,732,609 | 4,626,439 | 4,632,134 | 4,904,731 |

Notes:  p is preliminary estimate
Bangkok represents Bangkok and vicinities
Source: NESDB

## Table 2.6: Percent Share of Gross Regional Product by Region at Market Prices, 1993-2000

unit: percent

| Region/Thailand | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| North | 9.3 | 9.2 | 9.1 | 9.3 | 9.1 | 9.5 | 9.3 | 9.0 |
| Northeast | 11.1 | 11.3 | 11.6 | 11.7 | 11.5 | 11.8 | 11.6 | 11.3 |
| South | 8.5 | 8.8 | 9.2 | 9.1 | 9.0 | 9.6 | 9.0 | 9.1 |
| East | 9.1 | 9.5 | 10.0 | 10.7 | 11.7 | 12.7 | 12.7 | 13.6 |
| West | 4.2 | 4.2 | 4.2 | 4.2 | 4.1 | 4.3 | 4.2 | 4.2 |
| Central | 4.2 | 4.3 | 4.4 | 4.6 | 4.5 | 4.6 | 4.5 | 4.5 |
| Bangkok | 53.6 | 52.5 | 51.4 | 50.5 | 50.0 | 47.5 | 48.6 | 48.3 |
| Thailand | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Notes:  p is preliminary estimate
Bangkok represents Bangkok and vicinities
Source: NESDB

## Table 2.7: Gross Provincial Product for the Northern Region at Market Prices, 1993-2000

unit: million baht

| Province | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| Chiang Mai | 56,254.34 | 63,746.83 | 71,784.56 | 79,354.72 | 83,200.98 | 82,293.52 | 81,396.54 | 81,423.42 |
| Chiang Rai | 25,494.32 | 28,915.62 | 31,140.24 | 33,649.07 | 32,427.94 | 33,008.97 | 32,207.16 | 34,303.27 |
| Kamphaeng Phet | 18,768.14 | 21,122.7 | 23,512.36 | 27,136.89 | 27,563.55 | 29,236.71 | 28,511.93 | 31,824.71 |
| Lampang | 24,629.64 | 27,620.61 | 30,984.47 | 33,549.60 | 35,260.55 | 33,704.19 | 32,110.50 | 32,065.54 |
| Lamphun | 18,475.61 | 20,869.00 | 23811.26 | 27,017.78 | 26,387.77 | 27,117.21 | 27,598.67 | 29,953.63 |
| Mae Hong Son | 3,608.34 | 4,250.04 | 5,031.26 | 5,437.41 | 5,839.16 | 5,492.88 | 5,667.76 | 5,691.38 |
| Nakhon Sawan | 27,314.24 | 31,408.35 | 37,508.83 | 42,399.05 | 42,681.72 | 43,998.99 | 42,328.9 | 42,532.12 |
| Nan | 8,528.66 | 9,638.10 | 11,320.29 | 12,573.25 | 12,629.02 | 12,666.43 | 12,717.87 | 13,274.54 |
| Phayao | 9,726.16 | 10,872.42 | 12,708.64 | 14,256.38 | 14,137.26 | 14,185.55 | 14,251.61 | 14,700.51 |
| Phetchabun | 17,761.19 | 20486.81 | 24,754.87 | 27,096.08 | 25,619.95 | 26,990.4 | 26,463.62 | 26,568.58 |
| Phichit | 11,188.57 | 12921.94 | 15,098.7 | 17,473.02 | 18,255.90 | 20,116.88 | 18,556.65 | 18,537.79 |
| Phitsanulok | 20,402.34 | 23430.91 | 27,296.09 | 31,975.70 | 32,286.55 | 34,229.87 | 32,418.3 | 33,235.23 |
| Phrae | 9,374.31 | 10742.53 | 12,234.72 | 13,456.01 | 13,228.83 | 13,160.11 | 13,102.46 | 13,080.16 |
| Sukhothai | 12,990.75 | 14,579.8 | 16,788.69 | 18,687.72 | 18,464.45 | 19,111.09 | 18,530.86 | 18,975.78 |
| Tak | 12,064.08 | 13,006.54 | 13,440.07 | 14,674.53 | 14,298.35 | 15,024.24 | 15,058.02 | 15,100.38 |
| Uthai Thani | 6,618.12 | 7,900.35 | 9,303.52 | 10,747.41 | 10,630.46 | 11,171.90 | 10,692.84 | 11,980.48 |
| Uttaradit | 11,328.25 | 13,629.88 | 15,079.63 | 17,682.86 | 17,583.00 | 18,013.80 | 18,239.01 | 17,700.85 |
| North (GRP) | 294,527.06 | 335,142.41 | 381,798.21 | 427,167.48 | 430,495.42 | 439,522.73 | 429,852.7 | 440,948.40 |
| | | | | | | | | |
| Thailand (GDP) | 3,165,186 | 3,629,335 | 4,186,205 | 4,611,036 | 4,732,609 | 4,626,439 | 4,632,134 | 4,904,731 |

Note: p is preliminary estimate
Source: NESDB

## Table 2.8: Percent Share of Gross Provincial Product for the Northern Region at Market Prices, 1993-2000

unit: million baht

| Province | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| Chiang Mai | 19.1 | 19.0 | 18.8 | 18.6 | 19.3 | 18.7 | 18.9 | 18.5 |
| Chiang Rai | 8.7 | 8.6 | 8.2 | 7.9 | 7.5 | 7.5 | 7.5 | 7.8 |
| Kamphaeng Phet | 6.4 | 6.3 | 6.2 | 6.4 | 6.4 | 6.7 | 6.6 | 7.2 |
| Lampang | 8.4 | 8.2 | 8.1 | 7.9 | 8.2 | 7.7 | 7.5 | 7.3 |
| Lamphun | 6.3 | 6.2 | 6.2 | 6.3 | 6.1 | 6.2 | 6.4 | 6.8 |
| Mae Hong Son | 1.2 | 1.3 | 1.3 | 1.3 | 1.4 | 1.2 | 1.3 | 1.3 |
| Nakhon Sawan | 9.3 | 9.4 | 9.8 | 9.9 | 9.9 | 10.0 | 9.8 | 9.6 |
| Nan | 2.9 | 2.9 | 3.0 | 2.9 | 2.9 | 2.9 | 3.0 | 3.0 |
| Phayao | 3.3 | 3.2 | 3.3 | 3.3 | 3.3 | 3.2 | 3.3 | 3.3 |
| Phetchabun | 6.0 | 6.1 | 6.5 | 6.3 | 6.0 | 6.1 | 6.2 | 6.0 |
| Phichit | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.6 | 4.3 | 4.2 |
| Phitsanulok | 6.9 | 7.0 | 7.1 | 7.5 | 7.5 | 7.8 | 7.5 | 7.5 |
| Phrae | 3.2 | 3.2 | 3.2 | 3.2 | 3.1 | 3.0 | 3.0 | 3.0 |
| Sukhothai | 4.4 | 4.4 | 4.4 | 4.4 | 4.3 | 4.3 | 4.3 | 4.3 |
| Tak | 4.1 | 3.9 | 3.5 | 3.4 | 3.3 | 3.4 | 3.5 | 3.4 |
| Uthai Thani | 2.2 | 2.4 | 2.4 | 2.5 | 2.5 | 2.5 | 2.5 | 2.7 |
| Uttaradit | 3.8 | 4.1 | 3.9 | 4.1 | 4.1 | 4.1 | 4.2 | 4.0 |
| North (GRP*) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| North(% share**) | 9.3 | 9.2 | 9.1 | 9.3 | 9.1 | 9.5 | 9.3 | 9.0 |
| Thailand (GDP) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Notes: p is preliminary estimate
    * As percent share of the North
    ** As percent share for Thailand
Source: NESDB

## Table 2.9: Per Capita Income of the Northern Region at Market Prices, 1993-2000

| Province | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| Chiang Mai | 39,588 | 44,578 | 49,885 | 54,993 | 57,539 | 56,754 | 56,020 | 55,846 |
| Chiang Rai | 23,325 | 26,311 | 28,181 | 30,369 | 29,214 | 29,684 | 28,911 | 30,710 |
| Kamphaeng Phet | 28,054 | 31,433 | 34,782 | 40,025 | 40,594 | 42,932 | 41,806 | 46,527 |
| Lampang | 32,493 | 36,200 | 40,344 | 43,571 | 45,674 | 43,545 | 41,433 | 41,215 |
| Lamphun | 43,472 | 48,759 | 55,375 | 62,541 | 61,083 | 62,482 | 63,591 | 68,859 |
| Mae Hong Son | 21,607 | 25,148 | 29,596 | 31,798 | 33,949 | 31,751 | 32,762 | 32,709 |
| Nakhon Sawan | 25,268 | 28,868 | 34,286 | 38,615 | 38,802 | 39,890 | 38,307 | 38,317 |
| Nan | 19,697 | 22,157 | 25,845 | 28,641 | 28,702 | 28,722 | 28,839 | 29,965 |
| Phayao | 19,729 | 21,920 | 25,468 | 28,513 | 28,218 | 28,258 | 28,333 | 29,110 |
| Phetchabun | 19,626 | 22,513 | 27,055 | 29,549 | 27,878 | 29,306 | 28,702 | 28,723 |
| Phichit1 | 9,629 | 22,512 | 26,168 | 30,230 | 31,530 | 34,684 | 31,939 | 31,797 |
| Phitsanulok | 25,924 | 29,584 | 34,292 | 40,070 | 40,358 | 42,627 | 40,321 | 41,184 |
| Phrae | 18,674 | 21,315 | 24,132 | 26,488 | 25,990 | 25,754 | 25,641 | 25,497 |
| Sukhothai | 22,359 | 24,965 | 28,552 | 31,728 | 31,296 | 32,337 | 31,355 | 32,000 |
| Tak | 34,667 | 37,162 | 38,074 | 41,571 | 40,391 | 42,322 | 42,298 | 42,298 |
| Uthai Thani | 21,770 | 25,818 | 30,305 | 34,894 | 34,514 | 36,155 | 34,605 | 38,772 |
| Uttaradit | 24,897 | 29,825 | 32,853 | 38,525 | 38,224 | 39,160 | 39,650 | 38,397 |
| North (GRP) | 26,795 | 30,310 | 34,331 | 38,314 | 38,537 | 39,243 | 38,332 | 39,188 |
| | | | | | | | | |
| Thailand (GDP) | 54,563 | 61,815 | 70,474 | 76,847 | 78,093 | 75,594 | 74,946 | 78,591 |

Source: NESDB

## Table 2.10: Indices of per Capita Income of the Northern Region at Market Prices, 1993-2000 (1993=100)

| Province | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p |
|---|---|---|---|---|---|---|---|---|
| Chiang Mai | 100 | 113 | 126 | 139 | 145 | 143 | 142 | 141 |
| Chiang Rai | 100 | 113 | 121 | 130 | 125 | 127 | 124 | 132 |
| Kamphaeng Phet | 100 | 112 | 124 | 143 | 145 | 153 | 149 | 166 |
| Lampang | 100 | 111 | 124 | 134 | 141 | 134 | 128 | 127 |
| Lamphun | 100 | 112 | 127 | 144 | 141 | 144 | 146 | 158 |
| Mae Hong Son | 100 | 116 | 137 | 147 | 157 | 147 | 152 | 151 |
| Nakhon Sawan | 100 | 114 | 136 | 153 | 154 | 158 | 152 | 152 |
| Nan | 100 | 112 | 131 | 145 | 146 | 146 | 146 | 152 |
| Phayao | 100 | 111 | 129 | 145 | 143 | 143 | 144 | 148 |
| Phetchabun | 100 | 115 | 138 | 151 | 142 | 149 | 146 | 146 |
| Phichit | 100 | 115 | 133 | 154 | 161 | 177 | 163 | 162 |
| Phitsanulok | 100 | 114 | 132 | 155 | 156 | 164 | 156 | 159 |
| Phrae | 100 | 114 | 129 | 142 | 139 | 138 | 137 | 137 |
| Sukhothai | 100 | 112 | 128 | 142 | 140 | 145 | 140 | 143 |
| Tak | 100 | 107 | 110 | 120 | 117 | 122 | 122 | 122 |
| Uthai Thani | 100 | 119 | 139 | 160 | 159 | 166 | 159 | 178 |
| Uttaradit | 100 | 120 | 132 | 155 | 154 | 157 | 159 | 154 |
| North (Per capita) | 100 | 113 | 128 | 143 | 144 | 146 | 143 | 146 |
| | | | | | | | | |
| Thailand (Per capita) | 100.0 | 113.3 | 129.2 | 140.8 | 143.1 | 138.5 | 137.4 | 144.0 |

Note: p is preliminary
Source: National Economic and Social Development Board

**Table 2.11: Number of Commercial Banks in the Northern Region, 1999 and 2000**

<div align="right">unit: banks</div>

| Province | 1999 | 2000 |
|---|---|---|
| Chiang Mai | 127 | 124 |
| Chiang Rai | 56 | 55 |
| Khamphaeng Phet | 22 | 21 |
| Lampang | 31 | 31 |
| Lamphun | 17 | 17 |
| Mae Hong Son | 10 | 10 |
| Nakon Sawan | 50 | 49 |
| Nan | 10 | 10 |
| Phayao | 19 | 18 |
| Phetchabun | 27 | 27 |
| Phichit | 31 | 29 |
| Phitsanulok | 34 | 34 |
| Phrae | 16 | 16 |
| Sukhothai | 23 | 21 |
| Tak | 19 | 19 |
| Uthai Thani | 15 | 13 |
| Uttaradit | 17 | 15 |
| Total North | 524 | 509 |

Source: Bank of Thailand

## 3. THE INFORMATION TECHNOLOGY WORKFORCE AND EDUCATION

### 3.1 Introduction

In the Learning Age, the governments of many developed countries educate and train their workforce to the standards of their best competitors. The future skills requirements of the new economy suggests that self-improvement (education) is essential not only to young people but for all of those who are in the workforce or are a mid-career professional. In the new economy, the ability to learn, distribute and use information for building and applying knowledge is as important as formal education. It is essential that mid-career professionals in the new economy constantly upgrade skills and knowledge throughout their lifetime.

### 3.2 Education

#### Primary and Secondary Schools

When it comes to telecommunications services, schools in Northern Thailand are among the most deprived institutions in society. Providing schools with computers and advanced telecommunications is an immediate challenge the Government is facing currently. A review of the status of computer and Internet-based learning at public and private schools shows that progress is slowly underway. It is clear that having access to advanced telecommunications in schools helps prepare and train much of tomorrow's labour force to be competitive in the job market. However, the supply of computer equipment remains uneven throughout the northern region.

Usually, teachers in private schools are more likely to work in better-equipped environments than teachers in poor and rural schools. In Chiang Mai, for instance, while the private schools in central city areas compete with private schools by providing access to quality computer equipment, most public schools are likely to have more insufficient technology elements. And those in the rural areas remain even more underprivileged.

The Education Reform Act adopted in 1999 and the national IT plan indicates that the role of the teacher in Thailand must change.  It is no longer sufficient for teachers merely to impart content knowledge.  Now, it is crucial for teachers to encourage thinking skills and help develop knowledge and information literacy.

What we can see is a need for teachers to adapt current teaching skills and practise to accommodate ICT, while the majority of schools in Northern Thailand do not even have access to ICT.  In many schools in rural areas of Northern Thailand, sufficient basic educational infrastructure and most other basic teaching equipment are still not in place to meet the needs of students and teachers.

**ICT Graduates in the Northern Region**

In Northern Thailand, the proportion of ICT-related graduates seems to be low in proportion to the importance of technology to the economy and society in general.  At present, there are 11 polytechnic institutions and 4 universities that provide IT-related diploma and degree programmes in Northern Thailand (Tables 3.1 and 3.2).

According to the computer engineering department at Chiang Mai University, the number of IT-related graduates very much depends on the enrolment of the first-year students. Whether Northern Thailand is producing an adequate supply of IT workers is still very much open to discussion. There is no single common definition of "IT worker", and there is little well-developed and reliable information available regarding the current or future ICT occupational-skills imbalances.

## 3.3 Local SMES and Employment in IT Occupations

It may appear that there are shortages of IT workers in Northern Thailand. However, a recent study of several leading manufacturers in upper Northern Thailand found that the demand for IT workers in the past few years also has not increased.

Examples of IT occupations include computer scientists, computer engineers, systems analysts and computer programmers; these are the IT positions that require the most education and skills. Many practitioners have relied on simply defining IT occupations as those positions involved in creating, operating and maintaining the IT infrastructure required to facilitate e-commerce and other Internet or network-related activities.

Private surveys and interviews with the acting director of NSTDA Northern Network provide additional insight into the specific IT skills in demand in Northern Thailand. The growth in e-commerce in Thailand, for example, has increased demand for workers with Internet-related technical skills, including network specialists, help desk/end user support staff and Internet and intranet developers. In Northern Thailand, however, employment levels in these IT occupations remains flat as the bulk of network application service providers reside in Bangkok.

The evidence that knowledge-intensive IT occupations, such as computer scientists, computer engineers and systems analysts, are in great demand in Northern Thailand remains ambiguous. Since there are very few IT-producing industries, the impact of IT on employment can be measured. But for non-IT related jobs, the impact can only be speculated upon.

### IT Investment in Local SMEs

One survey (Chulasai, L and Siroros, N, 2002) of northernSMEs found that some local entrepreneurs do not realize how their businesses could benefit from knowledge management and basic utilization of ICT. The idea of allocating funds for ICT training and other ICT intangible assets, such as skill improvements, are usually viewed as an investment. There is an understanding by the majority of local businesses that only high-tech business and IT-related business benefit from information technology and that it is not relevant to traditional manufacturing and service businesses.

**The Use of IT Equipment, Including Software**

Despite the spread of networked computers, the Internet, e-commerce and the associated growing demand for high-quality digitized products and services, most Northern Thailand manufacturers do not have any idea how information technology could provide significant benefits to their businesses. Except for some activities from a Web site initiated by NSTDA, there is no evidence that firms are moving their supply networks and sales channels online.

The survey (Chulasai, L and Siroros, N, 2002) found that less than 5 percent of Northern Thailand manufacturers use information technology in their business practices. Those that do use tools such as computer software to coordinate product design and/or provide some IT training to their workforce.

According to the survey of the leading manufacturers in upper Northern Thailand, the use of IT equipment, including software, usually involves basic bookkeeping applications and inventory management. Advance integration of ICT into business practices, such as business-to-business e-commerce or online pricing that allows store-to-store comparisons, is basically unattainable since most firms are unaware of enterprising software applications.

Regarding the use of information technology in most manufacturing and service businesses in the region, some noteworthy findings include:

- The mainstream usage of software applications include document processing, spreadsheets applications and accounting applications, although many firms are at the beginning stages of implementing e-commerce technologies in their business practices.
- Because prices for IT equipment and software have been falling, investment spending may have risen while the growth of industry spending on IT software has been minimal; what there is has been easily accessible illegal copies of software.

- There are no official output measures for IT-intensive manufacturing and service industries in Northern Thailand. However, studies conducted by the SME Institute at Chiang Mai University (2003) of handicraft industries found that the greatest benefit of computers appears to be realized when computer investment is coupled with other complementary investments, such as new product design strategies and new business practices. A good example of these firms is King Collection Company. (www.king-collection.com)

The Government recognizes the existence of digital divides between large and small firms and among the country's regions (Kagami, M and Tsuji, M. eds., 2002 p 149). Education levels are a major cause for digital divides in Thailand. The cost of Internet leased-lines also poses obstacles to IT development for local SMEs. The use of high cost leased-lines is more concentrated among larger firms. As the majority of firms in Northern Thailand are small and medium enterprises, the high cost of a leased-line makes it difficult for local SMEs to have access to handy e-business processes, including B2B e-commerce application, application service provider and suppliers and logistic operators.

## 3.4 Local IT Industries and the Northern Region Industry Estate

### Local IT Industries
The strength of the digital economy is based on IT producing companies that deliver the goods and services that support IT-enabled business practices across the economy. There are around 18 major local software development firms in upper Northern Thailand, many of them in Chiang Mai (Table 3.3). The majority of these firms are producing business software with Thai nuances (such as using the Thai calendar format where the year 2546 is equivalent to the year 2003 in the international format) that involves basic business operations, such as inventory tracking and bookkeeping. Most software development firms hire an average of 10-15 employees with the minimum monthly wages of an IT worker between 8,000 and 15,000 baht. Jimmy Software Co. Ltd is widely recognized as one of the most accomplished software developers in Thailand. The company also markets its software, including games and applications, to the international market.

However, according to NESDB's Northern Development Centre and NSTDA's Northern Network, the performance of a local software industry in Northern Thailand has not shown any measurable impact on the growth of the regional economy. The regional productivity and growth associated with IT-related innovation appear to be negligible. Although the costs of computing and communications have been declining, investment in new software, particularly locally developed by Thai software firms, cannot be captured by official output and productivity measures. Applications software developed by Thai firms also don't appear to have gained sufficient consumer confidence in its reliability and superiority. Further, local businesses and consumers have access to cheap pirated versions of foreign-made software. In Chiang Mai, pirated software is commonly available, even in most major department stores or the pirated software can be mail-ordered to private houses.

**Northern Region Industrial Estate**

Since the Fourth National Development Plan (1977-1981), the Thai Government has indicated that in order to decentralize urban conglomeration and foster economic progress, it will develop one principal city in each region of the country. As far as the North is concerned and after considering the situation, the Government has decided that the most appropriate strategy to further develop the principal city of Chiang Mai is not to concentrate every activity in the same city but set up the Northern Region Industrial Estate (NRIE) in Lamphun province. It is the province that will accommodate medium and larger industries, in addition to the growth of Chiang Mai province. The Industrial Estate Authority of Thailand is a semi-public agency existing under the jurisdiction of the Ministry of Industry. The objective for establishment of an industrial estate is to support a systematic and orderly development of industries. The construction of the NRIE started in April 1983 and was completed in March 1985. The North is a very attractive place to make investments because in addition to its inherent economic strength, there is a quality labour force that is available, abundant and low-cost. Markets are readily accessible in neighbouring provinces and nearby countries (Myanmar, China and Lao People's Democratic Republic).

The Northern Region Industrial Estate is located in Ban Klang district, Lamphun province and consumes a total area of approximately 1,788 rai. Easy access to road, rail and Chiang Mai's international airport marks the NRIE as a major industrial zone within Northern Thailand (See Figure 3.1). There are now 68 businesses in NRIE, almost all of which are managed and owned by overseas investors from several countries, including Japan, Singapore, Taiwan, Korea, Switzerland, United States and the Netherlands. Factories are categorized into nine groups: electronics, agriculture, food and beverage, construction, equipments and spare parts, wood and timber, jewellery and ornaments, leather and miscellaneous (Table 3.4). Currently, there are 23 electronic factories accounting for 33.8 percent of the total number of factories. Food and beverage and equipment and spare parts each account for 19.12 percent; agriculture and construction each account for 2.94 percent.

NRIE's economic contribution to the city of Lamphun includes the employment of an average 51,357 full-time and part-time employees (in 2000), total investment of around 32,458 million baht. Export value in 2000 was around 40,105 million baht. Many businesses and factories in the NRIE are networked with each other, and all have easy access to the industrial estate facilities, such as shops.

According to the Bank of Thailand, more than 85 percent of the total foreign trade value in Northern Thailand with shipment by air through Chiang Mai international airport involves trading of electronics components produced in the Northern Region Industrial Estate in Lamphun. These electronics components being produced are transistors, condensers, transformers, ceramic filters, coils, delay line, TV tuners, quartz crystal tuning, printed circuit board assembly (PCBA), membrane switches, semiconductors, hard disk parts and fibre optic cable.

The majority of electronic firms in the NRIE are Thai affiliates of foreign-owned companies operating in Northern Thailand because of favourable labour costs. Most of the manufacturing processes involve the production of value-added electronic components that require imported parts from overseas affiliates. The cheap labour costs allow firms in the NRIE to achieve a lower cost of production than overseas competitors. More complex production processes that require advanced manufacturing technology are performed by other affiliates overseas.

# Table 3.1: Estimated Number of IT-Related Graduates from Polytechnic Institutions in Northern Thailand During the Period of the Eighth and Ninth National Development Plans

| Educational institution and available field of specialization | National Development Plan 8 | | | | | National Development Plan 9 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Polytechnic Lumpang (วิทยาลัยเทคนิคลำปาง) | | | | | | | | | | |
| • Information Systems (สารสนเทศ) | | | | | | | | | 20 | 20 |
| Rajabhat Institute Chiang Rai (สถาบันราชภัฏเชียงราย) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | 19 | 17 | 28 | 23 | 27 | 20 | 40 | 40 | 40 | 40 |
| Rajabhat Institute Lampang (สถาบันราชภัฏลำปาง) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | 60 | 47 | 40 | 32 | 56 | 56 | | | | |
| Rajabhat Institute Nakornsawan (สถาบันราชภัฏนครสวรรค์) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | 10 | 23 | 36 | 65 | 53 | 23 | 56 | 50 | 44 | 44 |
| • Information Technology (เทคโนโลยีสารสนเทศ) | | | | | | | | | 43 | 43 |
| Rajabhat Institute Petchabul (สถาบันราชภัฏเพชรบูรณ์) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | 39 | 42 | 0 | 39 | 45 | 79 | 35 | 35 | 35 | 35 |
| Rajabhat Institute Utaradit (สถาบันราชภัฏอุตรดิตถ์) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | 29 | 48 | 36 | 63 | 94 | 149 | 91 | 98 | 88 | 80 |
| Rajamankala Institute of Technology Payup (สถาบันเทคโนโลยีราชมงคลวิทยาเขตภาคพายัพ) | | | | | | | | | | |
| • Computer Engineering (ครุศาสตร์อุตสาหกรรมคอมพิวเตอร์) | | 30 | 46 | 46 | 30 | 3 | 61 | 40 | 40 | 40 |
| • (ปวส. ระบบสารสนเทศ) | | | | | | | | | 64 | 64 |
| Rajamamkala Institute of Technology Tak (สถาบันเทคโนโลยีราชมงคลวิทยาเขตตาก) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | | | | | | | | | 27 | 30 |
| Polytechnic Institute Petchabul (วิทยาลัยเทคนิคเพชรบูรณ์) | | | | | | | | | | |
| • Computer Business (คอมพิวเตอร์ธุรกิจ) | | | | 81 | 75 | 85 | 80 | 80 | 80 | 80 |
| North College (วิทยาลัยนอร์ท-เชียงใหม่) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | | | | | | | | 9 | 4 | |
| Yonok College (วิทยาลัยโยนก) | | | | | | | | | | |
| • Computer Sciences (วิทยาการคอมพิวเตอร์) | | | | | | | | | | 10 |
| Sub-total | 157 | 292 | 313 | 423 | 478 | 452 | 445 | 389 | 565 | 521 |
| Total | | | 1,663 | | | | | 2,372 | | |

Source: NESDB – Northern Development Office, 2002

Table 3.2: Estimated Number of IT-Related Graduates from Universities in Northern Thailand During the Period of the Eighth and Ninth National Development Plans

| Northern Thailand Degree Graduates in IT-related fields | Eighth National Development Plan | | | | | | | | | Ninth National Development Plan | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Academic Year 2000 | | | Academic Year 2001 | | | Academic Year 2002 | | | Academic Year 2003 | | | Academic Year 2004 | | | Academic Year 2005 | | | Academic Year 2006 | | |
| | Bachelor | Master | PhD | Bachelor | Master | PhD | Bachelor | Master | PhD | Bachelor | Master | PhD | Bachelor | Master | PhD | Bachelor | Master | PhD | Bachelor | Master | PhD |
| **Chiang Mai University** | | | | | | | | | | | | | | | | | | | | | |
| Computer Sciences | 85 | 11 | | 10 | 10 | | 100 | 15 | 70 | 60 | 15 | 70 | 60 | 15 | 100 | 60 | 15 | 5 | 60 | 15 | 5 |
| Computer Engineering | 50 | | | 5 | | | | | | | | | | | | | | | | | |
| Information Technology | | 50 | | | 60 | | | 150 | | | 150 | | | 150 | | | 150 | | | 150 | |
| **Maejo University (universitas?)** | | | | | | | | | | | | | | | | | | | | | |
| Computer Sciences | 51 | | | 5 | | | 60 | | | 60 | | | 60 | | | 60 | | | 60 | | |
| Information Technology | | | | | | | 50 | | | 50 | | | 50 | | | 50 | | | 50 | | |
| **Naresuan University (universitasum?)** | | | | | | | | | | | | | | | | | | | | | |
| Computer Sciences | 175 | | | 200 | | | 200 | | 70 | 200 | 25 | 70 | 200 | 10 | 100 | 200 | 10 | 100 | 200 | 10 | 100 |
| Information Technology | | | | | 10 | | 40 | 25 | 100 | 40 | 25 | 100 | 40 | 25 | 100 | 40 | 35 | 100 | 40 | 35 | 100 |
| **Mae Fah Luang University (universitsasfmm?)** | | | | | | | | | | | | | | | | | | | | | |
| Information Technology | 43 | | | 7 | | | 100 | 25 | | 100 | 25 | | 100 | 25 | 5 | 100 | 25 | 5 | 100 | 25 | 5 |
| Computer Science | 56 | | | 7 | | | 70 | | | 70 | | | 100 | 15 | | 100 | 15 | 5 | 100 | 15 | 5 |
| **TOTAL** | 663 | | | | | | | | | 5,170 | | | | | | | | | | | |

Source: NESDB – Northern Development Office, 2002

## Table 3.3: List of IT-Related Firms in Chiang Mai and Northern Thailand

| | |
|---|---|
| 1. | Global Business Solution Co., Ltd |
| 2. | PF. Profess Software & Solution Co., Ltd |
| 3. | Premier Network Enterprise Co., Ltd |
| 4. | PC Software 1994 Co., Ltd |
| 5. | EPOS Corporation Ltd |
| 6. | ITS Information Technology Solution Co., Ltd |
| 7. | www.japankiku.com |
| 8. | Jimmy Software Co., Ltd |
| 9. | Jasmin Solution Provider Co., Ltd |
| 10. | www.lanabiz.com |
| 11. | Lothar Munch  Advance Company and Information Technology Consulting and Research |
| 12. | CMPEG Technology square 1 |
| 13. | Soft Square 1999 Co., Ltd |
| 14. | Northern Star Software Co., Ltd |
| 15. | Plan-Phum Co., Ltd |
| 16. | Henry Castiel |
| 17. | Thai Trade Point |
| 18. | Chiang Mai EDP Co., Ltd |

Source: NESDB – Northern Development Office, 2002

**Table 3.4: Number of Factories in the Northern Region Industrial Estate (NRIE), Lamphun**

| Type of industry | Number of factories | % |
|---|---|---|
| Electronics | 23 | 33.82 |
| Agriculture | 2 | 2.94 |
| Food and beverage | 13 | 19.12 |
| Construction | 2 | 2.94 |
| Equipments and spare parts | 13 | 19.12 |
| Wood and timber | 2 | 2.94 |
| Jewellery and ornaments | 6 | 8.82 |
| Leather | 4 | 5.88 |
| Miscellaneous | 3 | 4.41 |
| Total | 68 | 100 |

Source: www.investmentthailand.com, 2002

# Figure 3.1: Northern Region Industrial Estate (NRIE)
##             in Lamphun Province
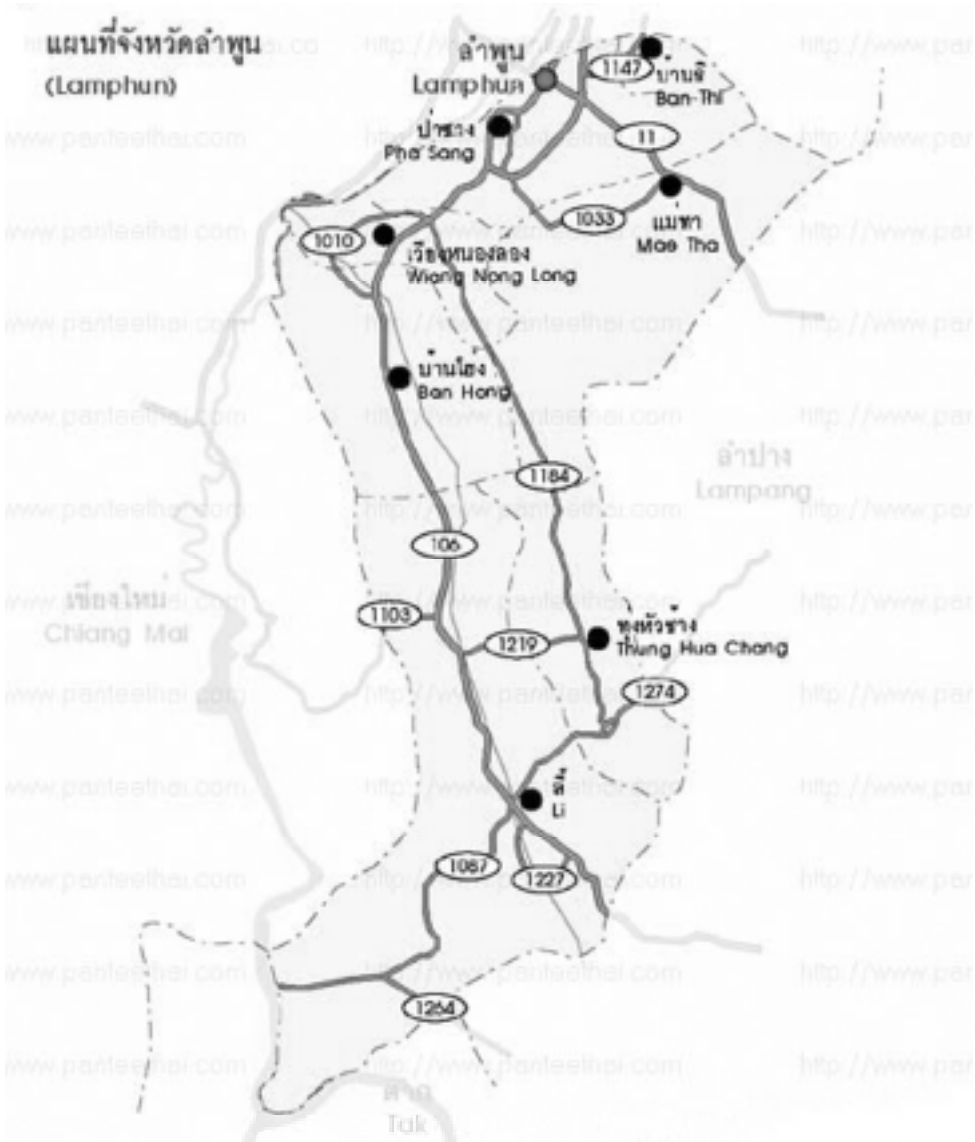


Source: www.panteethai.com

## 4.  KEY ISSUES FOR NORTHERN THAILAND

### 4.1 Local SMEs

The skills required to work and do business are changing. In order to maintain the competitiveness of the region and the whole nation, it is necessary for local companies to respond to the world's rising expectations for better services, quality and products.  Proper management of knowledge promotes innovative types of goods and services that are more profitable, and it ensures a better-quality product.  Several local SMEs, for instance, have employed e-commerce marketing techniques that promote handicraft products manufactured in Northern Thailand.

However, there is little evidence that suggests the use of ICT improves product design or manufacturing processes. There is a primary misunderstanding that the use of knowledge and information technology benefits only the high-tech business and is not relevant to traditional manufacturing and services.  Local prominent businesses of all types in Northern Thailand, from handicraft, decorative products, food processing and services industry such as tourism, need to improve their knowledge, skills and creativity to improve their products and services and raise their productivity. In the past few years, a number of efforts have pushed for more widespread ICT awareness programmes in Northern Thailand, yet the local SMEs suffer long-standing shortcomings, as the following section explains.

Too many local firms have not succeeded in matching the performance of their overseas competitors, not only in terms of productivity, innovation and quality but also in ability to manage their basic internal business management.  Often business practices and problems are not clearly defined and documented.   Despite all current and future ICT technology, the computer still owes its power and usefulness to people who define the problems to be solved by the computers.  It will be almost impossible to integrate ICT into business management without clearly defined and documented problems to be solved.

A communications gap has always existed between those who need the computer and those who understand the technology. Entrepreneurs may not fully understand the capabilities and limitations of modern computer technology. Likewise, computer programmers frequently do not understand the business applications they are trying to computerize. This illustrates a lack of investment in human capital and a lack of emphasis on learning beyond the classroom in other ways.

Further, there has been too little or no investment in research and development and other intangible assets. Typically, the corporate interest in knowledge management has been minimal. Therefore, there has been minimal market value of intellectual capital. This lack of appreciation for intellectual capital is prevalent in Thai society and often discourages people to integrate their specialist knowledge to produce goods and services.

It is a challenge that is national in nature that in order to promote knowledge transmission and circulation, organizational and cultural changes are needed. A new approach to education has to be achieved both at the level of individual as well as organizational level. Some significant issues in relation to local SMEs are:

- Cultural changes are needed to promote the use of knowledge management. Information technology may be a necessary foundation for knowledge management but it is not enough on its own. Lifelong learning will be essential for individuals in an organization to upgrade skills and knowledge to maintain their jobs. Knowledge only achieves its full potential to create intangible value when it is embedded in human resource development, business routines and practices.

- Trust is needed among local SMEs to generate the flow of knowledge sharing. SMEs that share common interests, such as a network of local handicraft manufacturing, could establish a network of knowledge that can make a significant contribution to development. A network of sharing information can serve a dual function: both as a depository for openly available knowledge that can play a key role in supporting knowledge-based development and as a mechanism for trade that uses customer information networks as a medium for exchanging trade information.

- The advent of the Internet and communications technology has coincided with dramatic changes in the marketplaces worldwide. Now, it is possible that customers, suppliers and businesses can access resources to compare prices and availability of goods from many countries in the world. A marketplace on the Internet serves as a "stall" that is housed within a global "grand bazaar" and accessible to customers throughout the world. It is important that local SMEs realize the new expanding market opportunities by focusing attention on the nature of the newly evolving market and adapt marketing strategies in a manner that fully utilizes the dynamic e-commerce nature. They will have to develop new pricing strategies, better understand user needs and demands and develop skills of their staff to contend with the new services.
- In order to promote the widespread use of knowledge among local SMEs, a secured computer network environment is needed to attract new industries and diversity and assist industries or educational institutions in moving toward an information- and service-based economy. A level of security infrastructures supporting a trusting and confident trading environment has to be achieved that focuses on scalable and usable authentication, including:
  - Authenticity of electronic transactions;
  - Protocols and transactional models, including electronic payments;
  - Technologies and systems to fight abuses and fraudulent or criminal activities; and
  - Personal rights of privacy, confidentiality and copyright.

These security infrastructures can be initially established among a small network of similar industries or local industry clusters. Sufficient security infrastructure to meet companies' needs may also strengthen the existing networks of industries and business relationships in the region.

## 4.2 Government Efforts

Government has a critical role to play in ensuring that public institutions are provided with sufficient IT infrastructure and relevant IT regulations. The Government is also instrumental in working with the private sector and public institutions to establish a strategic vision for IT policy development and deployment. A shared vision between government and the public sector make it possible to promote efficient cooperation and networking between local businesses, educational institutions and the local government agencies. To help Northern Thailand's information infrastructure evolve into better interconnected networks that allow institutions to share information and communicate as a local and regional community, some key issues should be put into effect:

### Relevant Statistical Data

In most countries, producing true output measures for IT industries presents a daunting task. A more complete estimate of IT's roles should cover the direct effects on education, employment and the economy. Even with such data, it is difficult for countries in the developed world to create satisfactory methods for measuring the output of IT businesses, IT labour markets and other IT-related contributions to the economy. In the absence of accurate measures of IT-related profiles data, e.g. the number of local IT workers or IT industries in Northern Thailand, it is not possible for the Government or any agency to develop relevant strategic IT policy and ICT deployment in the region. At present, there is no reliable evidence that suggests Northern Thailand is suffering from a shortage of IT-skilled labour. Nor does it appear that there have been any IT-skills shortages in the past, or if there have been any demands of IT skills in the region at all.

At present, the apparent combination of minimal computer use in most local industries and the low number of IT-producing businesses in the region does not necessarily suggest that Northern Thailand needs more IT workers. However, we cannot rule out the possibility that local businesses are not aware of the technology potential to make businesses more efficient. Without

relevant statistical data, the Government and businesses cannot be certain how much to invest in human capital and the minimal skill level necessary for KBE development. The question of how to develop relevant regional IT-related policies or how they would contribute to the regional economic performance will remain largely unknown, at least until the Government develops reliable measuring methods.

To measure how information technology is changing business practices, there should be more complete surveys of IT-intensive products and service industries. For instance, the techniques used to measure output in these industries should assume labour productivity changes, changing business practices and raising productivity throughout the regional economy. There is also a need to measure the quality, price and output changes for computers and certain telecommunications equipment, along with the productivity in all sectors. There is also a lack of basic statistical information regarding the use of computer and advanced telecommunications in public and private schools, including: the number of schools that have computers, the number of computers and students or teachers, and the number of schools that have access to a computer network, such as a wide-area network or the Internet.

With better measures of IT's role and other IT-related contributions to the economy, the information available will help in estimating the current or future occupational skill imbalances and in showing how IT could contribute to the local service industry's productivity or overall labour productivity, both inside and outside the IT sectors.


**Combination of ICT and University-Industry Collaboration**
Relationships between universities and local businesses have evolved in most developed countries for decades (Blume, Ferne, Gibbons, 1984). Businesses are usually looking for a solution to a problem and access to technical knowledge; academic institutions are typically looking for the opportunity to conduct useful research and apply their knowledge in a hands-on environment and to train students. Strong collaboration between universities and industries allow local firms to have access to specialists' expertise, improve a firm's capacity to solve problems and promote a lifelong learning culture among firms and individuals, which, over time, generates tangible economic and social benefits.

The majority of the existing collaborations between industry and universities in Northern Thailand are established on individual relationships, mostly of an informal nature. The existing informal contacts with industry have provided opportunities for academic researchers to bring together local entrepreneurs and industrialists for the discussion and identification of problems. However, there are boundaries that may prove difficult for certain types of formal relationships between academic researchers and non-academic organizations to engage official joint research and education programmes with universities. Such boundaries may include the official regulations and the bureaucratic systems that discourage the cooperation between the researchers and entrepreneurs. Efforts that the Government can carry out include building closer alliances between the sectors to extend their interactions with the local industry. This interaction provides an opportunity to introduce the use of knowledge and change the attitudes, culture and expectations of learning.

The rapid development of ICT extends the university and industry collaboration process by facilitating new ways to involve students in highly specific areas of industry. For instances, the University for Industry (UFI) programme was established by the Government of the United Kingdom to provide learning services that promote lifelong learning and IT competency, including intermediate skills for SMEs. This programme enables UK citizens to gain new skills by providing the learning material through the Internet. There are courses designed to target specific types of businesses, which provide new learning skills directly relevant to specific problems and people's interests.

Government efforts to establish a university-industry alliance to be subsidized by local firms would be beneficial to both the university and the local firms. The partnership would provide long-term benefits to the Northern Thailand economy, such as:

- Learning culture in the Thai education community.
- Relevant technical information and skills needed especially in SMEs.
- Basic IT literacy, and promote the harnessing of new technologies.
- Savings in the cost of education and training.
- Access to education to be more accessible and flexible, thereby allowing lifelong learning and training.

- Allow the Government to capitalize on the marketing opportunities generated by the learning activities and Internet interaction.
- SMEs gain easy access to the top students and researchers in the region.
- Stimulated research and development activities among local communities.
- Trust and information sharing among sectors and industries.

The success of integration of ICT into the university-industry cooperation development should allow an effective transfer of knowledge to industrial production and create a well-developed learning culture in Thai society.

## Intellectual Property Rights and Pirated Software

As in many Asian countries, software pirating is prevalent in Thailand. The problem is also regional as illegal copies are transferred over the Internet directly to the copier regardless of location. Anyone can openly purchase a bundle of illegally copied CDs worth hundreds of thousands of baht from most local computer stores and shopping malls. Whereas Chiang Mai has much potential for software development and growth opportunities for local software industries, the market for pirated software is also growing rapidly. Because most of the software CDs that are being illegally copied are produced by overseas firms, the traditional view of many, Thai computer users is that software pirating is an almost "victimless" crime.

In the long run, however, software-development industries in Northern Thailand will lose thousands of new jobs. Locally registered software distributors will lose their potential profits. And the Government will lose millions of baht of tax revenue because of the trade in illegal software. The traditional approach to support local software industries in Northern Thailand would require tighter law enforcement and need to reshape the public view of intellectual property by providing well-developed intellectual property guidelines for businesses. In due course, government efforts to change public attitudes toward the value of intellectual property will be a greater challenge as it will ultimately require the use of legitimate software in all government agencies and public schools.

## 5. CONCLUDING REMARKS

The rapid development of ICT presents new and expanding opportunities for the world economy. In order to maintain the regional capabilities and competitiveness, Northern Thailand has to reposition itself to accommodate the competition. As the new economy requires businesses to be equipped with people who have essential ICT skills, changes in human resource development are required to improve the quality of regional human capital. The regional government institutions have been working to deliver appropriate support and relevant policies in Northern Thailand. However, lack of statistical data needed makes it difficult to develop relevant regional IT-related policies for the community.

IT can offer cost savings, expanded markets and more intense competition for private businesses in almost every industry; however, it presents many new and difficult issues for the Government: Sufficient ICT infrastructure in place does not promise economic growth. Individuals are faced with a multitude of information and need the skills and understanding of how to use them innovatively. The success of KBE development in most of the developed world is closely linked with the innovative use of the learning rea of technology and perhaps more importantly, investment in its people.

Evidently, the wide variety of pirated software openly available to the public does not help increase the number of IT-skilled workers in the community. Nor does it stimulate the local industries to use more software tools to improve their production and respond to customer demands. Rather, the appreciation for software piracy demonstrates the low public attitude toward the value of intellectual property as a whole.

One of the significant features in the knowledge-intensive economy is commitment to research and development. Government efforts to establish a university-industry alliance coupling with ICT application may help stimulate R&D activities among the local communities as well as provide easy access to relevant information and specialists' expertise from universities. Development toward a knowledge-based economy requires the alteration of attitudes and the creation of a culture of learning in organizations and the community. Such revolutionary development efforts will be weakened in the absence of government support.

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