TSUNAMI DISASTER RESPONSE: A CASE ANALYSIS OF THE INFORMATION SOCIETY IN THAILAND

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The December 2004 Indian Ocean Tsunami wrecked thousands of lives, homes, and livelihoods – losses that could have been avoided with timely and better information. A resource such as information is needed at a fundamental level much like water, food, medicine, or shelter.

This dissertation examines the development of the Thai information society, in terms of the share of information workforce and the level of diffusion of information and communication technologies (ICT), as well as, the role of the Thai information society in response to the tsunami disaster. The study combined the historical and political economy analyses in explaining factors influencing the growth of information workforce and the development of ICT in Thailand.

Interviews conducted in 2007-08 revealed the Thai information society responded to the 2004 Tsunami – the first global internet-mediated natural disaster – in two areas: on-site assistance in collecting and recording identification information of tsunami disaster victims and on-line dissemination of disaster relief information. The effectiveness of ICT institutions in providing the tsunami disaster relief efforts and increasing the development of the information society were assessed using statistical procedures analyzing the perceptions of the Internet-based survey respondents. The disaster effects on survey respondents were also assessed.

The study's findings include: (1) the Thai information sector development pattern confirmed a key difference between development patterns of information sectors in developed and developing countries, (2) the increasing number of Thai information workers was due more to the expansion of government than the expansion in the manufacturing and service sectors during the 1997-98 Asian financial crisis, (3) Thailand's expansion of ICT infrastructure was

influenced not only on the basis of economic profitability but also by political desirability, and (4) volunteers were crucial in humanitarian aid and disaster relief.

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ABBREVIATIONS

ADSL	Asynchronous Digital Subscriber Line
AIS	Advanced Info Service Public Company Limited
ASEAN	Association of South East Asian Nations
Baht	The Thai currency
BTO	Build-Transfer-Operate agreements
CAT	Communication Authority of Thailand
CDC	Centers for Disease Control and Prevention
CEO	Chief Executive Officer
CIFS	Central Institute of Forensic Science
CMS	Content Management System
DDPM	Department of Disaster Prevention and Mitigation
DTAC	See TAC
DVI	Disaster Victim Identification
FEMA	Federal Emergency Management Agency
Gbps	Giga Bits Per Second (one billion bits per second)
GDP	Gross Domestic Product
GNP	Gross National Product
ICT	Information and Communication Technologies
IFRC	International Federation of Red Cross
ILO	International Labour Organization
INET	Internet Thailand Public Company Limited
ISCO	International Standard Classification of Occupations
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
Mbps	Mega Bits Per Second (one million bits per second)
MICT	Ministry of Information and Communication Technology
MOPH	Ministry of Public Health
NDI	National Democratic Institute
NDWC	National Disaster Warning Center
NECTEC	National Electronics and Computer Technology Center
NIE	Newly Industrialized Economy
NSO	National Statistical Office
NSTDA	National Science and Technology Development Agency
NTC	National Telecommunications Commission
OECD	Office of Economics Council Development
ONI	OpenNet Initiative
OSS	Open Source Software
OSSN	Open Source Software Network
PM	Prime Minister
PTD	Post and Telegraph Department
PTT	Petroleum Authority of Thailand

SIM card	Subscriber Identity Module card
SIPA	Software Industry Promotion Agent
SMS	Short Messaging Service
SOE	State-owned enterprises
SRS	Strategic Restructuring
SST	Social Shaping of Technology
TA	Telecom Asia
TAC	Total Access Communication
TMD	Thai Meteorological Department
TOT	Telephone Organization of Thailand
TT&T	Thai Telephone and Telecommunication Public Company Limited
UCOM	United Communication Industry Public Company Limited
UN	United Nations
USGS	United States Geological Survey
WTO	World Trade Organization

CHAPTER I

INTRODUCTION

The purpose of this dissertation is to examine the development of the information society in Thailand and its role in response to the 2004 Southeast Asian tsunami disaster. It analyses the information society from the perspective of the information workforce, and information and communication technologies (ICT), within the Thai socioeconomic context and government policies. There is minimal explanation of the development of the information society in Thailand. This research investigates factors influencing the development of the Thai information society. It includes a case study of the role of the Thai information society in response to the tsunami disaster. It adds to a body of literature on country-specific information society studies and provides ICT policy and technology guidelines for disaster relief.

This chapter outlines theoretical concepts of information society and the shortage of information society research in developing countries. It presents the significance of the 2004 Southeast Asian tsunami as the worst natural disaster in Thailand, affecting large international communities. It outlines how the medium of the Web was used in a collaborative networked environment to aid recovery. It also explains the limitations of the study.

Problem and Background

For the past decade, a significant amount of academic research has been dedicated to the ideas of new societies, formed and shaped by the introduction of information and communication technologies. Early research between 1960 and 1980 emphasized empirical analysis in quantifying information-related occupations or industries as a dynamic and powerful economic and social force in an economy. Thus, emerged the concepts of knowledge workers, information

sector (Machlup, 1962; Porat, 1977), and post-industrial society (Bell, 1973). This research conducted primarily in the United States has been repeated widely in Western Europe and Asia Pacific countries (Barnes & Lamberton, 1976; Karunaratne & Jussawalla, 1988; Katz, 1988; Kuo & Low, 2001; OECD, 1981).

Information Societies

Researchers have shown that the formation of information societies in developed countries is driven by the economic need to promote greater efficiency in the production of goods and services (Barnes & Lamberton, 1976; Porat, 1977). In contrast, Katz (1988) argues that the increase of information workers in many developing countries – "countries with low or middle per capital income" (Talero, 1997), was the result of the growth of the government, rather than the expansion of the private manufacturing and service sectors. Additionally, he contends that the diffusion of information technologies in developing countries was strongly influenced by political factors, such as nation-building imperatives, industrial policies, or protection of government-owned telecommunication services. Moreover, corruption and power struggles between interest groups hindered the transition of a country to an information society (Castells, 1996).

Scores of documented trends indicate that developing Southeast Asian economies are rapidly transforming from basic agriculture structures to information economies (Karunaratne & Jussawalla, 1988). As Katz (1988) writes:

> The concept of "information society" – developed for industrialized countries – is only an analytical benchmark against which different countries can be analyzed, rather than a model that nations must follow in order to enter postindustrial stages. … there are as many profiles of an information society as there are countries in the world. (p. 139)

Research in the development of information society in developing countries remains scarce. A comprehensive search only yielded two research studies that showed Thailand's

information workforce in 1980 being 13.7 % (Karunaratne & Jussawalla, 1988, p. 169) and less than 10 % (Katz, 1988, p. 19). This evidence is minimal and almost two decades old. Furthermore, the evidence fails to explain or identify development factors. It is imperative to start developing case studies on information societies in specific countries. The research helps to explain the massive social and technological transformations currently taking place.

Information Workforce

Previous studies determining the size of information workforce compared to other labor sectors do not agree in the definitions of information workers and information industries. Nevertheless, Dordick & Wang (1993) suggested that there is considerable evidence that the growth of the information sector indicates economic growth in terms of the larger the information sector, the higher the GNP (gross national product) per capita. In some instance, the size of a nation's information sector alone is not a measure of economic growth. In a few poverty-stricken developing countries, government employees providing health and welfare services are classified as information workers. In these cases, a government job is deemed as the last resort for the jobless and industrial productivity has been sacrificed for public service (Dordick & Wang, 1993).

Some scholars suggest that developing South East Asian economies are transforming from agriculture structures to information economies (Karunaratne & Jussawalla, 1988). Moreover, in countries described as highly dependent on agriculture with low levels of urbanization, information occupations are in short supply (Katz, 1988).

Thailand's Workforce Shift

From the late 1970s to the mid 1980s, the Thai government shifted the economic strategy towards promotion of exports, in both service and manufacturing industries. Many multinational firms moved production processes to Thailand to take advantage of low-cost conditions, especially the supply of cheap labor. Established local firms as well as many new entrants invested in export-oriented enterprise. Export-led growth fed a secondary boom in the Thai domestic market (Phongpaichit & Baker, 1995).

In the 1970s, 60 % of net additions to the workforce had entered agriculture. In the 1980s, this dropped to 20 % and the remaining 80 % entered service, commerce, and manufacturing. With the decline in agricultural growth and the closing of the "agrarian frontier," citizens who made a living in the countryside started to move to the city more rapidly and more permanently (Phongpaichit & Baker, 1995).

Information and Communication Technologies

According to a report by International Telecommunication Union (ITU, 2006), access to information and communication technologies (ICT) in terms of mobile subscribers, fixed telephone lines, and Internet users continues to grow. By the end of 2004 (see Figure 1.2) there were approximately 3 billion telephone subscribers – 1.8 billion mobile subscribers and 1.2 billion fixed lines, and 840 million Internet users – comprising 13 % of the world's population (ITU, 2006).

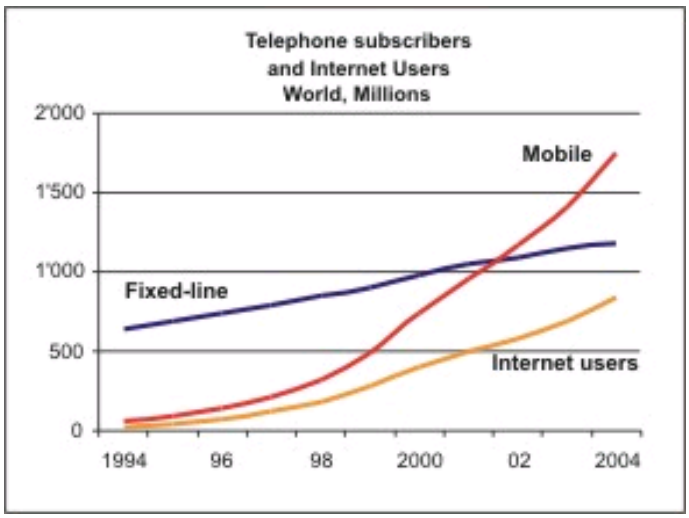


Figure 1.1. World's telephone subscribers and Internet users from 1994 to 2004 (ITU, 2006).

In the 1990s, the scope of ICT infrastructure was limited to fixed-line telephones as shown in Figure 1.1. The size and growth of fixed-line telephone lines is fundamental in providing the infrastructure to support Internet access (Wellenius, Braga, & Qiang, 2000). A strong ICT infrastructure is stated to be essential for rapid and efficient social and economic development (Saunders, Warford, & Wellenius, 1994) and the development of an information society (Lievrouw, 2002b).

Nevertheless, ICT skills and applications are built on the foundation of accessible ICT infrastructure. In the World Summit Information Society (WSIS) report framework (ITU/UNTCD, 2007), ICT infrastructure includes:

(1) *Fixed lines:* Fixed telephone lines have historically been important for voice, fax, texts, and data communications. Nevertheless, responding to the rise of mobile communications, fixed lines in homes are declining. Fixed line connectivity has a role in Internet access.

(2) *Mobile communications:* Cellular mobile communications are important for access to ICTs, especially for developing countries. Growth in mobile telephony offers the most

immediate way of bridging the digital divide. There is a high level of private sector ownership in the mobile sector.

(3) *Broadband:* Broadband connectivity represents the future of the Internet. Broadband refers to any dedicated Internet connection speed of 256 kbps or more for at least one direction (upload or download).

(4) *Wireless communications:* Wireless technologies offer easy-to-install, low-cost solutions compared to conventional fixed line infrastructure. The flexibility and ease of installation of Wi-Fi and satellite communications mean that networks can be built by local communities.

A strong ICT infrastructure is stated to be essential for rapid and efficient social and economic development (Saunders, Warford, & Wellenius, 1994). The size and growth of fixed-line telephone lines is fundamental in providing the infrastructure to support ICT development and Internet access (Wellenius, Braga, & Qiang, 2000). Access to ICT is the necessary first step to ICT use and is a measure of the potential for social, political, and economic growth.

The results from a survey of 60 countries worldwide shows that developing countries more than doubled their annual investment in ICT infrastructure in the past decade (Wellenius, Braga, & Qiang, 2000). Although, the investments in ICT were strongly related to national income (Saunders, Warford, & Wellenius, 1994), the growth in ICT investment accompanied, rather than caused, economic growth (Mansell & Wehn, 1998). There are cases of large investments in ICT with little impact on Gross National Product (Dordick & Wang, 1993).

The limitations of the measurement are in assessing the human dimension. The size and percentage of information workforce and telecommunication network is easier to measure than the quality of the information workforce. The quality, along with the size contribute to a nation's

economic growth, economic health (Dordick & Wang, 1993) and the effective use of ICT (Mansell & Wehn, 1998).

ICT Development and Internet Use in Thailand

In the late 1980s, Thailand had one of the poorest telecom services records in Southeast Asia, with a waiting list for fixed-line telephones close to one million and a ratio of 1.8 fixed-line telephones per 100 persons (Petrazzini, 1995). The 1980's economic expansion provided a way for the government to implement telecommunications reform as two state-owned telecommunications enterprises (SOTE) failed to respond to rapid service demand. The reform allowed private companies to build networks, and transfer the ownership to the government, but operate the service through revenue sharing arrangements with the two SOTEs (Ure, 1995).

By the year 2000 there were approximately 11 million telephone subscribers – 5.8 million fixed lines, 5.5 million mobile subscribers, and 2.3 million Internet (ITU, 2002).

Impact of the Tsunami

The United States Geological Survey estimated the Indian Ocean earthquake and its resulting tsunami, to have released the energy of 23,000 Hiroshima-Nagasaki type atomic bombs (USGS, 2004). The earthquake and its tsunami is believed to have caused an estimated of 225,000 to 283,100 deaths in countries including India, Indonesia, Malaysia, Maldives, Myanmar, Seychelles, Somalia, Sri Lanka, and Thailand (CDC, 2005a). See Appendix A for propagation of the Indian tsunami.

According to the United Nation's assessment report (UN, 2005b), the 2004 Southeast Asian tsunami is considered the greatest natural disaster in Thailand's history. It affected six Thai provinces along the Andaman Coast causing more than 8,000 deaths – a third of them foreigners. It impacted over 400 villages, including well-known tourist destinations. Livelihoods

of workers in fishing, tourism and ethnic migrant communities were destroyed and their survivors were left to cope with the aftermath's psychological trauma. The total financial impact of the tsunami is estimated at more than 2 billion USD, making Thailand the second most severely affected country in financial terms. It is estimated that the tsunami reduced Thailand's GDP growth by 0.4%. The sectors most affected were tourism, fisheries and agriculture.

Disaster Relief in the First Global Internet-Mediated Natural Disaster

A dramatic event, such as a tsunami, causes a sudden increase in information need and mass media rarely are able to immediately respond to it (Kivikuru, 2006). The Indian ocean tsunami – one of the greatest natural disasters, was the first global internet-mediated natural disaster (Samarajiva, 2005). For Scandinavians, the southern coastal beaches in Thailand are one of the most popular holiday destinations. The tsunami disaster was believed to have caused more deaths of Scandinavian citizens than any other event during peacetime. In Finland, the volume of mass media coverage and the use of the Web increased dramatically after the Tsunami. However, the type of media that was most successful in providing real-time information about the disaster, was not the mainstream news media, but mobile phones and amateur-run Web discussion groups (Kivikuru, 2006).

The Web was used in a variety of ways to aid recovery in the aftermath of disasters such as the December 2004 Southeast Asian tsunami and the August 2005 Hurricane Katrina. For instance, the South-East Asia Earthquake and Tsunami (SEA-EAT) blog aggregated news and first-hand information at a time when the mainstream media's coverage was seen as fragmented and insufficient (Jones & Mitnick, 2006). The blog's ability to reach vast numbers of people quickly with onlooker reports and to side-step government and corporate control have made blogs effective forums for sharing information (Ramos & Piper, 2005). It expanded beyond

information dissemination into a more interactive, decentralized attempt to identify and allocate recovery assistance (Jones & Mitnick, 2006).

In addition to the online assistance of formal aid organizations, the recovery efforts included attempts to provide help through collaboration among distributed networks of volunteers. Data-driven relief, such as identifying resources and persons, coordinating assistance to victims, publicizing services, and establishing communication standards, are areas of assistance where open networked collaboration can thrive (Jones & Mitnick, 2006).

The ability to form multi-organizational networks rapidly among formal aid organizations and a distributed network of volunteers is crucial to humanitarian aid and disaster relief (Denning, 2006). An open ICT ecosystem, including development, access, and ownership of technologies, is necessary in coping with innovation in politics, health care, and disaster management (Berkman, 2006). Furthermore, it is a good ICT strategy for developing countries to use open source software (OSS) to gain knowledge about the technology itself, and to create technology products that fit their specific needs (Câmara & Fonseca, 2007).

The World Disasters Report 2005 (IFRC, 2005) suggests that information is "a life-saving resource" and much of the devastation caused by the 2004 tsunami could have been avoided with "better information and communication."The report emphasizes that accurate and timely information is a form of disaster response and that communicating with people affected by disaster by giving them the right information is crucial to efficient aid assessment and delivery.

The Kingdom of Thailand

Thailand, a constitutional monarchy located in the center of Southeast Asia is one of Asia's oldest democracies and a key political and economic leader in the region (Sulistiyanto,

2002). Thailand's economy is typical of Southeast Asian economies that possess dualistic structures – a predominantly rural agricultural economy coexisting with a modern urban industrial economy (Karunaratne & Jussawalla, 1988). Between 1976 and 1996, Thailand made impressive economic and technological advancement when its annual gross domestic product (GDP) – a measure of national wealth – averaged 8 %, among the highest in Southeast Asian countries (ITU, 2001). The number of people living in poverty was reduced from 32 % to 11 % (World Bank, 1998).

A natural disaster is defined as an incident resulting from a natural event – (i.e. earthquake, flood, volcano) whereas a man-made disaster is an incident resulting from the breakdown of regular processes within the social system – (i.e. war, recession, riots, technological or economic failures) (Albala-Bertrand, 1993). Thailand was struck by a man-made disaster when the country's currency (Thai Baht) was devalued in July 1997, unexpectedly causing the widespread 1997-98 Asian economic crisis (Krugman, 2000). The economy began to turn around after mid-1998 and the World Bank declared the worst of the economic crisis in the country had passed (World Bank, 2000). However, on December 26, 2004, the country was hit by a tsunami – declared the greatest natural disaster in Thailand's history (UN, 2005b). Prominent international tourists destinations in the six provinces (see Figure B2), namely Krabi, Phang-Nga, Phuket, Ranong, Satun, and Trang were impacted.

In 1996, Thailand had the first national information technology policy, termed IT 2000, prepared by the National Electronics and Computer Technology Center (NECTEC). The plan "to invest in an equitable information infrastructure: to enhance human ability and enhance life quality" was remarkable for strong social and economic goals (Thajchayapong, Reinermann, Goodman, & Pipe, 1997).

In 2002, Thai government responded to the fast-paced ICT development by establishing the Ministry of Information and Communication Technology (ICT) (Karnjanatawe, 2002). The ICT Ministry implemented a successful policy that triggered price-cutting competition among local PC manufacturers and international software vendors. Over 200,000 budget PCs were sold. The project was considered highly successful and sparked interests from other governments (Waltham, 2003). A similar project has been initiated in Brazil aiming to sell up to 1 million computers, with costs partially subsidized by the government (Wade, 2005). Nevertheless, the effectiveness of the ICT Ministry came into question (Sambandaraksa, 2007e) four years after the government who established the Ministry was ousted by a bloodless coup on September 19, 2006 (Mydans, 2006).

This dissertation relies on bodies of literature in (1) information society theories and the political economy of ICT diffusion in developing countries to explain the development of information society in Thailand, and (2) the social shaping of technology to explain the technological innovations of the Thai information society in response to the tsunami disaster.

Purpose

In light of the lack of underlying definition of Thai information society, and the dearth of recent work on political and economic issues specific to the Thai context of the information society, this dissertation focuses on examining the development of the Thai information society and the Internet-mediated nature of global and collaborative effort of disaster response in Thailand. This information will help address concerns over the ability of countries to form multi-organizational information networks to rapidly and effectively provide humanitarian aid and disaster relief effort (Denning, 2006) as well as underlining the need to form disaster relief ICT policy (IFRC, 2005).

The Goal of the Study

The objective of this dissertation is to determine whether the establishment of the highest level ICT governing body such as a Ministry of Information and Communication Technology (MICT) compared to other less authoritative ICT agencies can increase the effectiveness of information society development. This study examines the case of the role of the Thai information society in response to the tsunami disaster. Through a methodical analysis of this case, the study provides policy implications for disaster relief in the Internet-mediated nature of global and collaborative effort.

The Scope of the Case Study

This dissertation focuses on analyzing the development of the information society in Thailand from 1970 to 2006 in terms of the share of information workforce compared to total workforce and the level of diffusion of information and communication technologies (ICT). The case study of the response of the Thai information society to the tsunami disaster was pursued. This dissertation investigates four major issues.

1. The development of the information society in Thailand, from the perspective of information workforce, and information and communication technologies. To accomplish this, this dissertation measures:
    a. Participation of the Thai population in the information workforce.
    b. The level of ICT diffusion in Thailand.
2. Factors influencing information workforce growth and the diffusion of ICT in Thailand including the explanation of information workforce growth and ICT diffusion in the political economy frameworks of strategic restructuring and structural causality model.

3. The degree to which theories of social shaping of technology (SST) and the diffusion of innovation contribute to understanding the specifics of technological innovation in response to the tsunami disaster, defining the mutual shaping lens of the social shaping of technology (SST) and the diffusion of innovation that enable the joint processes of technological and social change in the specifics of technological innovation in response to the tsunami disaster.
4. The effectiveness of ICT institutions in responding to the tsunami disaster.

In explaining the development of the Thai information society, the structures of information workforce and the determinants of ICT diffusion have been linked. The forces that produce information-intensive employment and the development of the Thai information society are both political and socio-economic. In addition, the social contexts and uses of ICT are as important as the forces of ICT diffusion.

The investigation into the social shaping of technology provided the necessary context with which to investigate the technological innovation and development of the Thai information society in the tsunami disaster relief. The investigation took the form of an inductive analysis of data from interviews with ICT industry leaders.

The research carried out an Internet-based survey and quantitative analysis of the effectiveness of ICT institutions in responding to the tsunami disaster.

There are three key contributions from this dissertation. First, it identifies the patterns of information-intensive employment in Thailand from 1971 to 2006 and thus provides a baseline for future information workforce studies. The establishment of the Ministry of Information and Communication Technology (Karnjanatawe, 2002) indicates a political force that could influence the deployment of information and communication technologies and generate demand for an

information workforce. Future studies to evaluate the long-term effectiveness of the Ministry could use this study as a reference. Second, the dissertation has added to a body of literature in country-specific information society. Third, the dissertation has developed an understanding of technological innovation and development of the Thai information society through the lens of their participating role in the tsunami disaster response This understanding will help to provide policy and technology guidelines for systems and protocols for managing information about the dead and missing (Morgan et al., 2006), and for disaster relief (IFRC, 2005).

Significance

Departure from Past Research

This research does not argue about whether economic factors exert more influence than political factors in the diffusion of ICT in developing countries as the literature review has clearly stated that, unlike ICT diffusion in industrialized countries, political factors play a vital role. The research also does not attempt to determine what type of government policies or political regimes are better than others in spreading the growth of information society and ICT adoption.

Rather, this research focuses on explaining the development of the information society and its ICT diffusion in Thailand through the interaction of four variables – structures, institutions, politics, and government policies within Thai historical context. In addition, through a mutual shaping lens of technology and society in the response of the Thai information society to the tsunami disaster, the research expects to discover the social factors of ICT diffusion and their related technology and policy implications.

This research diverges from past research in that it investigates the effectiveness of ICT institutions in responding to the 2004 tsunami – the first Internet-mediated natural disaster. The

understanding will help to provide policy and technology guidelines for systems and protocols for managing data-driven disaster relief.

Definition of Terms

Information Society

Information society is defined as a socioeconomic structure that demonstrates high-employment of information related-occupations and widespread use of information and communication technology.

Information Workforce

The Yearbook of Labour Statistics 2001: 60th Issue, published by the International Labor Organization (ILO) provides data on the distribution of the populations who supply the labor for the production of goods and services. Table 2C of the yearbook provides data on the distribution occupation, according to International Standard Classification of Occupations ISCO-68.

The ISCO-68 classification includes nine major groups (one-digit codes), 83 minor groups (two-digit codes), 284 unit groups (three-unit codes), and 1,506 occupational categories (five-digit codes) (ILO, 1969). Appendix B shows the classification of these occupations in 83 minor groups. Table 1.2 shows the structure of workforce by sector, nine major groups, and occupations.

Table 1.1
Workforce Sectors and Occupations

Sector	Group	Occupation
Information	0-1	Professional, technical and related workers
	2	Administrative and managerial workers
	3	Clerical and related workers
Service	4, 5	Sales workers, Service workers
Agriculture	6	Agriculture, forestry workers, fishermen and hunters
Industry	7,8,9	Production and related workers, transport equipment operators and laborers

Source: International Standard Classification of Occupations (ILO, 1969)

In this research, the term "information workforce" refers to Table 1.1's Information Sector comprising of ISCO-68 classification's major groups 0, 1, 2, and 3. From Table 1.2, these occupations include workforce in Professional, technical and related workers, Administrative and managerial workers, and Clerical and related workers.

The classification of the sectors and occupations above was devised and used by the OECD in a project aimed to measure the size of the information workforce in several industrialized countries (OECD, 1981). The advantage of this measurement is the use of national statistics which were collected annually based on a common set of international standards that are readily available. This classification can be used to perform detailed comparative analysis of the information workforce at the country level.

The disadvantage is the exclusion of occupations (i.e. telecommunication and media workers) that may be deemed to fit in the information category but are included in the service

category. Fortunately, the difference in classifications of this segment did not yield a statistical significance (Katz, 1988).

ICT Core Indicators

Information and communication technologies (ICT) have been defined in many different ways. Canada's National Statistical Agency outlines ICT to include "technologies such as desktop and laptop computers, software, peripherals and connections to the Internet that are intended to fulfill information processing and communications functions" (Statistics Canada, 2007). Guide to Measuring the Information Society (OECD, 2005) defines ICT sector as production of goods and services industries that "facilitate, by electronic means, the processing, transmission and display of information" (p.101). International Telecommunication Union (ITU, 2006) defines access to information and communication technologies (ICT) to include the use of mobile telephones, fixed telephone lines and Internet.

In an attempt to "set standards and harmonize ICT statistics at the global level" (UN, 2005a), several international organizations including the International Telecommunication Union (ITU) have developed a "core list of ICT indicators that could be collected by all countries and serve as a basis for internationally comparable statistics on the information society" (UN, 2005a). The proposal for the core list of ICT indicators (see Appendix D) was presented and adopted by participants at the World Summit on the Information Society (WSIS) meeting in February 2005.

The core list contains four sets of indicators:

1. ICT infrastructure and access
2. Access to, and use of, ICT by households and individuals
3. Use of ICT by businesses and

4. ICT sector and trade in ICT goods.

For the purpose of this research, the indicators of the ICT infrastructure and access were selected to determine the Thailand's capability in building ICT infrastructure. These indicators as shown in Basic core A1 to A6 in Appendix C are:

(1) *Fixed telephone lines per 100 inhabitants:* is calculated by dividing the number of main telephone lines by the population and multiplying by 100. Main telephone lines connect a subscriber's terminal equipment to the Public Switched Telephone Network (PSTN) which has a dedicated port on a telephone exchange. Main lines may also include public payphones and ISDN channels.

(2) *Mobile cellular subscribers per 100 inhabitants* is calculated by dividing the number of cellular subscribers by the population and multiplying by 100. Mobile cellular telephone subscribers are subscribers to a public mobile telephone service using cellular technology, which provide access to the public switched telephone network. Post-paid and prepaid subscriptions are included.

(3) *Computers per 100 inhabitants* is calculated by dividing the number of personal computers by the population and multiplying by 100.

(4) *Internet subscribers per 100 inhabitants* is calculated by dividing the number of Internet subscribers by the population and multiplying by 100. Internet subscribers refer to the number of dial-up, leased line and broadband Internet subscribers.

(5) *Broadband Internet subscribers per 100 inhabitants* is calculated by dividing the number of broadband subscribers by the population and multiplying by 100. Broadband Internet subscribers refer to the sum of DSL, cable modem and other broadband subscribers.

(6) *International Internet bandwidth per inhabitant (bits per person)* is calculated by dividing the international Internet bandwidth by the population. International bandwidth refers to the amount of international Internet bandwidth measured in Mega Bits Per Second (Mbps).

The Southeast Asian Tsunami

This term is widely used in Thai media, newspapers and websites. However, journal articles published in the United States tend to use the term "Indian Ocean earthquake" as the undersea earthquake erupted in the Indian Ocean. As the earthquake occurred on Boxing Day, the term "Boxing Day Tsunami" is used by media in European countries, the United Kingdom, Canada, Australia, and New Zealand. The study uses these terms interchangeably according to sources.

Tsunami Disaster Response

This research focuses on two main responses to the tsunami disaster; on-site collecting and recording of disaster victim identification (DVI) information from volunteers whose occupations are defined as "information workforce" and online dissemination of information from government, semi-government, and non-government agencies.

One of the main factors that led to a high casualty rate in the 2004 Southeast Asian tsunami was the lack of information: there was no early warning system in place to alert the victims (Samarajiva, 2005). The high casualty rate could have been avoided with better information and communication. As a consequence, it is clear that accurate and timely information is a form of disaster response and communicating with people affected by disaster by giving them the right information is crucial to efficient aid assessment and delivery (IFRC, 2005).

A dramatic event such as the 2004 tsunami, causes a sudden increase in information need and mass media rarely are able to immediately respond to it (Kivikuru, 2006). Thus, the medium of the Web was used in a variety of data-driven aid responses. Data-driven relief, such as detailed information about the tsunami casualties including the latest death toll, names and photos of survivors and missing persons, links and guides to aid agencies were disseminated.

To date, there are neither technical guidelines for managing mass fatalities, nor information available about post-disaster management of the dead following large natural disasters (Morgan et al., 2006). Under Thai law, a forensic investigation is required to identify disaster victims, and determine the time, place, cause, and manner of death. In the tsunami case, the main purpose of the investigation was to identify the disaster victims (Sribanditmongkol, 2005). This research investigates two main responses to the tsunami disaster:

(1) on-site assistance in collecting and recording identification information of tsunami disaster victims;

(2) on-line assistance in disseminating information from government, semi-government, and non-government agencies.

Scope and Limitations

This study is limited to the examination of the development of the information society in Thailand from 1971 to 2006 and the role of the Thai information society in response to the Indian Ocean tsunami disaster in December 2004. This study relied on first-hand information from the interviewees whom may not recall the detailed aspects of the incident a few years after. In addition, data collected from the interviews and the survey reflected interviewees' and survey respondents' own perspectives on the Thai government's tsunami disaster responses. There was

no attempt to interview government officials who were assigned the responsibility to evaluate the effectiveness of their tasks. The study is country-specific and may not be generalized.

Assumptions

This study was based on the assumption that data collection methods and definitions of information occupations from the International Labor Organization (ILO) and ICT indicators from the World Bank and the International Telecom Union (ITU) were consistent during the period from 1971 to 2006. In addition, it is also assumed the methods and definitions of indicators of ICT infrastructure and access were consistent during the period from 1971 to 2006. The study assumed that the perceptions of Thai and foreign community of tsunami disaster volunteers, survivors, as well as IT professionals accurately reflected the effectiveness of the Thai government on tsunami disaster response tasks. The study also assumed that the interviewees and the survey participants gave honest answers to the questions asked.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter reviews literature of previous theoretical work on information societies including information workforces and information and communication technologies (ICT). It outlines the framework of the political economy, as well as the theories of diffusion of innovation and social shaping of technology.

It also presents the strategic restructuring (SRS) model used in explaining the development of the information society and the pattern of ICT diffusion. This section is divided into four main topics as distinct determinants of ICT diffusion in Thailand – the structural context, the role of institutions, the role of individuals and government policies.

The chapter concludes with literature of the impact of the December 2004 tsunami in Thailand and the role of information and communication technology (ICT) in emergency response and disaster relief.

Information Society Theories

In broad terms, information society has been described as "the social, economic, technological, and cultural changes associated with the rapid development and widespread use of information and communication technologies" (Lievrouw, 2002b). Criticism has been directed at this definition as being "vague and imprecise, even of dubious value" (Webster, 2003). This disparagement is based on the grounds that information is an imprecise term which conveys different meanings to different people. Terms such as data, knowledge, documents, systems, ideas, signs, or symbols can all be referred to as information (Lievrouw, 2002b). Nevertheless, the citizens of economically advanced nations such as North America, Japan, and Western

Europe are said to live in information societies (Webster, 2003) – societies that are dominated by extensive state-of-the-art telecommunications infrastructures, and an increasing number of information workers (Lievrouw, 2002b).

Dearnly & Feather (2001) acknowledge that information society theories were developed by scholars in various disciplines such as sociology, political science and economics. Both maintain that economist Fritz Machlup (1962) was the first to define and measure knowledge workers" in the United States economy, as workers whose production had an economic significance comparable to the production of goods. In addition, they suggest that social scientist Daniel Bell (1973) was the first information society theorist who identified the post-industrial society as a service-based knowledge-driven society (Bell, 1999).

Furthermore, based on Machlup's work, Marc Porat (1977) added an information sector category to a traditional economy and suggested the United State's economy was dependent upon, and dominated by, the production and distribution of knowledge. By bibliometric standards, the theories by the three founding American scholars maintaining that modern economics are characterized by the expansion of an information sector and its knowledge workers are predominant in the studies of information society (Duff, 2000).

Nevertheless, the explicit identification of post-industrial as the information society can be found in the work of the Japanese writer, Yoneji Masuda (Dearnley & Feather, 2001). While the Japanese thesis – *Jahoka Shakai*, translated "informationised society" – focuses on the measurement of information by means of information flow across all media in society (Masuda, 1980), the European view concentrates on the proposition that computerization and the widespread use of information technology contribute to the formation of information society (Nora & Minc, 1980).

There are other distinctive theories of the information society. By tracking the flow of information in the United States, the American political scientist Ithiel de Sola Pool (1983) found that information largely flows through mass media and the fastest rate of growth is in media that provide information to individuals, known as point-to-point media. The growth in both mass and point-to-point media has been greatest in electronic information (Pool, 1998).

Dearnley & Feather's (2001) book describes that, by analyzing mass media, the American sociologist Herbert I. Schiller presented the information society as being dominated by self-interested media capitalists who controlled the press and the broadcasting networks. Meanwhile, the British sociologist, Anthony Giddens, argued that information has always been a vital component of society and that the importance of information in society was nothing new. The book suggests that this view concurs with that of the British social scientist, Frank Webster, sees the present display of a long period of change as the, 'informatisation of life', by which he means the growing awareness of the significance of information and its communication.

The book concludes that this view is more strongly expressed in the recent writings of Manuel Castells who stated that networks have changed everything, and that electronic networking, such as the internet has wrought fundamental change. Although, scholars in various disciplines still question the definition of information society, most of them agree on the impact of technology on society (Dearnley & Feather, 2001).

Measurement of Information Workforce

In the early 1960s, in an effort to calculate the proportion of the U.S. workforce engaged in the production and distribution of knowledge, Machlup (1962) grouped 30 industries into five major elements of the knowledge industries, namely education, research and development, communications media, information machines (computers), and information services (finance,

insurance, real estate). He measured the contribution of these industries to Gross National Product (GNP) and identified the rise of the information workforce (Machlup, 1962). Employing a much stricter definition of knowledge workers to those who produce and disseminate new knowledge, Bell (1973)'s information workforce represented a smaller percentage than Machlup's. However, Porat (1977) reinforced Machlup's study showing an increase of workers in the information sector, and a decline of workers in agriculture and manufacturing sectors (see Figure 2.1).

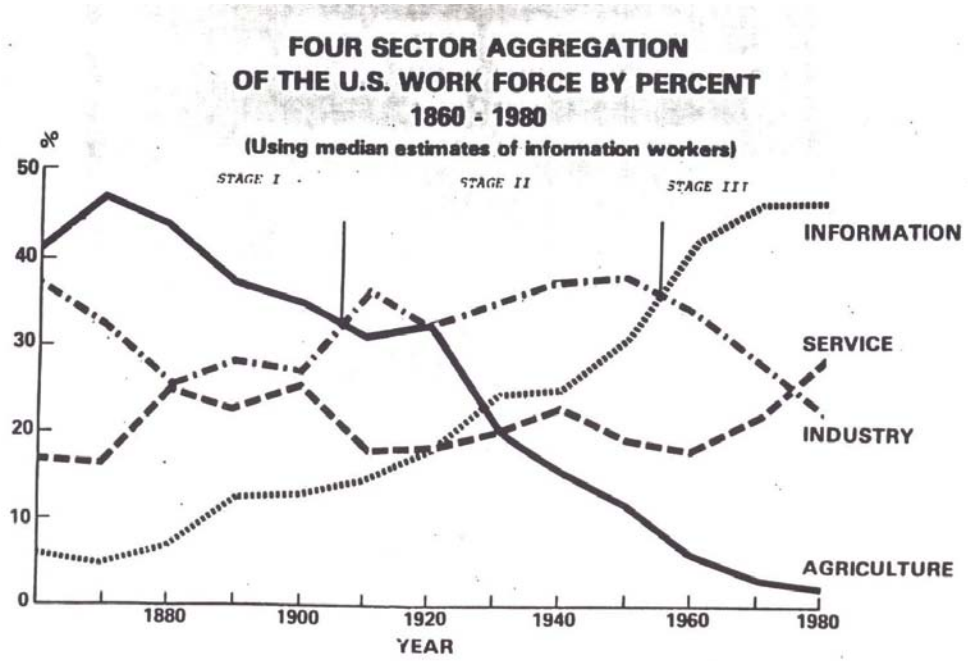


Figure 2.1. Structure of the workforce in the United States from 1860 to1980 Porat (1977).

He explained that in Stage I (1860-1906), agriculture was the largest single group in the labor force, and industrial occupations became predominant during Stage II (1906-1954). In Stage III (1954-1980), information occupations encompass other professions. However, the growth of the information sector of the workforce flattened after 1970 (Porat, 1977).

In the early 1980s, the Organization for Economic Cooperation and Development (OECD, 1981) measured the size of the information workforce in several industrialized

countries. The OCED devised the classification of information occupations based on Porat's work. The raw data used by the OECD were obtained from national statistics that used the 1968 International Standard Classification of Occupations (ISCO). The measurement scheme devised by the OECD was based on a common set of principles for defining information activities and procedures.

In the late 1980s, Katz (1988) conducted a comparative analysis of information workforce growth in developed and developing countries. He measured the size of information workforce in 20 developing countries between 1960 and 1980 using information occupations defined by the OECD as a starting point to estimate the size of the information sector for countries for which disaggregated statistics are unobtainable.

Regardless of the different approaches used to measure the information sector (see Table 2.1), all authors have consistently shown an increase in information-based occupations.

Table 2.1
Definitions in Studies of the Information Workforce

Time	1960s	1970s	1970s	1980s	1980s
Year Studied	1958	1963	1860-1970	1950-1970	1960-1980
Author	Machlup (1962)	Bell (1973)	Porat (1976)	OECD (1981)	Katz (1988)
Sector Definition	Knowledge Society	Post-Industrial Society	Information Sector	Information Sector	Information Sector
Country Studied	United States	United States	United States	9 OECD Member Countries	20 Developing Countries

Source: Adapted from Katz (1988).

Information Workforce Growth

Researchers have shown that the formation of information societies in developed countries is driven by the need to promote greater efficiency in the production of goods and services (Barnes & Lamberton, 1976; Porat, 1977). Two decades later, an updated work of Porat's by Martin (1998) shows that the U.S. information sector continues to grow in proportion to all employment, although this growth has been slower in recent years. Moreover, the restructuring of information sector employment is largely due to the implementation of information technologies which yields different effects in increasing productivity, reducing organizational hierarchy, and creating gaps in information rich and poor occupations. The study indicates that growth is stronger among highly educated occupations that produce information than lower-skilled occupations that handle information in routine ways (Martin, 1998).

A similar study (Kuo & Chen, 1987) of the occupational structure of the information workforce in Singapore shows that the implementation of massive industrialization policies which focused on labor-intensive export-oriented industries has created employment for Singaporeans throughout the 1960s and 1970s. Later, in the 1980s when the export market became competitive, a new economic policy including programs to upgrade the skill level of labor force – to encourage research and development and to speed up the use of computers nationwide – was implemented. The study suggested that an increase in bureaucracy has lead to growing demand in information workforce (Kuo & Chen, 1987).

More than a decade later, a follow-up study (Kuo & Low, 2001) of Kuo & Chen's (1987) finds that the long-term trend of growth in the information workforce has been in line with planned industrial changes – a result of proactive government policies in directing industrial restructuring and occupational changes. Clearly, government policies can play a crucial role in

information occupational restructuring. For example, to meet the challenge of becoming a "knowledge-based economy", the government of Singapore initiated policy changes in the educational system (Kuo & Low, 2001).

On the growth of the information workforce in developing countries, Katz (1988) argues that the increasing number of information workers is due more to the growth in the government than to the expansion of the private manufacturing and service sectors. The conceptual framework, illustrated in Figure 2.2 shows that the expansion of government (A) which is needed to support delivery of basic services and the oversupply of educated labor force (B) results in the state absorbing the surplus of educated labor that cannot be employed by private sector, and this, in turn, has driven the growth of government information workers up. Moreover, the industrialization process and managerial complexity (C) in requiring information workers to organize and manage increasingly complex production processes drives the growth of industry-related information workers up.

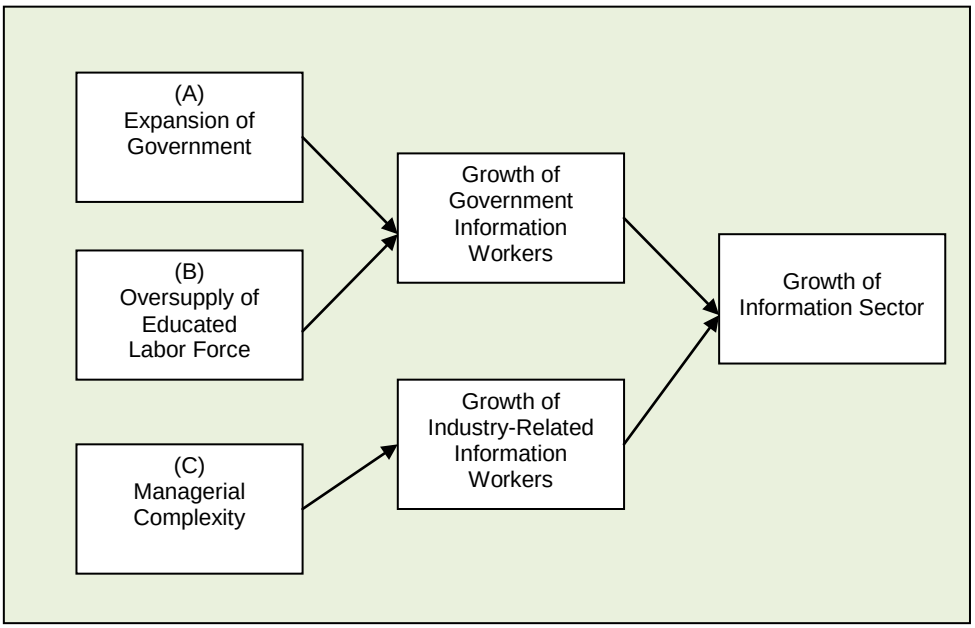


Figure 2.2. Information sector growth in developing countries (Katz, 1988).

Katz (1988) concludes that there is a uniform growth of information occupations not only throughout the developed world, but also in most developing countries. However, there is no uniform pattern of development of an information sector among developing countries. He argues that the information workforce of these countries follows different transformation patterns depending on: (1) the time at which they start to industrialize; (2) the internal economic and political conditions; and (3) the country's trade orientation. His main argument is that societies tend to adopt information technologies not only on the basis of technological feasibility or economic profitability, but also in terms of political desirability.

Perspectives in Political Economy

Political economy was originated in the 18th century by philosophers such as Adam Smith who considered how nations should best control the economic forces at work, and how individuals are motivated primarily by self-interest. It serves as an instrument to understand social change by studying "how power is used to shape the production, distribution, and use of

information as a commodity" (Mosco, 1988, p. 3), or "how organized power prevails in the allocation, production, and distribution of resources: the organization of civil society; and the management of social equities" (Sussman, 1999, p. 85). To many scholars, political economy is relevant in the present era of global telecommunication liberalization, privatization, and deregulation (Sussman, 1999) and of local communication media and new technology convergence (Mosco, 1999).

In general, political economists place the question of power front and center (Babe, 1993; Wilson III, 2004) and explain that social actors employ power resources to protect and advance their own material interests and gains (Wilson III, 2004). Because political economists assume that "human beings are self-interested animals constantly on the search for their own relative advantages, they look for the self-interests behind administrative or technical rationales and try to explain who gets what and why" (Wilson III, 2004). For example, they are interested not only in texts that circulate in society, but also in the context of cultural production – "how the production of culture takes place; how it is organized, politically, economically, and institutionally; who produces it and why" (Babe, 1993, p. 32).

In the view toward a political economy of information, Mosco (1992) argues that contemporary traditions of social science research have taken on a narrow view where "reality is objective, rational, and empirically testable" (p. 43) and failed to see the big picture whereas discipline founders such as Adam Smith, David Ricardo, Thomas Malthus, and Karl Marx asked questions and defined their analysis in broader terms of subjectivity and moral philosophy.

To bridge the gap between the "dinosaurs" and the contemporary, Mosco (1992) identifies three core elements of a political economic analysis; (1) the value of history, (2) the analysis of wider social totality, and (3) moral philosophy. To understand the role of information

and its technology in modern society, the theoretical framework of political economy can be used to examine changes in (a) the stakes – the growth of a controlling commodity, (b) the players – the rise of concentrated information power, and (c) the development of electronic services arena. Moreover, the moral significance of information rich and poor and the ability of the technology to undermine personal and social privacy need to be considered (Mosco, 1992). He writes;

> Today, it is fashionable to talk about the ways that information technology will define the vision of future generations... it was not technology that would shape the moral climate, but rather it was moral individuals acting from a moral philosophical perspective that would determine the form of technology and the social institutions that use it (p. 45).

On the down side of the eclectic approach of political economy which can be less rigorous, robust and convincing than in a narrow study, Wilson III (2004) suggests that there are tradeoffs in the breadth of the study. He writes:

> When confronted with a relatively new phenomenon, conventional models may provide the depth but miss critical new interconnections and non obvious overlaps among key trends. At such moments, applying the open-architecture meta-frameworks of political economy can advance both expert and popular understanding. An open-architecture intellectual approach is especially critical when reviewing the ICT experiences of many countries over a period of years (p.39).

Perceptions of Information

Sandra Braman (1989) posits a four-level hierarchy in conceptualization of information as a resource, as a commodity, as perception of pattern, and as a constitutive force in society. Beginning at the lowest level, information as a resource, like other physical resources, can be processed. Her emphasis is on "the uses people make of information rather than its effects upon people and society" (p. 236*).*

The second level of conceptualization is that of information as a commodity where it incorporates the exchanges and the uses of information among people and related activities. The social structure of information as a commodity is complex. It is comprised of the buyers, sellers and organizations required to sustain a market. This type of definition grants information some economic power (Braman, 1989). Schiller (1988) offers the views that information as a commodity is a resource socially revalued and redefined through progressive historical application of wage labor and market to its production and exchange. He insists that information commodity whose emerging industry sustained economic expansion in a similar fashion as those of railroad, electrical, and automotive industries (Schiller, 1988).

The third level is information as perception of pattern. By adding context, "information from this perspective has a past and a future, is affected by motive and other environmental and causal factors, and itself has effects" (Braman, 1989, p. 238). The highest level of conceptualization is that of information as the constitutive force in society – "information is not just affected by its environment, but is itself an actor affecting other elements in the environment" (p. 239). She contends that information can be treated as a commodity and as a constitutive force in society simultaneously, and suggests that policymakers use more than one definition of information in resolving a particular problem.

Diffusion of Information and Communication Technologies

Diffusion of innovations has been defined as the process by which new products, processes, or ideas are introduced through certain channels over time and adopted by the members of a social system (Rogers, 2003). In other words, a new technology or innovation is introduced to a community, organization, nation, or market industry by a change agent whose interest is to promote the innovation (Lievrouw, 2002a).

In general, the success of the innovation depends on the influence of a handful of actors, namely early adopters. Other members, who share similar interests with the early adopters, may be persuaded to adopt the innovation, and they in turn influence others. Successive adoption continues until the innovation reaches a saturation point that varies depending on the characteristics of the innovation and the social system. In short, "diffusion concepts include the adoption threshold, the number of necessary early adopters to induce other actors to adopt an innovation for it to succeed, based on the rate or momentum of adoption" (Lievrouw, 2002a).

Information and communication technologies (ICT) have been defined in many different ways. Guide to Measuring the Information Society (OECD, 2005) defines the ICT sector as production of goods and services industries that "facilitate, by electronic means, the processing, transmission and display of information" (p.101). Canada's National Statistical Agency outlines ICT to include "technologies such as desktop and laptop computers, software, peripherals and connections to the Internet that are intended to fulfill information processing and communications functions" (Statistics Canada, 2007). In the political economy framework, Wilson III (2004) argues that as people are interested in the desirable things that technology can bring, ICT is conceptualized as "a scarce and desirable resource that groups and individuals contend for in order to consume, control, or own for their own purposes" (p. 40). This definition can explain the diffusion of new technologies through society and their complex interactions with various aspects of society (Wilson III, 2004).

The Internet is recognized as an example of diffusion of technology – much as other technologies, the Internet has been diffused unevenly across countries – raising concerns over a worldwide digital divide (Corrales & Westhoff, 2006; Milner, 2006). These political science scholars agree that the adoption of the Internet has been driven neither by technological, nor

economic factors alone. Rather, political factors exert a powerful influence. Milner (2006) argues that groups that believe they will lose from the propagation of the Internet use political institutions to enact policies that block the spread of access to the Internet. In contrast to autocratic regimes, democratic governments facilitate the spread of the Internet (Milner, 2006).

Nonetheless, Corrales & Westhoff (2006) contend that differences in political liberties do not lead to uniform differences in internet use. Specifically, not all authoritarian regimes discourage internet use similarly. High-income, market-oriented autocratic governments are less restrictive. While the governments fear the political consequences of internet expansion, they welcome its economic payoffs (Corrales & Westhoff, 2006). In all, the spread of democracy may help reduce the digital divide (Milner, 2006), but is not necessary in autocracy, where economic benefits may prevail (Corrales & Westhoff, 2006).

Social Shaping of Technology

The theory of social shaping of technology (SST) emerged in the 1980s, through a critique that technological determinism is an inadequate explanation of technological innovation and development, or of social change in general (Lievrouw, 2002a). Criticizing the techno-centric approach of the information society theories, the theorists of SST proposed that technological change is patterned by the conditions of its creation (Williams & Edge, 1996). According to the SST, the development of a new product is ultimately a process of negotiation between different constituencies, and the development of content is fundamentally a social process (Mackinzie & Wajcman, 1999).

There is considerable disagreement among sociology scholars about how and why technologies develop (Mackinzie & Wajcman, 1999; Williams & Edge, 1996). Some argue that technological innovation just happens, as when a lone inventor develops a new device. Another

point of view argues that old technology causes new technology, as inventions come about through gradual modifications of earlier devices – to the extent that some researchers claim that certain inventions are inevitable once their component technologies have been created. And yet there are counterexamples involving strong personalities, social movements, moral values that demonstrate social influence in engineering (Case, 1994).

In Cases' examination (Case, 1994) of how videotext – an end-user information service – technology develops in various countries in Europe and North America, he finds failure of videotext as a result of these bottlenecks: (1) failure to determine transmission channels; (2) poor choice of a display device; (3) disagreement in coding standards; and (4) unsuccessful marketing of resulting services. He concludes that these bottlenecks are examples of how strong personalities, social movements, moral values that demonstrate social influence in engineering – how non-technical factors, such as social, political, and economic elements can influence the development of new information technologies (Case, 1994).

The Mutual Shaping of Technology and Society

Theories of the diffusion of innovations and the social shaping of technology have strongly influenced the social study of new media (Boczkowski, 2004; Lievrouw, 2002a). Boczkowski (2004) records that while the diffusion of innovations offers insight on the direction and pace of technological adoption, the social shaping of technology generates knowledge on the construction of media artifacts. He argues while the diffusion scholars overlook the relationship between the adoption of media artifacts and their social construction, the social shaping researchers fail to investigate the link between the development of media artifacts and their planned and actual diffusion. Thus, drawing from the work in sociology and history of technology, organization studies, social informatics, and computer-supported cooperative work,

he suggests that the shaping and diffusion of media artifacts are closely tied so that they should be seen as "the two sides of the same innovation coin" (p.255).

His analysis of the history of videotext newspapers in the United States shows that (a) actors concurrently pursued interdependent technological and social transformations, that (b) this was an ongoing process in which partial outcomes in the technological realm influenced social events at a later phase and that (c) such process was influenced by historical developments (Boczkowski, 2004).

A Structural Approach to ICT Diffusion

Ernest J. Wilson III (2004) argues in "*The Information Revolution and Developing Countries*", that both institutions and politics are important to the diffusion of ICT. Specifically, individuals and the ICT outcomes are restricted to structural or institutional constraints – "both structure and agency are central to large societal innovations like the information revolution" (p. 37). He suggests four distinct determinants – *structures, institutions, politics, and policies*, whose interactions explain outcomes of ICT diffusion in a nation (Wilson III, 2004).

The Structural Context

Wilson refers "structures" to the fundamental elements of society that do not change quickly or easily, including (a) level of economic development, measured in terms of gross domestic product per capital; (b) economic structure, captured in shares of economic production contributed by agriculture, manufacturing, and services (including information) in the national economy; (c) social structure, measured in shares of educated white-collar workers, farmers, and other classes; and (d) political structure, that is the local political culture – for instance "participatory or authoritarian, with people seeing themselves as citizens or as subjects" (p. 41). The demographic and economic structures of a society indicate the demand patterns for

information and communication services and goods. For example, rural agriculture societies have lower demand for high-tech services but seek other ICT services instead.

Thailand Overview

Thailand is geographically located in Southeastern Asia, bordering the Andaman Sea and the Gulf of Thailand, southeast of Burma. The total area of Thailand covers 514,000 square kilometers (198,456 square miles), or is approximately the same size as France. In 2007, its estimated total population is 63.83 million (World Bank, 2008) with 75 % ethnic Thai, 14 % Chinese, and 11 % other. Thailand has the greatest proportion of Buddhists of any country (Ash, 1997) where 94.6 % of total population are Buddhists, 4.6 % Muslims, 0.7 % Christians and 0.1 % other. Thai is an official language and English is a secondary language of the elite (CIA, 2008).

Political Change

> *"Of forms of government, let fools contest, whatever's governed best is best" (Alexander Pope)*

Thailand is one of Asia's oldest democracies and a key political and economic leader in the region. Known as Siam until 1939, a bloodless coup d'état in 1932 transformed the Siam kingdom from a 150 year-old absolute monarchy into a constitutional monarchy. The only Southeast Asian country never to have been colonized, Thailand has experienced uneven democratic development with a succession of coups and coup attempts as well as unstable and short-lived civil and military governments (Baker & Phongpaichit, 2005; CIA, 2003; NDI, 2000).

From 1932 to February 1991, the number of coup attempts and general elections held over that period were exactly the same at seventeen – these statistics represent the equality in

strength between democratic and authoritarian forces in the country's politics (Laothamatas, 1996). Thai politics had enjoyed a period of coup-free from 1992 until September 2006 when the modern "pro-democracy" coup attempt dubbed "smiling coup" (Mydans, 2006) ousted a former telecom tycoon cum prime minister who was described as "an opportunistic politician, for whom ideas are simply a means to an end" (McCargo & Pathmanand, 2005). Appendix D shows a succession of Thai governments since 1958.

Authoritarian Rule from1930s until 1970s

In Thailand, authoritarian rule has been the norm since 1945 and a military coup the method by which to change the government (Hewison, 1997). Over the next three decades, the military monopolized the prime minister and key ministerial positions, and used force and repression to disperse challenges. A violent student-led mass uprising in October 1973 followed by a student activists' protest turned massacre in October 1976 signified a political turning point in the downfall of the military authoritarian rule (Girling, 1996).

Democracy from 1980s onwards

Despite the economic downturn of the mid-1980s and two failed military coups in 1981 and 1985, the high economic growth at the end of the 1980s seemed to channel Thailand's political and economic future. In 1988, the military lost control over the premiership. For the first time since 1976, the country had an elected government headed by a prime minister who was an elected member of parliament (Hewison, 1997).

The political crisis of 1992

In February 1991, the military staged a successful coup to restore military control and disband the elected government. It provoked strong opposition and in May 1992, the streets of Bangkok witnessed the most extreme political violence since October 1976. Hundreds of

thousands of Bangkok residents – the country's high income group – rose against the military (Hewison, 1997).

The "Bloody May Massacre of 1992" (Girling, 1996) or "Black May" (Baker & Phongpaichit, 2005) signified the final end of military-controlled government leadership. The crisis lead up to a political transformation and a steady process of democratization that has produced elected governments (Hewison, 1997). It gave rise to the important role in the processes of democratization and political reforms of the urban "middle class" (or *chonchan klaang* in Thai), which has been identified as an affluent class consisting of homogenous urban-based elites, as distinct from farmers and other people on the lower steps of society's ladder (Funatsu, 2000). This is a class which, though small in size, wields strong political clout. It has been considered one of the most influential actors in political developments in Thailand in recent years (Funatsu & Kagoya, 2003; Girling, 1996; Laothamatas, 1996).

The Constitution of 1997 (B.E. 2540)

The 1990s saw increasing demands for reform of political system. Vote-buying and electoral fraud appeared to have increased considerably from the mid 1980s onwards, and the scale of illegal practices in the 1995 and 1996 general elections exceeded previous levels (McCargo & Pathmanand, 2005). In 1995, the Committee on Democratic Development (CDD) identified three main areas of weaknesses which demanded reform of the constitution: "the poor performance of parliament and the erosion of its legitimacy because of vote-buying, corruption, and the quality of most politicians; the continued over-centralized of governments; and the lack of any true rule of law" (Phongpaichit & Baker, 2000).

The 1997 constitution has been variously described as a breakthrough for liberal democracy, a delayed outcome of the May 1992 crisis (McCargo & Pathmanand, 2005) and a

political reform to bring the country into line with changes in economy and society – the "People's Constitution" (Phongpaichit & Baker, 2000). The constitution was drafted with the deteriorated economy in the background and was disseminated in October 1997 - a few months after the Asian Financial crisis began. Important reforms included the establishment of several new independent bodies to oversee voting process, to ensure human rights, and to break up the military's near monopoly in broadcasting and electronic media (McCargo & Pathmanand, 2005; Phongpaichit & Baker, 2005).

Section 40 of the 1997 constitution states that "transmission frequencies for radio or television broadcasting and radio telecommunication are national communication resources for public interest". The Constitution further commits the country to establishing independent regulatory bodies for posts and telecommunications and for broadcasting (ITU, 2002).

The Thaksinization of Thailand, 2001-2006

Many scholars gave credit to the rise of the "Thaksinization of Thailand" (McCargo & Pathmanand, 2005) or the "Thaksinomics" (Phongpaichit & Baker, 2005) by the new 1997 constitution and the 1997 economic crisis. While, the constitution changed the electoral system in ways that favored a business-based party, the economic crisis crushed the popularity of the governing Democrat Party and created a void to be filled by new political concepts and figures (Phongpaichit & Baker, 2005).

The crisis also left the telecommunications sector heavily indebted and leveled the playing field for the Big Four Telecoms – Shin Corp, UCOM, TA and TT&T-Jasmine. Shin Corp's owner – Thaksin Shinawatra founded the "Thai Rak Thai" (Thai Loves Thai) Party in July 1998 (McCargo & Pathmanand, 2005). In January 2001, the Thai Rak Thai Party won the

general election by landslide and Thaksin Shinawatra was appointed the 23rd Prime Minister of Thailand (Secretariat of Cabinet, 2009).

Economic Transformation

In 2008, Thailand has a per capita income of USD 2,712 and an economic structure that is 11.4 % agriculture, 43.8 % industry, and 44.8 % service (World Bank, 2008). The total labor force in 2007 is 36.43 million (CIA, 2008). An estimated 42 % of the total population works in agriculture, 20 % in industry, and 37 % in services (World Bank, 2008).

Rice Economy in the 1960s and 1970s

For over a century, from 1850s to 1950s, small rice farmers and crop producers were the foundation of Thailand's society and economy. In 1960, the rice and other crops accounted for over 80 % of all national export value. From the late 1970s to the mid 1980s, the government shifted the economic strategy in both service and manufacturing industries towards promotion of exports. Several multinational firms moved overseas productions to Thailand to take advantage of low-cost conditions, especially supplies of cheap labor. Local manufacturing firms and new entrants also invested in export-oriented industries (Phongpaichit & Baker, 1995).

Newly Industrialized Economy in the1980s and 1990s

The high economic growth contributed to major economic restructurings from and agricultural to industrialized economy. The economic boom started to ascend in the late 1980 when the country's GDP per capita growth peaked in 1988 at 11.8 %. The growth progressed until early 1991 when the aftermath of the 1991 coup and the Persian Gulf crisis caused a setback to the Thai economy.

Nevertheless, Thailand was able to maintain the vitality necessary to achieve annual growth rates averaging 7 % during 1991-1995 before the economy started to slow down in 1996.

Thailand's economic progress came to an end after the devaluation of the baht (the Thai currency) in July 1997, following large fiscal deficits and the government's failed attempt to defend the nation's currency (Krugman, 2000; Niyomsilpa, 2000; Phongpaichit & Baker, 2000). The 1997-98 economic crisis brought the GDP growth to negative 11.5 %. Appendix E shows figures of Thailand's GDP per capital growth from 1970 to 2007.

Thai Workforce

Agricultural Labor

During the high economic growth of 1980s, a growing proportion of the labor force was concentrated in large manufacturing export-oriented firms. In the 1970s, 60 % of net additions to the workforce entered agriculture. This number dropped to 20 % in the 1980s, while the remaining 80 % entered service, commerce, and manufacturing. The significant drop in agricultural labor force was attributable to the government's economic strategy shifting towards promotion of exports in both service and manufacturing. The economic policy shift enabled high economic growth. The growing economy was accompanied by population increase and rural migration. In succession, these factors enabled the supply of labor. Multinational firms moved overseas production to Thailand to take advantage of low-cost conditions and supplies of cheap labor (Phongpaichit & Baker, 1995).

Industrial Urban Workers

In the decade after 1985, the number of industrial workers doubled to around 3 million. About half of these workers were distributed across thousands of small enterprises, with the other half grouped in some 4,500 establishments with over 100 workers each. Roughly a quarter of a million workers were members of a union (Phongpaichit & Baker, 1995).

For the next three decades, the countryside supplied the reserve army of labor. In the 1980s, the demographic swelling passed and the economic boom accelerated demand beyond the capacity of this supply. By the mid-1990s it was estimated that there were one million illegal immigrant workers, the largest proportion coming from Burma (Phongpaichit & Baker, 1995).

White-collar Middle Class

Export-oriented and capital-intensive industrialization created a high demand for skilled labor. Between the 1960s and the late 1980s, the numbers in white-collar jobs grew from around half a million to around 4.5 million. Over these three decades, Thailand acquired a new white-collar, working class, dubbed "middle class" – salaried men and women who are essentially workers whose skills and education are a form of capital. They occupy a spectrum which runs from managerial employees at one end, to self-employed professionals, to small businesses and sub-contractors at the other (Phongpaichit & Baker, 1997).

The Role of Institutions

In analyzing the evolution of the information technology sector in South Korea, India, and Brazil during the 1970s and 1980s, Berkeley sociologist, Peter Evans, established that the state's role is essential in economic transformation (Evans, 1995) . In this case, the roles and strategies of the states are important to the success and failure of the development of IT industry in newly industrialized countries (NICs). The key to economic transformation in the late industrializing countries, Evan argues, is developing a "shared project" between the state and the industrial elites. It requires more than state autonomy; it requires "embedded autonomy" – "a concrete set of social ties that binds the state to society and provides institutionalized channels for the continual negotiation and renegotiation of goals and policies" (Evans, 1995).

In a comprehensive comparison of the political economy of selected newly industrialized countries (NICS) in East Asia and Latin America, Stephan Haggard emphasizes the institutional context within which political choices take place (Haggard, 1990). The governing state is not only an actor but a set of institutions that exhibits continuity over time, providing different incentives for groups to organize, he argues. Institutional variation is crucial for understanding why some states are capable of pursuing particular policies. Thus, policy choices and institutional constraints come together to provide the political explanation of economic growth (Haggard, 1990).

Haggard stresses the importance of state-market interaction, noting how the South Korean and Taiwanese states directed the shift from import substitution strategies to export-led growth in response to international market opportunities. Similarly, for Hong Kong and Singapore, the moves toward export-led growth were also driven by a mixture of markets and politics. For all four, exposure to the international oil price hikes of the early 1970s, plus the need to respond to increases in international protectionism throughout the 1970s and 1980s, made even clearer that state power in and of itself was meaningless without a capacity to utilize that power in conjunction with market constraints and opportunities (Haggard, 1990).

Emerging economies in the Asia-Pacific region have experienced dramatic and accelerating changes in patterns of ownership and investment in their ICT sectors, including telecoms equipment and services (Jussawalla, 1999). Countries with higher growth rates in ICT investment achieved consistently higher growth rates of GDP and productivity. Successful ICT production countries, such as Singapore, Taiwan and Korea, have succeeded largely through attracting multinational companies to invest in production facilities or subcontract with local firms. For example, Korea has used protectionism as a tool for promoting ICT production, and

Korea only did so for a limited period, banning imports of microcomputers from 1982 to 1987 (Kraemer & Dedrick, 2001).

As Evans (1995), Haggard (1990) and other scholars have shown state agents and multinational corporations have played critical roles in the spread of technological advances in NICs. Indeed, the economic development of peripheral capitalism in the 20th century was partly brought about by Japanese, European, and American corporations seeking factor and product markets and by state agents seeking to provide goods and services that the private sector would not or could not provide (Wilson III, 2004).

General Institutions

Among Thailand's most important general institutions are the constitutional monarchy and the military. A handful of nations in the world have monarchs as heads of state, a beloved King Bhumibol Aduldej of Thailand is the world's longest reign monarch with over 60 years of ruling. He was considered to have used his moral authority to guide Thailand through many political crises (Horn, 2006).

A second general institution of influence has been the power of the military. Throughout the four decades in 1950s, 1960s, 1970s, and 1980s, Thai politics was dominated by the military, which affected the distribution of ICT resources in several ways. Top military officers in the 1970s and 1980s were given posts in the boards of directors of state-owned enterprises such as the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT) (McCargo & Pathmanand, 2005).

Institutions in the ICT Sector

A country's institutions are the second big determinant of ICT diffusion. Institutions typically reflect aspects of national social structure but also maintain some relative autonomy

(Evans, 1995). The word "institution" refers to concrete organization with names and addresses, as well as legal concepts such as the institution of property as conventionally defined (Wilson III, 2004).

Wilson III (2004) contends that institutions directly shape the behaviors of individuals to act in certain ways. Leading institutions with ICT responsibilities include ministries of communication or information, state-owned enterprises like the telephone companies, regulatory agencies, specialized ICT bodies, and joint public-sector/private-sector institutions. These institutions are somewhat important since "an individual's institutional position shapes his or her behaviors and politics" (p. 43).

Ministry of Information and Communication Technology (MICT)

Under the administration of Prime Minister Thaksin Shinawatra, the Ministry of Information and Communication Technology (MICT) was established on October 3, 2002. The MICT is responsible for implementing strategies and plans in accordance with the national IT policy (IT 2010) and ICT Master Plan (2002-06). The strategic plans are to lead the Thai nation to a "Knowledge-Based Society", to improve the nation's competitiveness through the use of ICT and to promote the use of ICT in the management and service provision of the government (MICT, 2005, 2006, 2007). ICT is considered the key to the development of "e-Thailand", consisting of e-Government, e-Industry, e-Commerce, e-Education, and e-Society (Koanantakool & Udomvitid, 2008).

The Ministry of ICT has six departments:

- Communications Authority of Thailand (CAT)
- Telephone Organization of Thailand (TOT)
- Thai Meteorological Department (TMD)
- National Statistical Office (NSO)
- Post and Telegraph Department (PTD)

- Software Industry Promotion Agency (SIPA)

In March 2003, to create awareness of e-Government development in Thailand, the MICT held a national workshop, chaired by Prime Minister Thaksin to showcase government's achievements in utilizing ICT to improve the country's competitiveness. One of the achieving milestones was that most of Thailand's public departments and ministries have disseminate information through websites (Krootkaew, 2003).

In July 2003, Thailand became the first country to impose a curfew on online gaming (ONI, 2007). Prime Minister Thaksin Shinawatra also pursued Internet censorship policies such as ordered ISPs to block web sites demonstrating gambling and sexual contents (Reporter, 2003) as well as political criticisms and dissents (RSF, 2006).

In December 2003, the MICT also released projects such as the National ID smart cards which were deemed expensive (Sambandaraksa, 2007b) and contentious as the cards contain the holders' personal information such as housing registration, social security number, and tax classifications (Wancharoen, 2004). The Government Contact Center (GCC) was also launched to provide e-Citizen services which allow direct access from citizens to all government services and information (MICT, 2005).

In January 2005, after December 2004's Indian Ocean tsunami, the MICT was designated as the task force for implementing tsunami disaster relief efforts. In cooperation with the IBM Crisis Response Team, the MICT constructed a "Disaster Portal" – www.ThaiTsunami.com (Woodworth, 2005).

In April 2006, the MICT's permanent secretary said in an interview of his vision for Thailand to become the new ICT hub of ASEAN by the year 2008. A ranking of ICT hub in ASEAN showed Singapore to be number one followed by Malaysia and then Thailand.

According to the International Telecommunication Union (ITU), indicators used to measure ICT readiness include the number fixed telephone lines, mobile cellular and broadband internet subscribers. One of the obstacles to the progress of ICT development in Thailand was said to be the too-often change of the Ministers – three in one year (Dhar & Banerjee, 2006).

In the aftermath of a military coup that ousted Prime Minister Thaksin in September 2006, there were questions whether the MICT was set up with a "hidden agenda" and should be dismantled (Sambandaraksa, 2007c). The political instability and the change of government and minister were said to attribute to the "lost opportunity" of the MICT (Sambandaraksa, 2007d) and the "missed milestones" of Thailand's ICT industry (Sambandaraksa, 2007a).

In April 2007, the MICT blocked YouTube after it initially refused to comply with demands to remove a video deemed to offend King Bhumibol Adulyadej. In Thailand, the crime of lese majeste—defaming, insulting or threatening the royal family--is punishable by up to 15 years imprisonment. In August, the MICT lifted the ban after YouTube agreed to prevent some of these lese majeste videos from being accessed through filtering by Thai ISPs (ONI, 2008). Thailand's censorship of the Internet continues to be a contested and controversial policy because the legal basis for filtering and actual filtering practices are not transparent (ONI, 2007).

Software Industry Promotion Agent (SIPA)

In September 2003, the MICT has established the Software Industry Promotion Agency (SIPA) as a public organization to promote Thai software industry and human resources. SIPA has established development guidelines for enterprise software, animation and multimedia, mobile applications and embedded software (Koanantakool & Udomvitid, 2008).

National Telecommunication Commission (NTC)

The first independent state telecommunications regulator – the National Telecommunications Commission (NTC) was established on October 1, 2004 in the provisions of the Act on the Organization to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunication Services B.E. 2543 (2000) and the Telecommunication Business Act B.E. 2544 (2001). Its duties and responsibilities are to regulate all telecommunication services in the country through formulating a Master Plan on Telecommunications Activities, setting criteria and categories of telecommunication services, permitting and regulating the use of spectrum for telecommunication services, and granting licenses to the telecommunications operators (NTC, 2009).

National Electronics and Computer Technology Center (NECTEC)

NECTEC was established on 16 September, 1986, initially as a project under the Ministry of Science, Technology, and Energy (the former name of the Ministry of Science and Technology). In 1991, NECTEC was transformed into a specialized national center under the National Science and Technology Development Agency (NSTDA), a new agency following the enactment of the Science and Technology Development Act of 1991 (NECTEC, 2009).

Its main responsibilities are to undertake, support and promote the development of electronics and computer technologies through research and development activities. NECTEC also provides linkage between research communities and industries through the established industrial clusters (NECTEC, 2009). NECTEC was a predecessor in developing the national IT policy and IT promotion as mandated by the National Committee in 1992. It handed over policy tasks to the MICT after the completion of the first National ICT Master Plan of 2002 (Koanantakool & Udomvitid, 2008).

The Role of Individuals and Groups

The strategic restructuring (SRS) approach assumes that institutions and structures are important but people make "political tugging and pulling" over particular resources and that these conflicts shape the outcomes (Wilson III, 2004). The model assumes that;

> Institutions and structures are important but people act individually and in groups to spread new technologies through society. Individuals are the social actors who make the information revolution happen. Individual people decide whether to buy computers, to use the Internet, to open an Internet service provider, to develop new local content, or to become a champion of freedom of the media. Individuals staff the institutions and reshape and reform them, even as they are being guided by those same institutional rules (p. 43).

The Information Champions

The SRS model identifies "information champions" as "individual elites" who are in a position to rewrite the institutional rules of the game to encourage the wider distribution of ICT services by introducing innovative technologies and practices. These people might be leaders of NGOs, senior government officials, or private-sector entrepreneurs (Wilson III, 2004). They are similar to what Everett M. Rogers calls "early innovators" who appear early in the process of social innovation (Rogers, 2003).

The development of the Internet in Thailand (Palasri, Huter, & Wenzel, 1999) revealed the culture of volunteers among the "key people" who helped advancing the Internet network and its use since its inception to Thai research community in 1992. These volunteers were highly educated individuals with Ph.D. degrees in engineering and computer science from universities in the United Kingdom, the United States and Australia. The group also included English speaking expatriates who were the experts in BBSs (bulletin board systems) (Koanantakool, 2007a).

Government Policies

The SRS model put forward the balance of government policies as the final factor that shapes ICT diffusion. These are policy balances in terms of private and public, domestic and foreign, monopoly and competition, and central and distributed. The pace, extent, and effectiveness of ICT diffusion can be directly shaped by these government policies. In general, in countries where these four policy balances are not favorable, ICT diffusions materialize much more slowly than in countries where the policy balances are favorable (Wilson III, 2004)

Telecommunications Reform

Historically, Thailand's telecommunications sector has been regulated and monopolized by two state-owned enterprises (SOE) – the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT) (Petrazzini, 1995). The TOT was established in 1954 to provide telephone service in Bangkok metropolitan area and extended to national wide coverage several years later. The CAT was founded in 1977 to operate international and radio communications. In 2002, these two SOEs were transformed into state-owned corporations under the Ministry of Information and Communication Technology (MICT, 2005).

Attempts to reform and liberalize the telecommunications industry began in the late 1980s. During that time, Thailand's politics were overshadowed by the military and the telecommunications sector was monopolized by the two SOEs. The CAT and the TOT played a leading role in Thailand's telecommunications policy, yet lacked the ability to keep pace with the extraordinary growth in demand (McCargo & Pathmanand, 2005) and hindered advances of Thailand's ICT infrastructure growth (Jussawalla, 1999). The reform efforts seem to coincide with a period of the country's major political (Niyomsilpa, 2000) and economic (Ure, 1995) changes.

Telecommunications Concession

The existing Thai telecommunications legislation grants exclusive ownership rights for the entire telecommunications network to the state, through the Telephone Organization of Thailand (TOT) in domestic services and the Communications Authority of Thailand (CAT) in international services. As a consequence, the means of financing large scale infrastructure build-out, namely privatization and the introduction of competition, were not available (Harrington, 1995; Ure, 1995).

Following the military coup of 1991, democracy was restored by the Anand Panyarachun's government in 1992. The new government removed the influence of the air force and army from the policy-making of the CAT and TOT, and pushed ahead with the privatization of the CAT and TOT (Harrington, 1995; Ure, 1995).

The government bypassed the legal restrictions by interpreting the legislation in a way that allowed the award of limited life concessions to the private sector. Under these concessions private companies build the telecommunications network, transfer ownership to either TOT or CAT and then operate it while giving a share of revenues and or profits to TOT or CAT. By using this BTO or Build-Transfer-Operate approach, the state remains informal ownership of all telecommunication facilities but private capital and expertise is attracted to the sector and network build out is promoted (Harrington, 1995; Ure, 1995).

From 1988 to 1997, the companies involved were transformed from being mere sales representatives of communication equipment and computers to business groups with diverse interests, listing on the stock exchange and making enormous actual and prospective income. Such a transformation was brought about through the new BTO concession system by elected politicians from the Chatchai Choonhawan era on-wards (McCargo & Pathmanand, 2005).

Nevertheless, extensive liberalization reforms or extensive opening of the market does not directly translate into an increase in penetration rates of information and telecommunication services. The implementation of telecommunication liberalization reforms needs to be tailored specifically to the country's development pace and users needs (Krairit, 2001).

The Impact of the Southeast Asian Tsunami

This section reviews literature of the impact of the December 2004 tsunami and the role of information and communication technology (ICT) in emergency response and disaster relief. The review focuses on two main responses:

- On-line assistance in disseminating information from government, semi-government, and non-government agencies.
- On-site assistance in collecting and recording identification information of tsunami disaster victims.

Tsunami Mass Fatality Management

A mass fatality incident is any situation where there are more bodies than can be handled by local resources. Mass fatality incidents result in a large number of bodies that stretch the community beyond its resources (McIntire, 2007).

When responding to mass fatality incidents, McIntire (2007, p.160) identifies the following issues:

- Care for investigation or crime scenes: Mass fatality incidents lead to death requiring special treatment of bodies.
- Logistics: Who will recover bodies? How will they be transported and stored?
- Family assistances: How will the next of kin be notified? What questions, concerns, and needs might they have, and how can these be addressed?

- Psychological issues: How will surviving relatives and emergency workers react to death and what kind of support will they need?
- Cultural and religious issues: What are the burial customs of different people and groups locally and around the world?

There are neither technical guidelines for managing mass fatalities, nor information available about post-disaster management of the dead following large natural disasters. Body recovery is deemed as the first phase of the management of dead bodies. In Thailand, the process was characterized as being initially "chaotic and uncoordinated," involving a large number of different actors including foreign tourists, local volunteers, Thai non-governmental organizations that specialize in body recovery following disasters (Po-Tek-Tung Foundation and Ruam-Ka-Tan-Yu Foundation), the military, and the police (Morgan et al., 2006).

Under Thai law, a forensic investigation is required to identify disaster victims, and determine the time, place, cause, and manner of death. In the tsunami case, the main purpose of the investigation was to identify the disaster victims. During this period, the investigation is supervised by (1) Department of Disaster Prevention and Mitigation, Ministry of Interior, (2) the Royal Thai Police, and (3) the Ministry of Public Health (Sribanditmongkol, 2005).

Disaster Victim Identification Guide (INTERPOL, 1997) suggests that accurate identification is achieved by matching AM (Ante Mortem) and PM (Post Mortem) data obtained from;

- Circumstantial evidence i.e. personal effects such as clothing, jewelry and pocket contents.

- Physical evidence provided by external examination of general features (description) and specific features (fingerprints), and internal examination such as medical evidence, dental evidence, and laboratory findings.

After the Tsunami struck, the Thai Ministry of Public Health (MOPH) activated mass casualty plans and deployed clinicians, public health practitioners, and medical supplies in assessment of health-care needs such as identification of the dead, injured, and missing, and active surveillance of related illness.

A central command center in Bangkok and command centers in each of the six impacted southern provinces namely Krabi, Phang-nga, Phuket, Ranong, Satun, and Trang (see Figure 2.3) were established to coordinate activities. Deployment included teams providing emergency clinical care, giving technical support and health education, conducting active surveillance and investigating outbreaks, and providing mental health support. Accredited massage therapists also provided traditional Thai massage therapy for relief workers and displaced persons (CDC, 2005b).

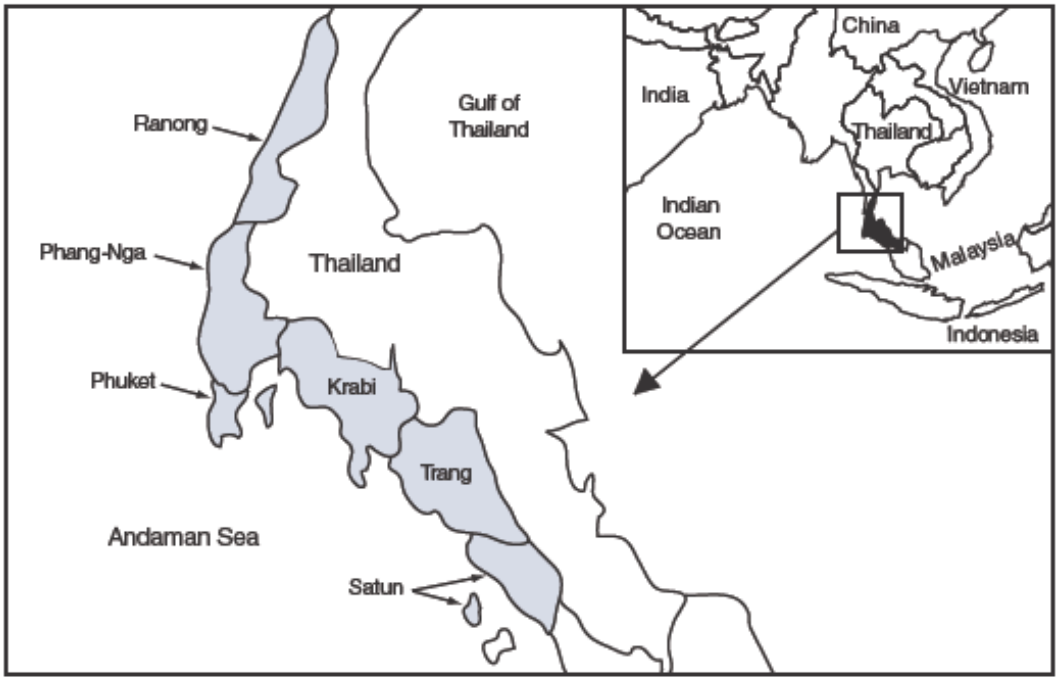


Figure 2.3. The six provinces in Thailand impacted by the tsunami (CDC, 2005a).

The Department of Disaster Prevention and Mitigation (DDPM), Ministry of Interior – the Thai counterpart of the United States Federal Emergency Management Agency (FEMA) declared casualties of Thais and foreign tourists as shown in Table 2.2

Table 2.2
Number of Tsunami Casualties by Provinces

Province	No. of Thai Death	No. of Foreign Death	Undetermined Nationality	Total
Phang-nga	1266	1633	1325	4224
Krabi	357	203	161	721
Phuket	151	111	17	279
Ranong	156	4	0	160
Trang	3	2	0	5
Satun	6	0	0	6
Total	1939	1953	1503	5395

Source: Department of Disaster Prevention and Mitigation, Ministry of Interior, Thailand (Sribanditmongkol, 2005)

Temporary Morgue Operations

Disaster Victim Identification (DVI) teams totaling at least 600 persons, from Thailand and approximately 30 other countries, converted temples and other buildings in the provinces of Phang-nga, Phuket, and Krabi into four temporary morgues by modifying buildings and procuring DVI equipment and supplemental electricity. Refrigerated containers were procured to store and preserve bodies which were initially cooled with dry ice. Bodies were stored in these containers until identified and released (CDC, 2005a, 2005b).

Thailand Tsunami Victim Identification (TTVI)

According to the CDC's Morbidity and Mortality Weekly Report (MMWR) (CDC, 2005a), DVI teams at the four morgues sites in Phang-nga, Phuket, and Krabi provinces initially used different forensic protocols including various numbering systems and methods for obtaining DNA specimens. These factors and the long travel times between the morgue sites (i.e. up to 6 hours by road) delayed data sharing between morgues and, consequently, victim identification. As a result, the multinational Thailand Tsunami Victim Identification committee (TTVI) was formed on January 12, 2005 to create specific standardized protocols and procedures for DVI, based on the *Interpol Disaster Victim Identification Guide* (INTERPOL, 1997) and subsidiary procedures for pathology, odontology, photography, fingerprinting, reexamination, moving of bodies, chain of custody, and DNA testing of ante mortem (AM) and post mortem (PM) samples.

TTVI also recommended appointment of an infection-control officer. Postmortem data were recorded on Interpol forms and matched with ante mortem data (e.g. primary data such as dental, fingerprint, or DNA data and secondary data such as age, race, sex, hair color, and jewelry) compiled regarding missing persons at an information center (IMC) in Phuket. Ante mortem data were provided by relatives or friends directly to IMC or through the Royal Thai Police, embassies, or consulates. The Plass System (Plass Data Software, Holbaek, Denmark) and DNA-matching software were used to generate preliminary matches. If these matches were confirmed by a review board of Thai medical and police authorities, identification was confirmed, a death certificate issued, and the body released (CDC, 2005a). See photographs of TTVI facilities in Phuket and Phang-nga provinces in Appendix F.

The MMWR's editorial note (CDC, 2005a) suggests that the DVI effort in Thailand might be the largest multinational DVI operation ever conducted. Complex public health and

logistical challenges arose related to identifying disaster victims from approximately 30 countries and working in temporary morgues; these challenges resulted in formation of the TTVI committee and institution of standardized protocols among DVI teams. However, even with standardized protocols, DVI in Thailand and parallel efforts in Sri Lanka and the Maldives are likely to take as long as 1 year. To date, identification of most tsunami victims in Thailand has relied on traditional forensic data (i.e., fingerprints and dental records) rather than DNA results. Centralization of DVI in the new temporary morgue could speed the rate of examinations, reduce the number of occupational health and environmental health hazards, and facilitate implementation of site safety recommendations (CDC, 2005a).

Online Disaster and Humanitarian Information Dissemination

On Sunday morning of December 26, 2004, most of the Thai TV channels broadcasted their usual weekend variety shows without breaking news. “On that day, the tsunami casualties were covered as a ‘normal’ disaster, not a major disaster of biblical proportion” (Chongkittvorn, 2005).

Although the volume of mass media coverage and the use of the Web increased dramatically, the main type of media used to communicate meaningful data immediately after the tsunami disaster were mobile phones and amateur-run web discussion groups (Kivikuru, 2006). The Internet was used by the relatives and friends of missing Westerners who were traveling through Asia on Christmas holidays, to search for their missing friends and family (Griffin, 2005).

Open Source Networked Collaborations

The ability to form multi-organizational networks rapidly among formal aid organizations and a distributed network of volunteers is crucial to humanitarian aid and disaster relief

(Denning, 2006). An open ICT ecosystem, including development, access, and ownership of technologies, is necessary in coping with innovation in politics, health care, and disaster management (Berkman, 2006). Furthermore, it is a good ICT strategy for developing countries to use open source software (OSS) to gain knowledge about the technology itself, and to create technology products that fit their specific needs (Câmara & Fonseca, 2007).

The Web was used in a variety of ways to aid recovery in the aftermath of disasters such as the December 2004 Southeast Asian tsunami and the August 2005 Hurricane Katrina. For instance, the South-East Asia Earthquake and Tsunami (SEA-EAT) blog aggregated news and first-hand information at a time when the mainstream media's coverage was seen as fragmented and insufficient (Jones & Mitnick, 2006). The blog's ability to reach vast numbers of people quickly with onlooker reports and to side-step government and corporate control have made blogs effective forums for sharing information (Ramos & Piper, 2005). In the case of the SEA-EAT blog, it expanded beyond information dissemination into a more interactive, decentralized attempt to identify and allocate recovery assistance (Jones & Mitnick, 2006).

In addition to the online assistance of formal aid organizations, the recovery efforts included attempts to provide help through collaboration among distributed networks of volunteers. Data-driven relief, such as identifying resources and persons, coordinating assistance to victims, publicizing services, and establishing communication standards, are areas of assistance where open networked collaboration can thrive (Jones & Mitnick, 2006).

CHAPTER III

RESEARCH METHODS

Introduction

This chapter presents the analytical framework of the dissertation. It begins with the basic definitions of the concepts used in the research followed by the methodologies and analytical framework, the justification of methodologies and framework, and then the data collection process.

This research proposes to examine the development of the information society in Thailand and the response of the Thai information society to the tsunami disaster. It analyses the information society from the perspective of the information workforce and information and communication technologies (ICT) within the Thai socioeconomic context and government policies.

Research Framework

The research design is an exploratory, descriptive, and inductive case study of the development of the information society in Thailand. At its first level, it describes and explores the current structure and policies, within the historical framework of Thailand's information workforce and ICT on the basis of government policy decisions and sector developments. At its second level, it evaluates the Thai information society within the context of its response to the tsunami disaster.

Case Study Approach

In general, case studies are the preferred strategy when "how" or "why" questions are being asked, when the researcher has little control over events, when the focus is on a contemporary phenomenon within some real-life context, when the boundaries between

phenomenon and context are not clearly evident, and in which multiple sources of evidence are used (Yin, 2003b).

In case study research, theory helps to select the cases to be studied, whether following a single-case or multiple-case design, to specify what is being explored, to define a complete and appropriate description, to stipulate rival theories, and to generalize the results to other cases (Yin, 2003a). Nevertheless, the mode of generalization from cases studies is theoretical, not empirical (Platt, 2007).

The case study as a research strategy comprises a method that covers the logic of design, data collection techniques, and specific approaches to data analysis. From this perspective, the case study approach, embedded with theory and context, provides an appropriate framework for this research agenda.

Theoretical Framework

This research builds on a political economic approach to the development of the information society and the pattern of ICT diffusion. The multivariate approach of strategic restructuring (SRS) model and the structural causality framework are used in the case study of the development of the information society and the pattern of ICT diffusion in Thailand.

Strategic Restructuring Framework

Ernest J. Wilson III argues in "*The information revolution and developing countries*", that no single factor can adequately explain the character of ICT diffusion (Wilson III, 2004). Thus, he proposes an open-architecture model that explains the pattern of ICT diffusion, namely the dependent variable to four independent variables;

(1) *Structure:* refers to fundamental elements of society that do not change easily over time. Society structures include (a) level of economic development measured by the indicators

such as GDP per capita, (b) economic structure captured by the domestic production in agricultural, manufacturing, and service (including information) sectors, (c) social structure which refers to the society hierarchy determined by the shares of educated professional workers, laborers, farmers, and other classes, (d) political structure which refers to local political culture i.e. citizen participatory or authoritarian regime.

(2) *Institutions:* shape the behavior of workers by providing them with incentives to act in certain ways. The most important institutions typically include ministries of communication or information, state-owned enterprises, regulatory agencies, specialized ICT bodies, and joint public-private sector institutions.

(3) *Politics:* is the center of the SRS model. Individuals are the social actors who spread new technologies through society. Internet diffusion is shaped largely by the strategic decisions of societies elite. The role of farsighted and influential individuals in promoting particular patterns of Internet diffusion is vast, especially in the early years when the institutions that typically should provide guidance, support, and incentives for individuals have not yet been established. In this way, the ICT sector has experienced elite, not mass politics.

(4) *Government policies*: specifically, a set of political balances between (a) private and public sectors, (b) monopoly and competition, (c) foreign and domestic ownership, and (d) centralized and distributed administration can directly shape the pace, extent, and effectiveness of ICT diffusion. These four policy balances act as an "intervening variable" in the SRS model. For example, when a government policy sets Internet service provider prices high, then Internet demand is certainly lowered.

Structural Causality Framework

Raul L. Katz argues in "*The information society: An international perspective*", that the process of diffusion of information technologies in developing countries is strongly influenced by political factors (Katz, 1988). He states that while correlation exists between economic development and expansion of information technologies infrastructure, some of the relationships between the economic system and the information and communications systems are mediated by the political system. In addition, diffusion of information technologies can also be exclusively the result of needs emerging from the political systems and having little to do with market mechanisms. He writes:

> In sum, we believe that diffusion of information technologies is determined by the interaction of plurality of variables, among which the economy plays an important-but not exclusive- role. The diffusion of an information technology is determined by the interaction between several factors, among which the configuration of the technology, its economics, and its political desirability are keys. (p.59)

In a framework of causal inference analysis that links the economic, political, and informational or communicational variables within a set of mutual relationships, a structural causality model operates in different ways according to each historical period. The hierarchy of causality – in statistical terms, the weight of each of the independent variables – will vary historically. The framework can be demonstrated in Table 3.1, representing the three phases of political and economic development in a given nation.

Table 3.1
A Framework of IT Diffusion

Phases	Economic Weight	Political Weight	IT Diffusion
State-building		x	To support the formation of a political institute aimed at political control and economic growth
Infrastructure building for economic development	x		To support economic growth. IT development is driven by economic needs, mediated by the political system.
Maturity	x		As a result of the industrialization process, manufacturing and service sectors are the main contributors to IT expansion.

Source: Based on Katz (1988, p. 63-65)

In summary, while industrialized countries have followed the three stages in a more or less linear fashion, developing countries tend to face the challenges of state building and economic development simultaneously. It is precisely the simultaneity of the economic and political development processes in developing countries that sometimes tends to hide the importance of the political variable in explaining the expansion of the communications and information infrastructures (Katz, 1988).

Research Questions

The objective of this dissertation is to determine whether the establishment of the highest level ICT governing body such as a Ministry of Information and Communication Technology (MICT) compared to other less authoritative ICT agencies can increase the effectiveness of information society development. This study examines the case of the role of the information society in response to the tsunami disaster. Through a methodical analysis of this case, the study

provides policy implications for disaster relief in the Internet-mediated nature of global and collaborative effort.

Hypotheses

In determining the effectiveness of ICT institutions in the development of information society, the study examines the responsiveness of these agencies to the tsunami disaster. This dissertation proposes the following hypotheses:

1. The highest level ICT governing body such as MICT is perceived to be significantly more effective than other specialized ICT semi-government and for-profit agencies in disseminating information in response to the tsunami disaster.
2. The highest level ICT governing body such as MICT is perceived to be significantly more effective than other specialized ICT semi-government and for-profit agencies in providing ICT infrastructure in response to future disasters.
3. ICT government agencies are perceived to be significantly more effective than other specialized ICT semi-government and for-profit agencies in the development of information society in Thailand from 1991 to 2008.

Data Collection Procedures

The data collection was conducted through library research, secondary sources, statistical data, interviews and survey questionnaires. While the qualitative data was collected through interviews and secondary sources, the quantitative data was collected through questionnaires and statistical data.

Library Research & Secondary Sources

The investigation started in early 2006 with a preliminary data search and analysis on the impact of the December 2004 tsunami and the role of information and communication

technology (ICT) in emergency response and disaster relief. Extensive secondary data was gathered from online and printed materials from UNT library, worldwide institutional websites, online English and Thai newspapers and archives, disaster relief websites, and blogs. Library research was carried out both before and after the interview process.

Statistical Data

Statistical data on labor force and ICT indicators were extracted from websites of LABORSTA Labour Statistics Database (ILO, 2008) and WDI (World Development Indicators) Online (World Bank, 2007, 2008, 2009) respectively.

Interview

Based on preliminary document analysis and literature review, interview questions were prepared – see Appendix F for complete list of interview questions. The interviews were conducted in two phases. The first interview phase conducted in October 2006 was part of a pilot case study to refine the plans to collect data and the procedures to be followed. The second phase conducted during November 2007 to December 2007 was for follow up questions and detailed questions for two more interviewees.

Procedures

Five semi-structured interviews with four individuals were conducted during October 2006 and November 2007 to December 2007. The interview sessions lasted from ninety minutes to two and a half hours. All but one of the interviews were conducted at the interviewees' offices. Table 3.2 shows profiles of the interviewees in chronological order of interview dates.

Table 3.2
Interviewee Profiles

Name & Position	Organization Name	Date
Trin Tantsetthi Chief Executive Officer & President	Internet Thailand Public Company Limited (INET)	26-Oct-2006 28-Nov-2007
Akarawuth Tamrareang Open Source Content Management System (CMS) Consultant	Open Source Software Network (OSSN) Thailand	28-Oct-2006
Hugh Thaweesak Koanantakool Vice President & Director	National Science and Technology Development Agency (NSTDA), Thailand, National Electronics and Computer Technology Center (NECTEC)	29-Nov-2007
Arawadee Photisaro Vice President ICT Solutions	Application Management Oil, Gas & Refinery, Petroleum Authority of Thailand	4-Dec-2007

The interviewees were selected based on their roles in the tsunami disaster relief. Two individuals were on site the day after the tsunami to direct the collection of disaster victim identification (DVI) data in Phang-nga – a province 500 miles south of the capital city and one of the six provinces affected by the tsunami. The other two interviewees were in the capital city of Bangkok and directed the construction of disaster relief websites.

All interviews were conducted in Thai language and were recorded on a digital voice recorder. The interview audio format (WAV) files were transcribed by two transcribers in Thailand. The transcripts were examined in order to extract relevant data and information from

the conversations. The results from the interviews were analyzed and used to construct a survey questionnaire, see Appendix G for interview questions.

Survey

Data was collected during February 2008 to June 2008, using Internet-based questionnaires. Statistical procedures including analysis of variances and regression models are used to test the hypothesis and to identify elements for disaster relief policy formation.

The Questionnaire

The questionnaire was designed and developed by the researcher based on a preliminary analysis and five comprehensive interviews conducted during the pilot study in October 2006 and follow-up questions in November to December 2007. Data was collected during February 2008 to June 2008, using an Internet-based questionnaire. See Appendix H for survey instruments.

The purpose of the study was explained on the study introduction page. Survey participation consent form was included on the front page and the voluntary nature of their participation was emphasized. By completing the survey, the participants gave their consent. The survey was divided into five forms to cover three sets of questions.

1) Set one contains three sections, total of 18 questions, at a seven-point Likert items. It evaluates the effectiveness of agencies in the following tasks:
    a) Tsunami Disaster Relief – 6 agencies
    b) Future Disaster Relief – 3 agencies
    c) Information Society Development – 9 agencies

2) Set two contains a section on participants' roles and three sections, total of 9 questions, at a seven-point Likert items. It evaluates the degree of the Tsunami Disaster Effects on respondents':
    a) Income, job security and wealth
    b) Family members, friends, and society
    c) Emotion, physical, and future well-being.
3) Set three contains a number of questions on respondent's general characteristics regarding:
    a) Personal data: Gender, age group, and education level
    b) Work place: Type of organizations and years of work experience.

The degree of effects on the Likert-scale is given weight as follow:

- "Strongly Agree" : 7 points
- "Agree" : 6 points
- "Somewhat Agree" : 5 points
- "Neutral" and "I Don't Know" : 4 points
- "Somewhat Disagree" : 3 points
- "Disagree" : 2 points
- "Strongly Disagree" : 1 point

The perceptions of survey participants towards the effectiveness of the agencies were measured using a seven-point Likert items.

Participants

The sample was identified from Thai and foreign community of tsunami disaster volunteers, survivors, as well as IT professionals. The researcher contacted the community via e-

mail calling for survey participation. The call for survey participation (see Appendix G) was also posted in two web forums – (1) a Thai and English language forum on Open Exchange for Collaborative Activities in Response to Emergencies (OpenCARE) and (2) a Thai language forum for Thai IT professionals.

Validity and Reliability

The research used "Statistical Analysis Software" (SAS) for the purpose of tabulation and processing data collected by the questionnaire. Validity is the degree to which an instrument measures what it intends to measure and reliability is the degree to which an instrument consistently measures whatever it is measuring (Lunenburg & Irby, 2008). The following statistical methods were conducted to substantiate the validity and the reliability of instruments used in this dissertation.

Descriptive Statistics

Descriptive statistics is used to describe the respondents' characteristics to frequency and percentages.

Dummy Coding

To interpret the effect of categorical variable such as organization in a regression model, dummy coding is used to represent respondent's work place or "organization." Since the majority of the respondents worked in "For-Profit" organization, it was not coded and was used as a reference group to which "Government" and "Education" were compared.

Analysis of Variance

Analysis of variance (ANOVA) is performed to determine whether an independent variable has a significant effect on a dependent variable being measured (Kvanli, Pavur, & Keeling, 2002). A two-way analysis of variance (ANOVA) to measure the effects of two

independent variables – agency and respondent on the dependent variable – agency's effectiveness was performed.

Duncan's Multiple Range Test

In this research, measurements of agency's effectiveness were categorized into three areas. They were tsunami disaster relief, future disaster relief and information society development. Rating was on a scale of 1-7, with 1 representing complete disagreement with the critical role of an agency and 7 representing complete agreement. To verify which specific group of agencies has stronger effects on the effectiveness of each task, the "Duncan's Multiple Range Test" method was used.

Factor Analysis

The primary purpose of factor analysis is data reduction and summarization. The method is used to assess the construct validity of a test or a scale. The research adopted the Principal Components and Varimax Rotation methods, commonly used in factor analysis, to identify representative factors from all disaster effect items. Factors are extracted on the basis of Eigenvalues larger than 1.0.

Regression Analysis

Regression analysis was performed to investigate how respondents' characteristics as well as disaster-effect factors, namely independent variables would affect the perceived success ratings/effectiveness of agencies (dependent variables) in tsunami disaster relief, future disaster relief, and information society development tasks The results from "Duncan's Multiple Range Test" were used to group agencies whose means are not significantly different into specific groups. These groups were identified as dependent variables on all three tasks.

The regression analysis is used to identify elements that are most conducive to relative effectiveness of agencies in disaster management. The government could take reference from these elements when formulating disaster relief policies.

Basic Assumptions

The study assumed that the perceptions of Thai and foreign community of tsunami disaster volunteers, survivors, as well as IT professionals reflected the effectiveness of the Thai government on tsunami disaster response tasks. The study also assumed that the interviewees and the survey participants gave honest answers to the questions asked.

Design Issues

This study relied on first-hand information from the interviewees whom may not recall the detailed aspects of the incidents when asked about them a few years later. In addition, data collected from the interviews and the survey reflected interviewees' and survey respondents' own perspectives on the Thai government's tsunami disaster responses. There was no attempt to interview government officials who were assigned the responsibility to evaluate the effectiveness of their tasks. The study is country-specific and cannot be generalized.

In addition, the study relies on the trustworthiness of the interviewees and survey respondents as well as the objectivity of the researcher. From 1995 to 1997, the researcher worked for Internet Thailand (INET) – a division of NECTEC at that time. Former INET and NECTEC colleagues were contacted to answer interview and survey questions.

CHAPTER IV

RESULTS

Introduction

This chapter presents the results of the dissertation. It is divided into three analysis sections documentary research, interviews, and survey analysis.

The documentary research section investigates the development of the information society in Thailand from the perspective of information workforce, and information and communication technologies (ICT). This section explains factors influencing information workforce and ICT diffusion in the political economy frameworks of strategic restructuring (SRS) and structural causality model.

The interview section describes the response of the Thai information society to the tsunami disaster. It depicts a mutual shaping lens of the social shaping of technology (SST) and the diffusion of innovations that enable the joint processes of technological construction and social adoption in the specifics of technological artifacts in response to the tsunami disaster.

The survey questionnaire section describes the hypothesis in the framework of this study and is aimed to determine the effectiveness of ICT institutions and to reveal disaster relief policy implications. The analysis results are presented throughout the section.

Thai Information Society Analysis

Information society is defined as a socioeconomic structure that demonstrates high-employment of information related-occupations and widespread use of information and communication technology. Scores of documented trends indicate that developing Southeast Asian economies are rapidly transforming from basic agriculture structures to information economies. Previous studies showed Thailand's information workforce in 1980 being less than 10 % (Katz, 1988, p. 19). The following section validates and updates previous studies.

Growth in Information Employment

Figure 4.1 presents data on employment from 1971 to 2006 aggregated into the four major sectors of the economy: Agriculture, Industry, Service, and Information. In 1971 the Agriculture sector employed 12 million out of 16 million total workers and accounted for 77 % of all employment. The Agriculture sector dominated the structure of total employment until 1993 when it first showed a trend of a steady drop.

Over the next three decades, the dominance of the Agriculture sector has gradually changed. In 2006 the Agriculture sector accounted for 36 % of all employment and engaged nearly 14 million workers.

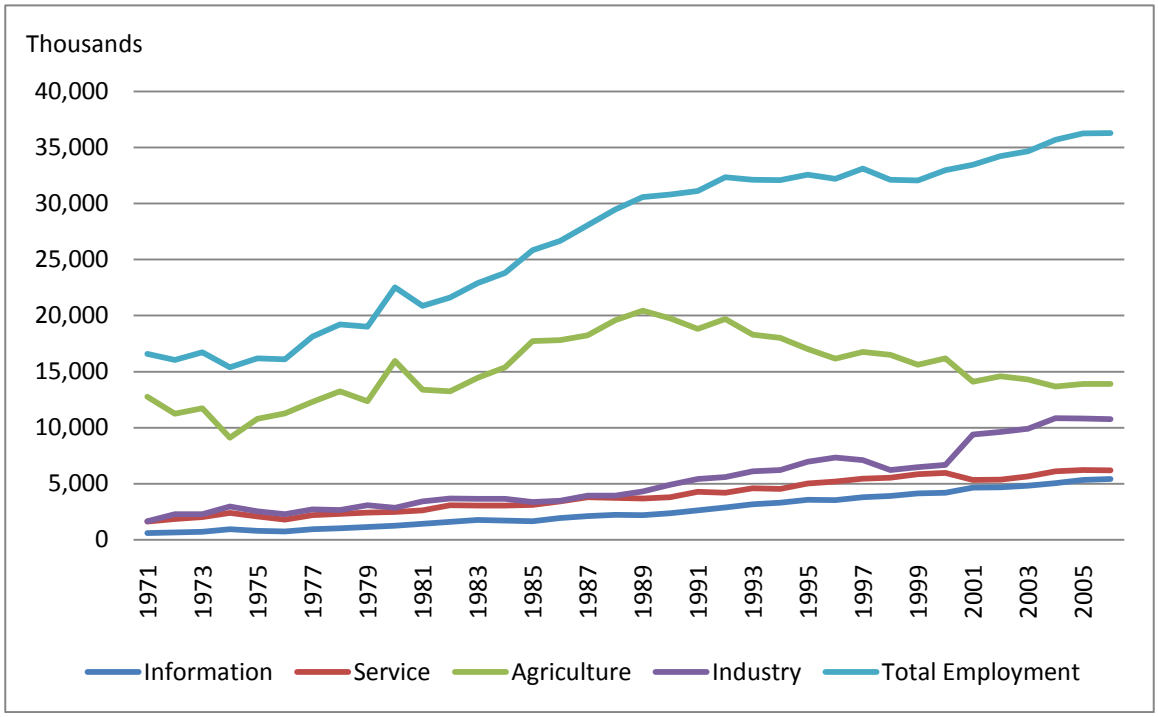


Figure 4.1. Four-sector aggregation of Thai employment from 1971 to 2006 (Appendix I).

While the Agriculture sector has slowly declined, the Industry, Service and Information sectors have gradually risen over the 35-year span. The Industry and Service sectors, each accounted for 10 % of all employment in 1971. By the end of 2006, Industry accounted for 30 % while Service comprised 17 % of all employment (see Figure 4.2).

The Industry sector has added nearly 10 million workers to total workforce over that time period. Correspondingly, the Information sector employed 581,000 workers and comprised 3 % of all employment in 1971. By 2006, the Information sector rose to 5 million workers and accounted for 15 % of all employment (see Figure 4.2).

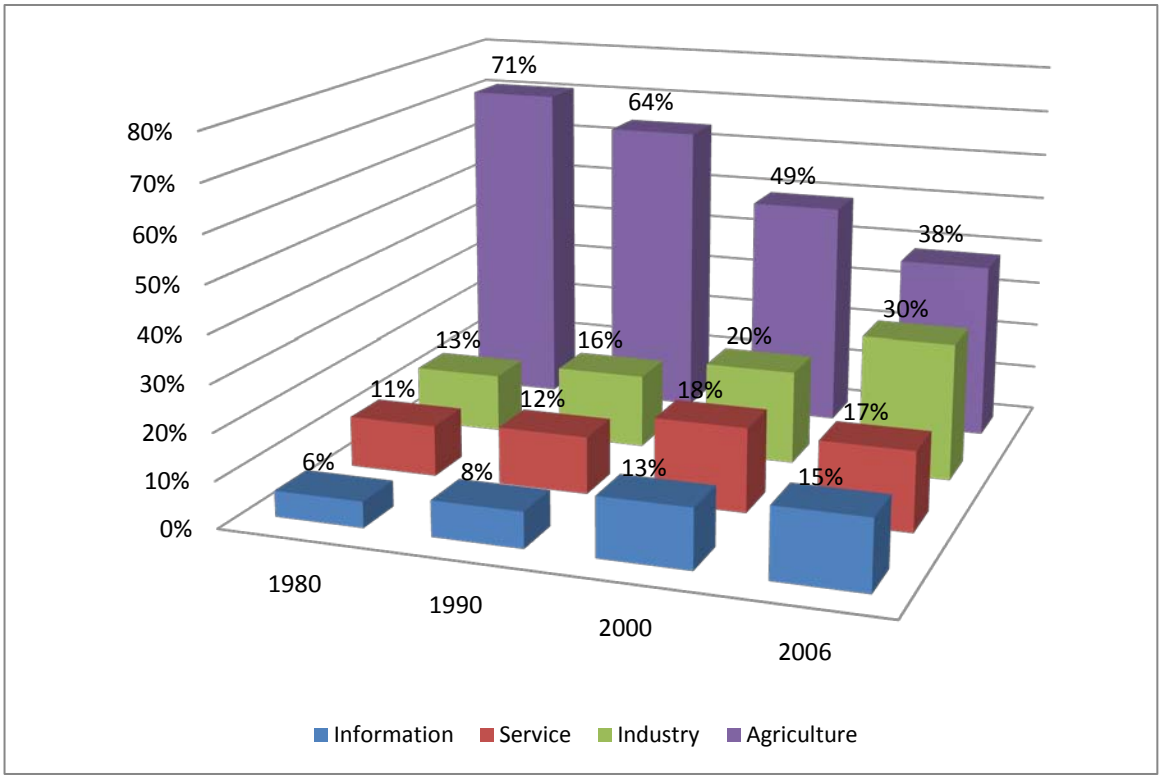


Figure 4.2. Four-sector percentage of Thai employment in 1980, 1990, 2000, and 2006 (Appendix I).

Figure 4.3 graphs the rate of growth of Information sector since 1972. The 0.15 points at which the rates of growth in Information sector drop into negative values are equivalent to high unemployment levels in Thailand in 1976 – a result of the 1973-76 political unrest which disrupted the confidence of business operators.

Except for the periods of high unemployment, the rate of growth for information employment has been positive. As can be seen clearly from the graph, compared to the rate of growth in other sectors, the Information sector's rate of growth has been steady since the early 1990s, compared to other sectors such as industry sector.

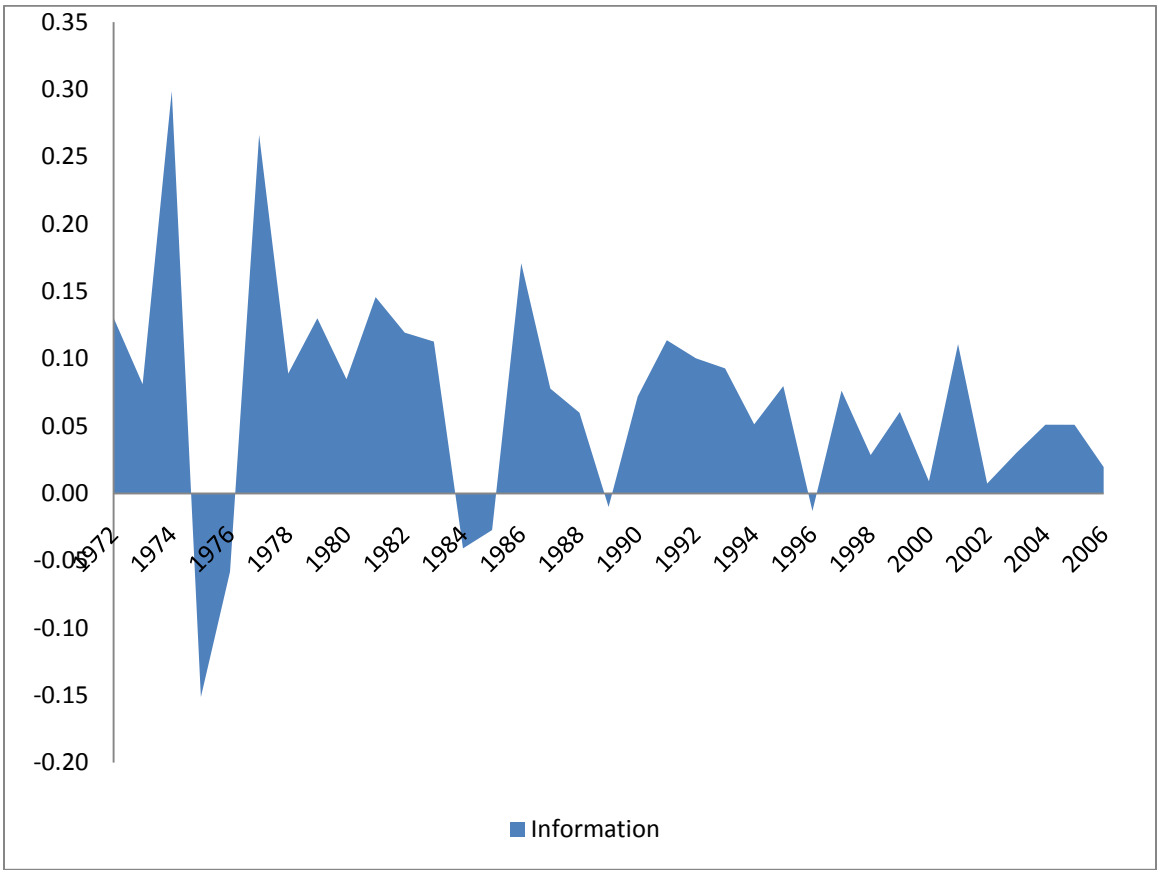


Figure 4.3. Growth rate of the information sector from 1972 to 2006 (Appendix J).

The steady growth of information workforce is evidenced in Table 4.1which shows the absolute numbers of employed workforce in Information, Service, Agriculture and Industry sectors and their growth rates for the past three decades.

Table 4.1
Thailand's Employment Sector Aggregation in Absolute Numbers and Growth Rate

	Information		Service		Agriculture		Industry		Total Employment	
Year	'000	GR	'000	GR	'000	GR	'000	GR	'000	GR
1980	1,246		2,477		15,960		2,841		22,523	
1990	2,353	89%	3,796	53%	19,755	24%	4,909	73%	30,814	37%
2000	4,180	78%	5,955	57%	16,178	-18%	6,681	36%	32,994	7%
2006	5,424	30%	6,198	4%	13,894	-14%	10,769	61%	36,285	10%

Note: '000 = Thousands, GR = Growth Rate

From 1980 to 1990, the information sector grew 89 % and added 1.1 million jobs to the total workforce. From 1990 to 2000, the sector grew 78 % and added nearly 2 million jobs. And from 2000 to 2006, the sector grew 30 % and added 1.3 million jobs. From 1980 to 2000, the rates of growth in Information sector exceeded those of other sectors.

Table 4.1 illustrates that from 1980 to 2006, the share of information, service, and industry occupations in Thailand has increased while the agriculture share has steadily decreased. That is all three sectors – information, service and industry expanded while the agriculture sector diminished.

Nevertheless, high growths in the information sector as a proportion of all employment in the last three decades (1980-2006) indicate a growing information society in Thailand. Even so, in absolute numbers, employment in information workforce is relatively small compared to other sectors. In 2006, the employments in the agriculture and industry sectors are roughly twice the size of the employment in the information sector.

Information and Communication Technology Development

What stands out most in Thailand's Information and Communication Technology (ICT) development over the last decade is the strong and continued growth in the number of mobile cellular subscriptions and the impressive rise in the number of Internet users (see Figure 4.4). In 2000, there were 5 mobile cellular subscriptions per 100 inhabitants and nearly 4 Internet users per 100 inhabitants. By the end of 2007, the penetration rates of mobile cellular subscriptions and Internet users were 124 % and 21 %, respectively. Over the same period, penetration rates for fixed telephone lines grew from 9 to 11 % and personal computers increased from 2.8 to 9.7 %. Broadband Internet subscriptions services were not available until 2001. In 2007, broadband Internet subscriptions remained low at 1.4 %.

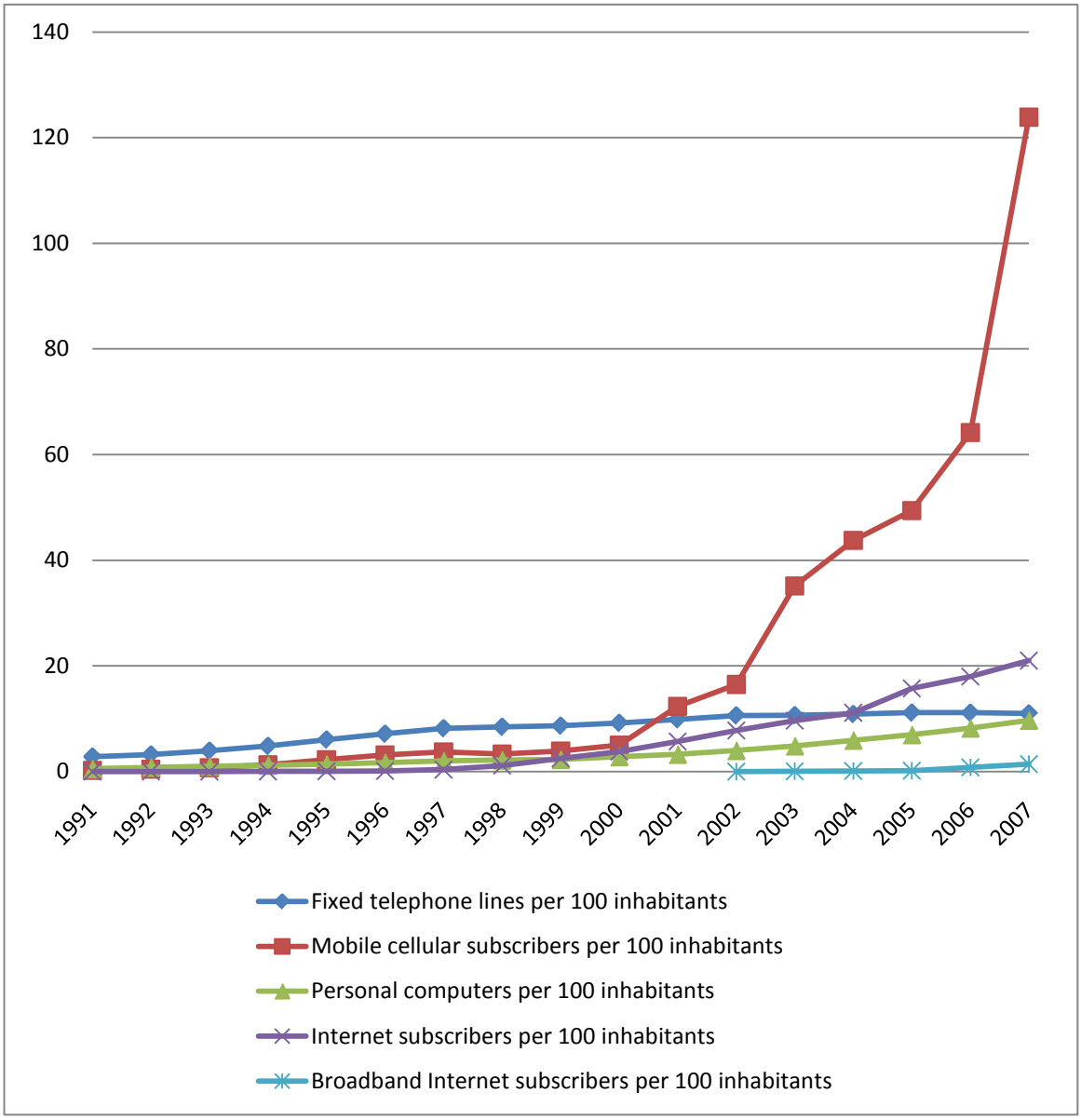


Figure 4.4. ICT indicators in Thailand from 1991 to 2007 (Appendix K).

Figure 4.5 shows a comparison between ICT penetration rates in Thailand and those of Asia and the Pacific region in 2007 (ITU, 2009b). Despite Thailand's impressive and high-growth in penetration rates of mobile cellular and Internet subscribers, fixed telephone lines and broadband subscribers were lower than the ICT penetration rates of countries in the Asia and the Pacific region.

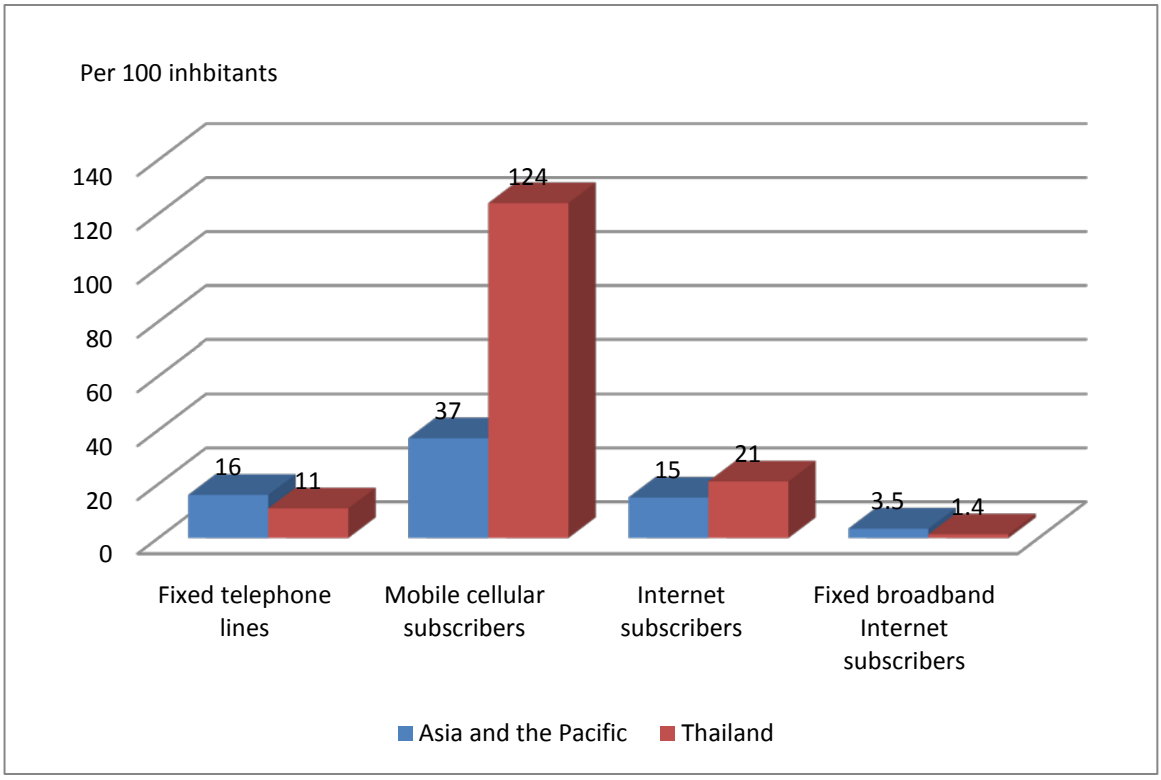


Figure 4.5. ICT penetration in Thailand and in Asia and the Pacific region in 2007 (Appendix K) and (ITU, 2009b).

Fixed and Mobile Technology

In 1991, Thailand had one of the poorest telecom services records in Southeast Asia with 1.5 million fixed telephone lines and a 2.8 % penetration rate. The export-led economic boom of the late 1980s required quality support and services from information and telecommunication infrastructure sector. A single digit growth of fixed telephone lines could not keep up with a double digit growth of the nation's GDP.

A major reform in Thailand's telecommunications industry which began in the late 1980s started to bear fruit after the political crisis of May 1992 which led to a final end of the military controlled government. The removal of military influence from policy-making posts in the two state-owned enterprises namely the Telephone Organization of Thailand (TOT) and the

Communications Authority of Thailand (CAT), together with the demand for quality ICT infrastructure services to support the growing economy accelerated the pace of the telecommunication reform. The reform enabled participation from private sectors and introduced competition to the telecommunication market.

From 1992 to 1997, the numbers of fixed telephone lines and mobile cellular subscriptions grew at average rates of 21 % and 64 %, respectively. During the 1997-98 Asia economic crisis, the growth in fixed telephone lines slowed down and the demand for mobile cellular subscriptions clearly dropped. Nevertheless, as the economy picked up in 2000, the country saw a steady rise in fixed telephone lines and mobile cellular subscriptions and the number of mobile cellular subscribers exceeded the number of fixed-line users in 2001 (see Figure 4.6).

From 2001 to 2007, Thailand had the highest increase in mobile cellular penetration rate in the Asia and the Pacific region (from 12 to 124 %) (ITU, 2009b). The number of mobile cellular subscriptions increased tenfold, adding more than 70 million mobile cellular subscriptions over the six-year period. In comparison to the country's limited and stagnant fixed telephone market, mobile telephony has undergone considerable growth (see Figure 4.6).

There are four key players in Thailand's mobile market – AIS, DTAC, True Move, and Hutch-CAT who commanded mobile subscriber market share in 2009 at 44 %, 30 %, 24 % and 2 % respectively. The majority of mobile cellular subscriptions is prepaid and account for 90 % of the total market. Postpaid subscription is not on a contractual basis, as there are very limited handset subsidy programs. Brand new handsets cost as little as USD 30 and lower-price handsets are also available through the second-hand market (AIS, 2009).

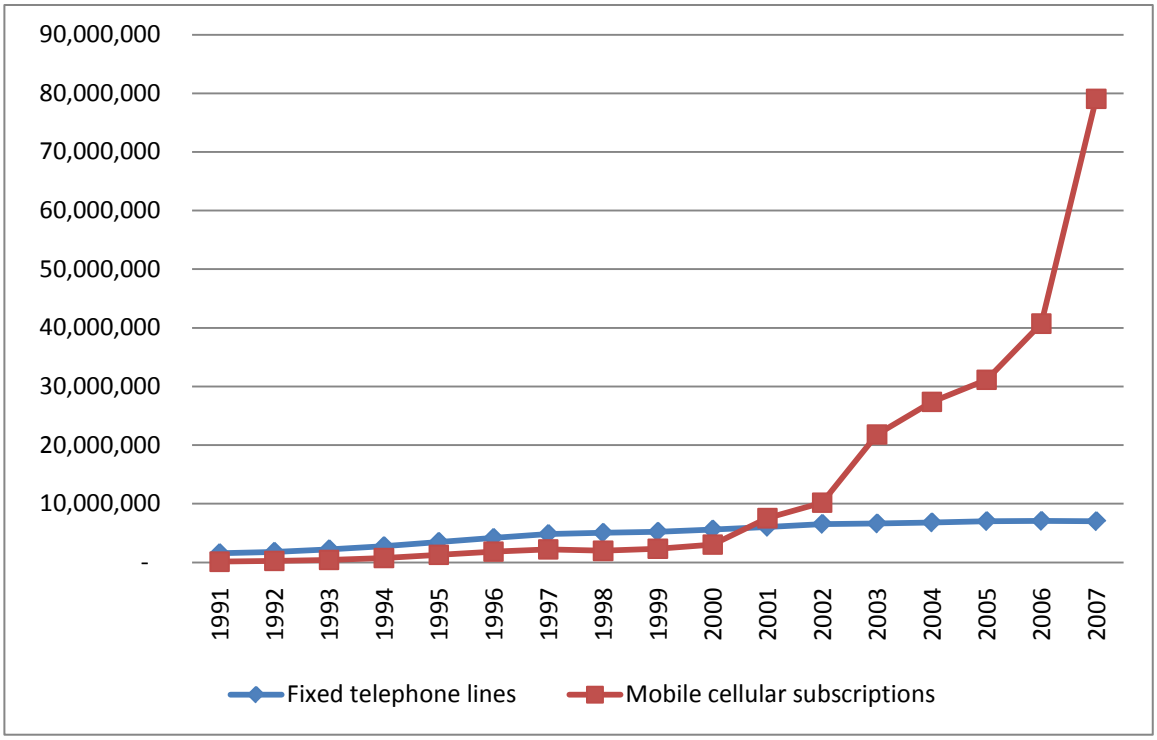


Figure 4.6. Mobile cellular subscriptions and fixed telephone lines in Thailand from 1991 to 2007 (Appendix K).

According to Sunitaya Shinawatra, a Vice President of Advanced Info Services (AIS) – a major mobile operator, prepaid subscription service or subscriber identity module (SIM card) was not permitted to operate prior to 1999, per contractual commitment with the TOT. The concession payments are somewhat different between the two services: postpaid (up to 30 %) and prepaid (up to 20 %) of gross revenue. A price war in SIM cards' prepaid services ensued among major mobile operators and permitted access to low-income/teen subscribers whose buying behaviors were driven by price. These "light users" switch numbers often depending on sales promotion. About 25 to 30 % of mobile cellular subscribers own more than one SIM cards (personal communication, Aug. 20, 2009).

In sum, the number of mobile cellular subscriptions surpassed that of fixed telephone lines in 2001. The same event happened in Africa in 2000 and globally in 2002 (ITU, 2009a).

Thailand's mobile cellular subscriptions continued to grow substantially reaching a total of 79 million, exceeding the number of Thai population by the end of 2007. The high ratio of mobile cellular subscriptions to fixed telephone lines, the high mobile cellular growth rate, and the drop in the number of fixed telephone lines suggest a stable shift in communication from fixed to mobile telephony.

Internet and Broadband

Over the last decade, Internet usage has greatly increased in Thailand. The Internet market together with the mobile cellular market represent an important area of ICT growth and development. The Internet is now recognized not only as a source of information, but also a form of social communication. With its innumerable applications, the Internet has demonstrated the capacity of a significant social, political, and economic development enabler.

Since 2004, Asia and the Pacific region has been the area with the largest share of Internet users in the world (ITU, 2009b). By the end of 2007, Thailand had 13 million Internet users – nearly ten times as many Internet users as it did in 1999. From 1999 to 2007, the country added over 10 million Internet users (see Figure 4.7). The number of Internet users per 100 inhabitants increased from 2.5 to 21 over the eight-year period.

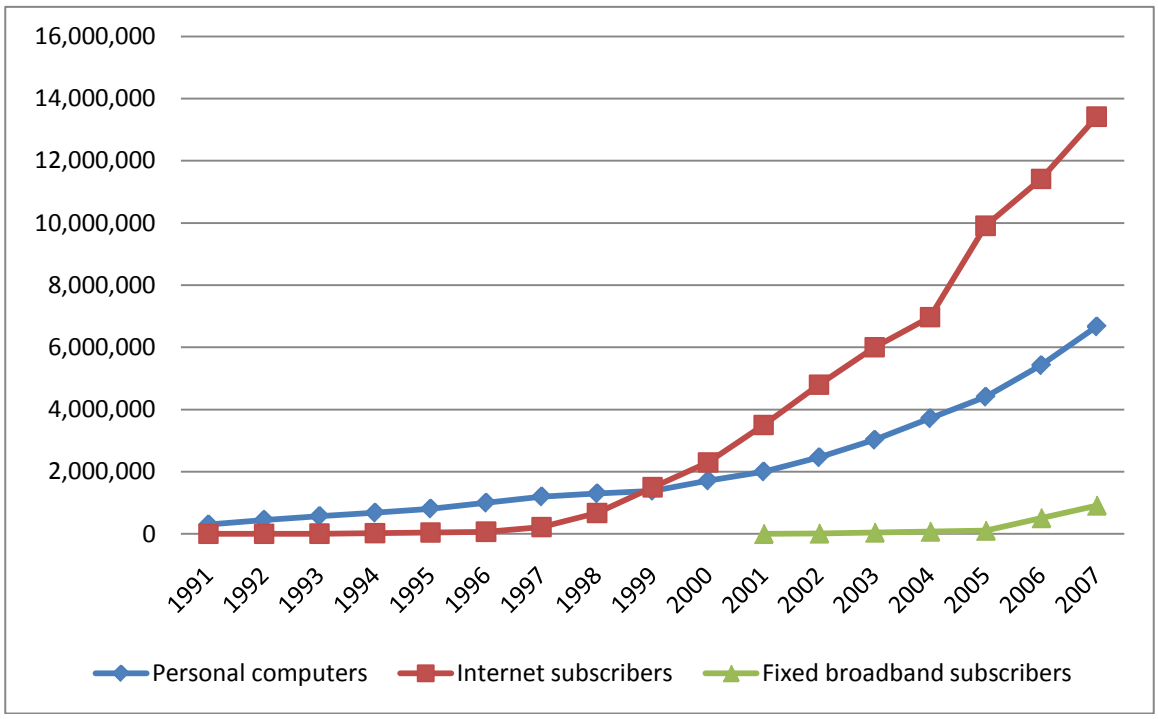


Figure 4.7. PCs, Internet and fixed broadband subscribers in Thailand from 1991 to 2007 (Appendix K).

As far as broadband is concerned, fixed broadband Internet services were first launched in Thailand in 2001(ITU, 2002). By 2007, the country had 913,000 fixed broadband subscribers – or 1.4 % which is rather low compared to Asia and the Pacific region (3.5 %) and to the developed world (19.4 %) (ITU, 2009b). At the end of 2007, mobile broadband Internet services were still not available (ITU, 2009b).

The unavailability of mobile broadband and very low fixed broadband penetration presented a divide in broadband access compared to countries in Asia and the Pacific region. In Africa, mobile broadband growth has been much stronger than that of fixed broadband (ITU, 2009a). In addition, The number of Internet subscribers has surpassed the number of personal computers since 1999. This pattern suggested that Internet subscribers access the Internet from outside the home either from a cybercafé or from public locations (ITU, 2002).

International Internet Bandwidth

In 2002, Thailand's international Internet bandwidth was at 1,010 Mbps (1 Gbps). Broadband local access through Asynchronous Digital Subscriber Lines (ADSL) and cable modem technology was introduced commercially in 2001. By the end of 2007, the international Internet bandwidth increased to 22 Gbps (see Figure 4.8) – the number of bits per person grew from 16 to 345 over the five-year period, see Appendix K.

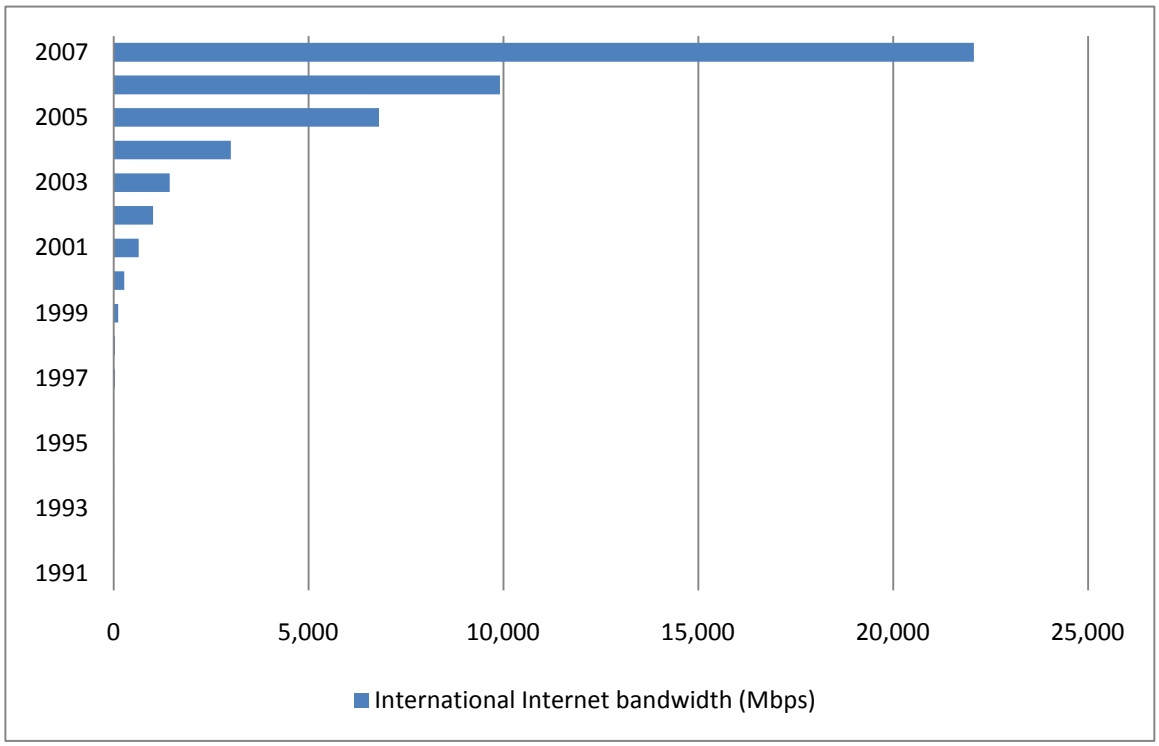


Figure 4.8. International Internet bandwidth (Mbps) (Appendix K).

The significant increase in international Internet bandwidth is in line with the increase in the number of Internet users during the same period. The compound annual growth rate of Thailand's international Internet bandwidth at 50.9 % is slightly higher than that of Asia and the Pacific region at 41.1 % (ITU, 2009b). Nevertheless, fixed broadband Internet subscribers per

100 inhabitants remained low at 1.4 % compared to Asia and Pacific region's 3.5 % and mobile broadband Internet was still unavailable at the end of 2007.

The Political Economy Frameworks of Strategic Restructuring and Structural Causality

There is no single factor that can adequately explain the character of ICT diffusion in a given information society. The political economy frameworks of strategic restructuring (SRS) using four independent variables namely structure, institutions, politics of individuals and groups, and policies and structural causality model linking the weight of economic and political influences to ICT diffusion in different ways according to each historical period are combined. The result is shown in Table 4.2 representing a framework used by this thesis to explain the growth of information workforce and the ICT development in the Thai information society. The three phases of political and economic development in Thailand include the followings:

- Phase I : State-building, 1971-1980
- Phase II: Infrastructure building for economic development, 1981-1990
- Phase III: Maturity, 1991-2000

In a framework of structural causality model, the influences of political and economic variables to ICT diffusion vary historically. The first phase of "state-building" is dominated by the political system which is the key driver in the diffusion of ICT. During this period in Thailand, "authoritarian had been the norm and a military coup the method by which to change the government." Appendix D shows succession of Thai Governments, from 1958 until 1980, the Thai government had been administered by three military Generals – Sarit Thanarat (62 months), Thanom Kittikachon (118 months), and Kriangsak Chomanand (37 months). In 1971, General Thanom Kittikachon staged a coup against his own administration and subsequently led the government. During the 22-year period, the Thai state was under 18-year military controlled.

In this stage of state-building, the Thai military were the primary ICT users who kept control over the allocation of ICT resources through the National Security Council and the policymaking officials of the two state-owned enterprises (SOE) – the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT) who monopolized domestic and international telecommunications services.

Beyond the first phase of state-building, the expansion of the state generally leads to Phase II "infrastructure building for economic development" – the buildup of an ICT infrastructure directed not only at optimizing the functioning of bureaucratic structures, but also at better serving the needs emerging from the economic system. In this phase, ICT development is driven by economic needs, mediated by the political system in terms of policy-making and regulatory processes.

In the late 1970s, the Thai government started to change the country's economic strategy in both service and manufacturing industries towards promotion of exports. Several overseas multinational firms moved their productions to Thailand to take advantage of low-cost conditions, especially supplies of cheap labor. Local manufacturing firms also invested in export-oriented industries. Thailand experienced a decade of high economic growth which peaked in 1988 when the GDP per capita growth reached 11.8 % (see Appendix E). In essence, the decade's economic boom had transformed the country's Rice Economy to Newly Industrialized Economy (NIE).

The export-led policy gave way to investments from multinational corporations which in turn created demand for an efficient ICT infrastructure. During this time, Thailand's politics were still overshadowed by the military and the telecommunications sector was monopolized by the TOT and CAT. These two institutions played a leading role in Thailand's

telecommunications policy for over two decades, yet lacked the ability to keep pace with the extraordinary economic growth.

By the end of 1990, as a result of the economic restructurings, as shown in Table 4.2, the employment in information (8%), service (12%), and industry (16%) sectors had increased while the employment in agriculture sector (64%) had decreased. Nevertheless, the penetration rates in fixed telephone lines and mobile cellular were relatively low at 2.4 % and 1.1 %, respectively.

In the second phase, it is obvious that the ICT infrastructure is needed to support the economic growth and the goals of telecommunication privatization are to increase economic efficiency and to improve the service quality. Thus, the economic variables generally weight more than the political variables in the ICT diffusion.

Table 4.2
The Political Economy Frameworks of Strategic Restructuring and Structural Causality

	Phase I: State-building	**Phase II: Infrastructure building for economic development**	**Phase III: Maturity**	**The Thaksinization of Thailand**
Factors	**1971-1980**	**1981-1990**	**1991-2000**	**2001-2006**
Political structure	Authoritarian rule had been the norm and a military coup the method by which to change the government. The military monopolized prime minister and key ministerial positions.	Failed military coups in 1981 and 1985. In 1988, the military lost control over the premiership. For the first time since 1976, the country had an elected government headed by an elected member of parliament.	From 1991-2001, there were no fewer than nine governments. The political crisis in 1992 dubbed "Black May" ended military controlled leadership. More liberal constitution was drafted in 1997.	Thai Rak Thai party, founded by Thaksin Shinawatra – Shin Corp's owner, won the 2001 general election by landslide. In 2006, the "pro-democracy" military coup was staged to oust PM Thaksin.
Economic structure	From 1850s-1950s, small rice farmers and crop producers were the foundation of Thailand's Rice Economy. From the late 1970s to the mid 1980s, the government shifted the economic strategy in both service and manufacturing industries towards export promotions.	Multinational firms took advantage of low-cost conditions. Local firms invested in export-oriented industries. A decade of high economic growth peaked in 1988, signifying a major economic restructuring from agriculture to Newly Industrialized Economy (NIE).	From 1991-95, the country maintained per capita GDP growth average at 7%. The 1997-98 economic crisis brought the per capita GDP growth to negative 11.5%.	The 2004 Southeast Asian tsunami disaster- the greatest national disaster in Thai history, causing more than 8,000 deaths – 1/3 were foreigners. It impacted over 4000 villages including well-known tourist destinations. It reduced GDP growth by 0.4%.
GDP per capita growth	3.19%	9.80%	3.76%	4.38%

(table continues)

Table 4.2 *(continued).*

	Phase I: State-building	Phase II: Infrastructure building for economic development	Phase III: Maturity	The Thaksinization of Thailand
Factors	**1971-1980**	**1981-1990**	**1991-2000**	**2001-2006**
Institutions	TOT, established in 1954 to provide telephone service in Bangkok metro area and later to nationwide coverage. CAT, founded in 1977 to operate international and radio communications.	NECTEC, established in 1986 to support and promote the development of electronics and computer technologies as a project in Ministry of Science, Technology, and Energy, est. in 1979	Big Four telecoms – Shin Corp, UCOM, TA, TT&T-Jasmine. INET - the first commercial ISP was established in 1995.	MICT, founded in 2002 to lead the Thai state to a "Knowledge-Based Society." NTC, founded in 2004 as independent state telecoms regulator. SIPA, founded in 2004 to promote software industry.
Individuals & groups	Student-led mass uprisings in 1973 and 1976 signified a downfall of the military rule.	The rise of political parties, technocrats, business enterprises, and state enterprises labor unions.	White-collar middle class rose against the military in 1992. "Information champions" made the Internet available to research community in 1992.	Thai Rak Thai political party founded in 1998 by Thaksin Shinawatra and won a landslide general election in 2001.
Policies	Monopolized domestic and international telecommunications industry by the TOT & CAT.	Telecommunications industry reform started in the late 1980s.	ICT infrastructure growth was achieved BTO concessions granted to telecom companies. In 1996, NECTEC/NITC drafted the first national IT policy (IT2000).	MICT to implement strategies and plans according to national IT policy (IT2010). Political censorship.

(table continues)

Table 4.2 *(continued).*

	Phase I: State-building	Phase II: Infrastructure building for economic development	Phase III: Maturity	The Thaksinization of Thailand
Effects/ICT Diffusion	**1980**	**1990**	**2000**	**2006**
Workforce				
Information	6%	8%	13%	15%
Agriculture	71%	64%	49%	38%
Service	11%	12%	18%	17%
Industry	13%	16%	20%	30%
ICT Penetration Rate				
Fixed line	0.8%	2.4%	9.2%	11.1%
Mobile cellular	0%	1.1%	5%	64.1%
Internet	0%	0%	3.8%	18%
Broadband	0%	0%	0%	0.8%
Personal Computer	0%	0.4%	2.8%	8.2%

Phase III represents a “maturity” period characterized by the decline in importance of the political variable, and an increase in relevance of economic factors in determining diffusion of ICT. In this phase, the private sector becomes the main consumer of ICT systems and tends to develop a conflicting relationship with the regulatory structures of the state.

Parallel with this trend, technological developments that occurred in past years have led to a decrease in the price of equipment. The decrease in the price of information production devices limits the government’s capability to enforce the control of diffusion of ICT. The private sector demand becomes the main driver of ICT expansion.

Thailand’s ICT growth has been greatly affected by two factors.

- The telecommunications policy shift by TOT and CAT in the early 1990s towards awarding telecom concessions to private owned companies to undertake network development under Build- Transfer-Operate (BTO) agreements.
- The effects of the financial crisis of the late 1990s.

As a result of industrialized process, from 1990 to 2000, the employment in information (13%), service (18%), and industry (20%) sectors have increased 13%, 18%, and 20%, respectively. Meanwhile, the employment in agriculture sector (49%) has decreased dramatically at 15%.

The expansion of the country’s industrialized economy in the early 1990s was cut short by the 1997-98 financial crisis. From 1997 to 1999 when the financial crisis was in full swing, there were over 300,000 jobs added to the information sector and close to 400,000 jobs added to the service sector. At the same time, the agriculture and industry sectors lost approximately 1.1 million and 600,000 jobs, respectively.

Tsunami Disaster Response Analysis

This section analyses the impact of the December 2004 tsunami and the role of the Thai information society in emergency response and disaster relief. The interviews, conducted during October 2006 and December 2007, revealed that mass fatality management and dissemination of disaster relief information were the two main areas that the Thai information society responded to. At the end of the section, a mutual shaping of perspectives of technology and society in the construction of technological artifact in response to the tsunami disaster is illustrated. The innovations of the Thai information champions are introduced for future research.

All interviewees in this thesis have long established career in ICT industry and personal network of high-level ICT professionals and government policy-makers. The interviews reflect the perceptions of the interviewees to the questions asked. Appendix G. outlines the interview questions.

Mass Fatality Management

Mass fatality incidents result in a large number of bodies that stretch local communities beyond their resources. On Sunday morning of December 26, 2004, the tsunami casualties were believed to be “a major disaster of biblical proportion.”

On the days following the tsunami, the two interviewees – Akarawuth Tamrareang (an Open Source Content Management System (CMS) consultant) and Arawadee Photisaro (a Vice President of ICT solutions at Petroleum Authority of Thailand) traveling independently with their colleagues and arrived in the affected areas of southern Thailand. Neither had any idea about what needed to be done. Nevertheless, they brought equipment such as computer notebooks, digital cameras, network routers and cable with them. Their intentions were to “help out” in whatever way they could.

After the tsunami struck, the Thai Ministry of Public Health (MOPH) activated mass casualty plans and deployed public health practitioners and medical supplies in responding to health-care needs such as identification of the dead, injured, and missing. A central command center in Bangkok and command centers in each of six impacted provinces namely Krabi, Phang-nga, Phuket, Ranong, Satun, and Trang were established to coordinate activities.

Almost eighty % of the casualties occurred in Phang-nga province where our interviewees – Akarawuth and Arawadee – volunteered. The Department of Disaster Prevention and Mitigation (DDPM) – the Thai counterpart of the US Federal Emergency Management Agency (FEMA) declared casualties of nationalities as follows: Thai (1,939), foreign (1,953) and undetermined (1,503).

Disaster Victim Identification (DVI) teams totaling at least 600 persons from Thailand and approximately 30 other countries, converted Buddhist temples and other buildings into temporary morgues and operation sites. Refrigerated containers were procured to store and preserve bodies which were initially cooled with dry ice. Bodies were stored in these containers until identified and released. The technical and logistical challenge of recovering and identifying victims after the tsunami were extraordinary. The hot climate increased the rate of body decomposition, making quick recovery and storage even more critical.

According to the interviewees, odors from the decomposition extended beyond the temporary morgue to the DVI data collection area. Data operators needed to wear surgical masks and sometimes gloves while performing data entry operation. Examinations of the bodies were performed on the ground of the temple pavilion while the data entry functions were performed on the floor of the monastery.

There were four forensic teams working independently under their institutions namely (1) Siriraj Hospital, (2) Khon Kaen Hospital, (3) Chiangmai University, and (4) the Central Institute of Forensic Science (CIFS). Each team used different forensic protocols including various numbering systems and methods for obtaining DNA specimens. At one time, there were over 15 volunteers performing data collection. The data entry operators assisted the forensic teams in taking digital photographs and recording external examinations and all personnel effects. One investigator was accompanied by three operators to assist in body handling and photographing.

The autopsy and evidence data was taken directly from handwritten autopsy forms and entered into Excel spreadsheets. The autopsy data was accompanied by photographs taken at the time of autopsy. The forms from each institution were assigned an English prefix for easy search purposes. For example, a form prepared by a forensic team from Siriraj Hospital was given an SA prefix. Other autopsy and evidence written in Thai was entered in Thai language. A missing person database was designed and created on the fly as there were inquiries on missing persons coming from those who were looking for their relatives and friends. According to the Director of the Central Institute of Forensic Science (CIFS), as long as bodies were not identified, those persons remain missing.

Appendix H shows photographs provided by Akarawuth of temporary morgue and data center operation scenes a few days after the tsunami. Wat Bang Muang is a Buddhist monastery located in Phang-gna province where the majority of the casualties occurred. There were a team of volunteers from the ICT unit of Petroleum Authority of Thailand (PTT) and many other volunteers who were not forensic experts. The PTT ICT team worked closely with the forensic team from the CIFS in the DVI data collection. According to Arawadee, a number of her PTT colleagues confessed of their emotional fear and nightmare upon returning home.

In Thailand, a disaster warning infrastructure was nonexistent when the undersea earthquake erupted in the Indian Ocean on December 24, 2004. The resulting tsunami was identified as one of the largest tsunamis during the past 100 years. Arawadee identified that "Unlike other natural disaster-prone nations, Thailand is not an earthquake-prone nation and has no experience of (sic) tsunamis. Subsequently, there are (sic) no budget and personnel allocated for national tsunami disaster warning systems." Akarawuth recognized the absence of a designated authority or organization to coordinate the forensic teams and standardize a data collection form.

Remarkably, both interviewees agreed that the health risk from body handling was considered minor to the data collection teams and that unfortunately, there were misuse of DVI data and photographs for personal gain.

In February 2005, the Central Institute of Forensic Science (CIFS) delivered all the data and artifacts collected during December 2004 to February 2005 to the Royal Thai Police The letter of submission, provided by Khun Arawadee Photisaro, is shown in Figure 4.9.

To Whom It May Concern:

From 26 Dec 2004 to 3 Feb 2005, the Central Institute of Forensic Science (CIFS) led by Dr. Porntip Rojanasunan prepared autopsy and evidence data from the Tsunami Disaster in Phang-nga Province Area. CIFS hopes that this data can help support all foreign DVI teams and avoid their having to repeat much of this work.

Most of this postmortem data was collected by many sources and various doctor teams such as:

Siriraj Hospital Team
Khon Kaen Hospital Team
Chiang Mai University Team
And Many Others

This Autopsy and Evidence Data was directly taken from the handwritten forensic autopsy forms and entered into Excel in spreadsheet format. All of this data was also accompanied by photographs which were taken at the same time as the autopsy was performed by each hospital team.

Furthermore, on 3 Feb 2005, CIFS had also gathered and delivered the semi-cleansed artifact data. All of this evidence gathered during the autopsy which included such artifacts as watches, necklaces, wallets, passports etc. were delivered to the Royal Thai Police through their representatives from Phang-nga province.

Here is a list of all the data and artifacts delivered to the Royal Thai Police on that date:

1.	Evidence Data printed on Paper by Autopsy Number	6 Folders
2.	Autopsy Data copied from documents prepared By various Hospital teams	21 Folders
3.	CD of the Data (same as item 2) in Excel File	1 Set
4.	CDs of Autopsy pictures related to the data in item 2	18 Sets
5.	All evidence artifacts related to item 1	
6.	Autopsy Location data last updated on 2 Feb 2005	1 Folder
7.	CD of Autopsy Location (same as item 6) in Excel file	1 Set

(figure continues)

(continued)

At an official meeting chaired by the Minister of Justice and attended by the Royal Thai Police, the Governor of Phang-nga Province and CIFS it was agreed upon that CIFS will prepare an initial current and updated and cleansed data (which was still being checked and processed) on 3 Feb 2005. (This was called the First Delivery.) Consequently, on 18 Feb 2005, CIFS then delivered the most updated and cleansed form of all this data to the Royal Thai Police which are as follows:

1. All missing persons Data recorded at WatYanYao and Wat Bang Muang — 10 Folders
2. External drive containing — 1 Set
    a. Missing persons data — 3,040 records
    b. Autopsy data — 4,459 records
    c. Evidence data — 3,821 records
    d. Autopsy pictures — 22 GB
    e. Application program for accessing and matching Autopsy and Evidence data

Now all data delivered to Royal Thai Police since 18 Feb 2005 remains stable and directly aligns with the autopsy code and autopsy locations of 3 Feb 2005, the date that the CIFS team pulled out from Wat YanYao. If any data are found to mismatch the data from CIFS data after that date, it may be due to subsequent changes to the autopsied bodies performed by foreign DVI and RTP teams.

In order to clarify this autopsy data and all other related data that CIFS has prepared during the 26 December 2004 to 18 February 2005 period, CIFS now would like to submit this data to all embassy groups who cooperate with the DVI teams working in Phuket Province now .

Sincerely Yours,

Dr. Khunying Porntip Rojanasunan
Director of the Forensic Science Institute
Ministry of Justice

Figure 4.9. Letter of submission from the Central Institute of Forensic Science to the Royal Thai Police.

Disaster Relief Information Dissemination

The SRS model identifies information champions as "the leading individuals who lead the charge for liberal ICT diffusion in a society … these people might be leaders of NGOs, senior government officials, or private-sector entrepreneurs" (Wilson III, 2004).

The next two interviewees, Trin Tantsetthi and Hugh Thaweesak Koanantakool were deemed information champions in the Thai information society. They both were "key people" and volunteers in the development of the Internet in Thailand (Palasri, Huter, & Wenzel, 1999). Both interviewees have influential roles in private and public ICT sectors.

INET Tsunami Relief Information

On December 24, 2004, Trin Tantsetthi, a CEO of INET – the first ISP in Thailand, received a telephone call about the tsunami from family members who own a resort hotel in southern Thailand. He used mobile phones to communicate to his sister and her husband mainly by sending short text messages (SMS) since voice messages on mobile phones were congested due to increased usage during crises. As the international mass media including BBC and CNN began feeding tsunami news that varied greatly from what was reported by local news and family members, Trin realized that the mass media lacked real time information to broadcast a dramatic event such as the tsunami.

Similar to hundreds of one-person run message boards, blogs, and chat rooms, the 2004 Thailand Tsunami Relief Information website was set up singlehandedly by Trin. One day after the tsunami, he said "it started out as a real-time news bulletin. But as more information were (sic) coming in, the site had turned into an information portal for tsunami relief, mitigation, statistics and victim database in Thailand."

In Thailand, government and official documents are recorded primarily in Thai while English documents are occasionally prepared as secondary sources. According to Trin, the record of names and locations of tsunami survivors and victims were a mix of Thai and English languages depending on data source. One of Trin's achievements was a website that English speaking natives could use. The searchable database contained over 168,000 records from 18 information sources. One could enter an English name in the search engine which returned a match or matches depending on the number of information sources.

The results of a search conducted in February 2009 using "Universal Search Engine for Identified Tsunami Victims in Thailand" (see Appendix M), on a surname "Guillet" - a French family are shown in Appendix M. In the "Guillet" family, the father and the son survived while the mother and the daughter perished. The search returns twenty two duplicated data sources of which six are distinct as listed in the followings;

(1) Source: mspsknown : NECTEC's Missing Persons website

(2) Source: krabihosp : Ministry of Public Health website

(3) Source: phuketitcity : the link returns "The page cannot be displayed"

(4) Source: thaitsunami : the link returns "The page cannot be displayed"

(5) Source: csiphuket : the link returns "The page cannot be displayed"

(6) Source: ems : the link returns "The page cannot be displayed"

Out of the above six sources, only two sources yielded valid links and references. One being (1) Source: mspsknown linking to a dynamic page from NECTEC's missingpersons.or.th database. The other being (2) Source: krabihosp returning an Excel file retrieved from Ministry

of Public Health website. This file contains names and status of all reported tsunami victims and survivors. The search for “Guillet” in the file shows all the family members and their applicable conditions. The search engine interface and result pages are shown in Appendix M.

NECTEC Registration for Missing Persons from Tsunami in Thailand

Twenty four hours after the tsunami, Hugh Thaweesak Koanantakool, the Director of National Electronics and Computer Technology Center (NECTEC) held an emergency meeting among his staff members to plan what could be done in their capacity as a specialized ICT research agency to provide tsunami disaster relief. From his contact persons in the southern provinces, it was clear that people were seeking information on missing persons – they were trying to find out if their family members and friends were missing or were the victims of the disaster. As a result, the “Missing Persons” website was put together to allow a registration of tsunami survivors.

From the website’s Disclaimer: “The information on missing persons is collected from several sources, and agencies for the purpose of efficient communication back to you when the authorities identify the person/body with the registry. For official records or confirmation, please contact the related agency that is responsible for the work of handling people, victims and bodies. NECTEC is responsible for the registration system of missing persons.”

The first attempt at data collection was from tsunami survivors of foreign nationalities who were flown to Bangkok’s Don Mueng international airport and transferred to a campus of Thammasart University for temporary accommodation before taking off for their home countries. The university was chosen as a temporary shelter for its proximity to the airport and its dormitory and Internet facilities. These survivors were asked to register in the “I Am Alive”

database. Those who registered in the “I Am Alive” database had their names removed from “Missing Persons” website.

The website featured both Thai and English languages. The number of registered missing persons was 4,636 from 62 countries. Out of the registered 4,636 cases, 346 were resolved (NECTEC, 2005) . Two comprehensive areas of the site that offer exceptional information are the Missing List and photographs in Missing Persons Gallery.

The Missing List area is searchable by first name, last name, or nationality. The search for Finland nationality returns 36 names with detailed information such as gender, age, photograph, location found and status of a missing person. Appendix N shows a Missing List page with a photo of a four-year old boy named Panu Aho of Finnish nationality and a status of deceased. There is a link to a memorial website –TSUNAMICHILDREN 26-12-2004 MEMORIAL.

The Missing Persons Gallery area shows 1,031 photographs in 115 pages. Each page displays 9 photo images captioned by name. Each name is clickable to a Missing List page. The Missing Persons Gallery is not searchable.

The Mutual Shaping of Technology and Society in a Tsunami Relief Website

The 2004 tsunami was considered the first global internet-mediated natural disaster. In Thailand, there was no precedent how a major disaster of "biblical proportion" should be responded to. The broadcasting mass media lacked the ability to broadcast real-time information about this dramatic event while a sudden increase in real-time information need from people around the world made this failing all too obvious. The main type of media used immediately after the tsunami disaster were mobile phones and amateur-run Web discussion groups or "web boards."

According to Trin Tantsetthi, the creator of INET Tsunami Relief Information, discussions, news, including names of foreign nationalities' missing persons and victims were posted on the local web boards in the Thai language. In a desperate attempt to find the names of family and friends who had taken vacation on the southern Thai beaches, foreign nationals including Finnish, Swedish, French, and Dutch who do not read and write Thai, posted their inquiries and contact e-mails in English on the web boards.

There was an obvious language gap between English speaking information seekers and the available information sources which were in the Thai language. This gap prompted Trin to put together an English language web-based "tsunami relief information" site which ultimately developed into an information gateway to tsunami relief and mitigation information and searchable victim database.

At that time, there were at least 18 websites from public agencies such as Ministry of Public Health, Ministry of ICT and Phuket City that contained information on missing persons and victims from the tsunami disaster. These websites maintained data in different formats or

databases such as Excel, PHP, or MySQL. When extracted to a single repository, these websites combined over 168,000 duplicated records.

A need to find a solution to eliminate duplication of data arose. Due to time constraints, Trin decided to contact QL2 – an American based data mining technology company – for a pro bono use of the software for a limited time. QL2 software allowed real-time interface of data extraction from the 18 websites to INET Tsunami Relief's data repository as well as the automation of the systematic removal of duplicate records.

Figure 4.10 illustrates the application of the mutual shaping perspective described above. The process began with the constraints on non-Thai information seekers trying to find names of tsunami survivors. This, in turn, limited the usability and validity of the information to tsunami-affected multinational information seekers.

The first few postings from foreign nationals to the Thai web boards inspired Trin to look for information and respond with names and conditions of the persons they were looking for. Driven by the desire to "help others" in need of critical information, Trin created an English language website conveniently hosted by INET. Trin's INET Tsunami Relief Information was one of many .gov and .org, and .com websites broadcasting tsunami related information.

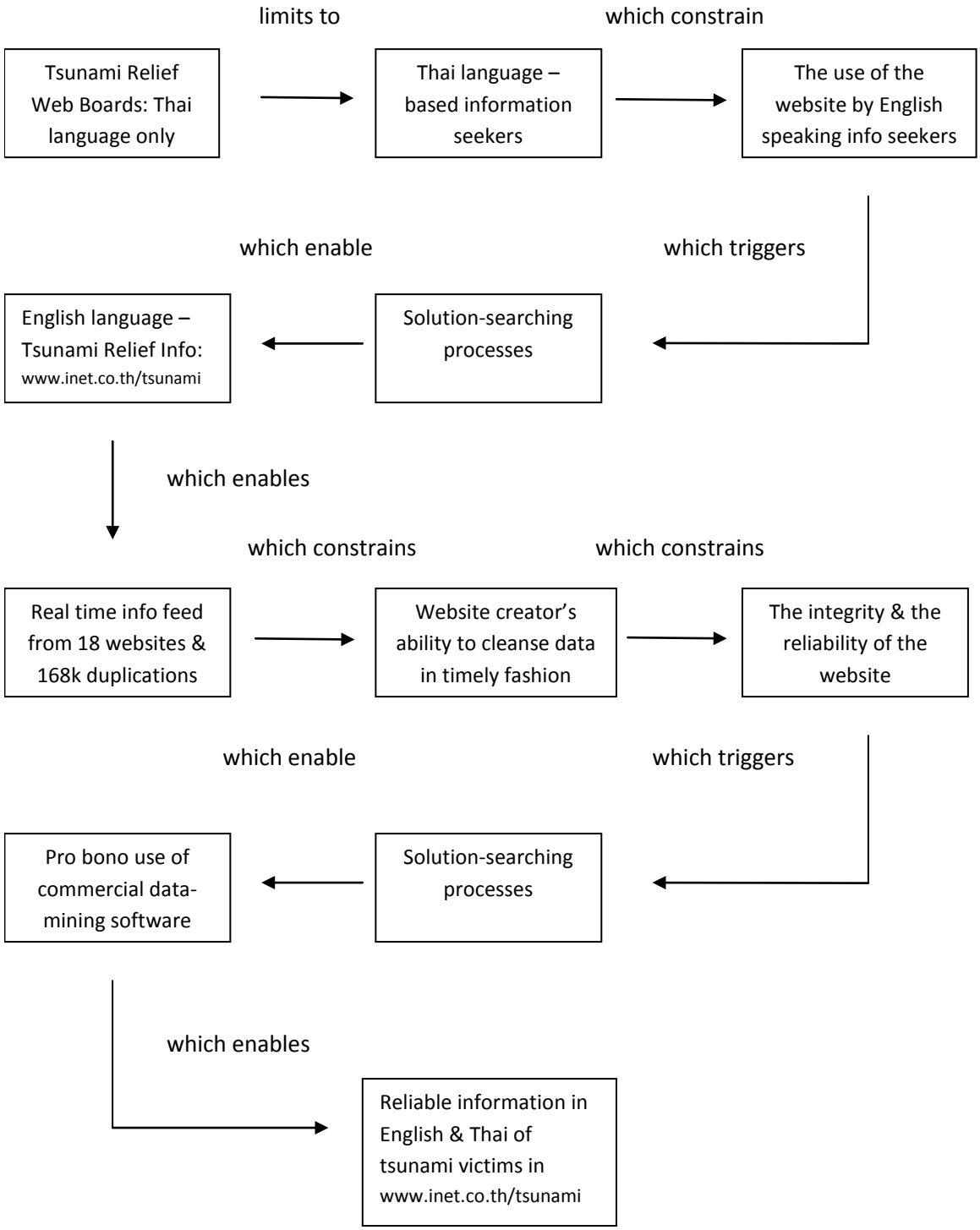


Figure 4.10. Graphical representation of mutual shaping processes leading to INET Tsunami Relief Information.

Trin's INET Tsunami Relief Information website allows data extraction from web pages or online documents and transfers them to other web sites. When considering how to extract and organize information from other websites to create a reliable source of information, Trin was faced with the choice of developing the tools himself or using commercial tools. In-house development was out of question with the time constraint. The cost of purchasing data mining software was prohibitive for a one-person operation. Nevertheless, he was able to convince QL2 of the altruistic nature of his work and was granted a pro bono use of the software for a limited time.

Trin's lessons learned from handing the 2004 Thailand Tsunami Relief Information are the basis of his founding of OpenCARE (Tantsetthi, 2006) – a scalable infrastructure to be implemented using open source software (OSS), to facilitate multi-agency handling of emergency situations and to support multiple languages.

The Thai Information Champions' Innovation

In retrospect, the tsunami in southern Thailand raised awareness in the country for how to effectively use to provide humanitarian aid and disaster relief. Specifically, people recognize that during a disaster there is an increased need to communicate to the public and emergency response teams and to report losses and coordinate rescue missions in a timely, effective, and reliable fashion. The following section describes ICT innovations after the tsunami. from our two information champions – Trin Tantsetthi's OpenCARE and Hugh Thaweesak Koanantakool's EECV.

Open Exchange for Collaborative Activities in Response to Emergencies (OpenCARE)

OpenCARE is an information middleware product that enables incompatible systems to work together. It supports multiple input and output alert systems and incident reports as well as

multiple languages. Essentially, OpenCARE nodes are placed on the Internet. Each node talks to other nodes to exchange information. At the same time, OpenCARE also talks to proprietary relief or emergency systems to make sure that the latest information can be shared among relief agencies. With OpenCARE acting as middleware, information on disparate proprietary systems can reach a wider audience. Conversion is done before entering or leaving OpenCARE allowing each interfacing system to speak in its native information format. OpenCARE is currently in the design phase and will be an open-source implementation (Tantsetthi, 2006).

Emergency and Educational Communication Vehicle (EECV)

One of the initiatives that the National Electronics and Computer Technology Center (NECTEC) in collaboration with the Disaster Prevention and Mitigation Department (DDPM) of the Interior Ministry and the Asian Disaster Preparedness Center (ADPC) and Cisco systems was an Emergency and Educational Communication Vehicle (EECV). EECV is an automobile with an installation of a large capacity ad hoc communication system for voice and data including telephone and broadband Internet access services for emergency response teams. It can be quickly deployed and is highly mobile (Koanantakool, 2006).

Appendix O exhibits the EECV photos provided by Hugh Thaweesak Koanantakool (personal communication, Oct. 8, 2009). The vehicle was first deployed in central Thailand's flooded provinces during August to October 2006.

Hypotheses

The hypotheses are based on the assumption that the perceptions of Thai and foreign community of tsunami disaster volunteers, survivors, as well as IT professionals reflects the effectiveness of the Thai government on tsunami disaster response tasks. The Ministry of Information and Communication Technology (MICT), established in 2002, was appointed by the Secretariat of Cabinet to undertake tsunami disaster relief related tasks. In addition, the MICT's main mission is to implement ICT strategies and plans to lead the Thai nation to a "Knowledge-Based Society."

This thesis hypothesizes that the establishment of the highest level ICT governing body such as the MICT compared to other less authoritative ICT agencies can increase the effectiveness of information society development. The analysis examines the role of the Thai information society in response to the 2004 tsunami disaster. In determining the effectiveness of ICT institutions in the development of Thai information society, the study examines the responsiveness of these institutions to the tsunami disaster relief. This dissertation proposes the following hypotheses:

1. The highest level ICT governing body, such as MICT, is perceived to be significantly more effective than other specialized ICT semi-government and for-profit agencies in disseminating information in response to the tsunami disaster.
2. The highest level ICT governing body such as MICT is perceived to be significantly more effective than other specialized ICT semi-government and for-profit agencies in providing ICT infrastructure in response to future disasters.

3. ICT government agencies are perceived to be significantly more effective than other specialized ICT semi-government and for-profit agencies in the development of information society in Thailand from 1991 to 2008.

Survey Data Analysis

Respondents

From February 2008 to June 2008, a total of 80 individuals were contacted via e-mail. Twenty-two (28%) individuals were non-respondents. Nine individuals (11%) filled in largely incomplete questionnaires – with only one or two questions completed. A total of 49 individuals (61%) completed a battery of scales and questionnaires. However, only 40 individuals (50%) provided personal information.

Seventy-three percent of the final respondents were men and 45% aged between 40 to 49 years old. Forty percent had received a master's degree, 33% a doctoral degree, 20% a bachelor's degree, and 8% an associate's degree. Forty-three percent had been in their professions over 10 years and 38% over 20 years. Forty-five percent worked in for-profit organizations, 35% in government and 20% in education organizations. Thirty-five of the respondents were on the disaster site and had participated in some form of rescue work and relief efforts.

Table 4.3 shows an overall view of the respondent's general characteristics by type of work place and gender, and lists them by age group, education degree, and years of work experience.

Table 4.3
General Characteristics of Survey Respondents

Organization	**Education**		**For-Profit**		**Government**		**Percent**	
Gender	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Age group								
20-29	1	0	0	3	1	0	5	8
30-39	1	1	1	3	0	2	5	15
40-49	1	3	1	5	4	4	15	30
50-59	0	1	0	2	1	2	3	13
Over 60	0	0	0	3	0	0	0	8
Total	3	5	2	16	6	8	28	73
Education degree								
Associate's	0	0	0	3	0	0	0	8
Bachelor's	1	0	0	6	0	1	3	18
Master's	1	2	2	6	3	2	15	25
PhD	1	3	0	1	3	5	10	23
Total	3	5	2	16	6	8	28	73
Years of work experience								
1-3	0	0	0	3	0	0	0	8
4-6	1	0	0	1	1	0	5	3
7-9	1	0	0	1	0	0	3	3
10-20	1	3	2	3	2	6	13	30
Over 20	0	2	0	8	3	2	8	30
Total	3	5	2	16	6	8	28	73

Agencies

The hypothesis equates “agencies” to institutions in the following three domains:

1. Highest level of ICT governing body
    - MICT – Ministry of ICT
        - www.thaitsunami.com (domain no longer active)
    - GCC – Government Contact Center

        - www.gcc.go.th
    - SIPA – Software Industry Promotion Agency
    - SmartCard – National ID Smart Card
2. Specialized ICT semi-government agencies
    - NECTEC – National Electronics and Computer Technology Center
        - www.missingpersons.or.th
    - DDPM – Department of Disaster Prevention and Mitigation
        - 203.170.239.222/tsunami/
    - NSTDA – National Science and Technology Development Agency
    - NTC – National Telecommunications Commission
3. For-profit agencies
    - INET – Internet Thailand Public Company Limited
        - www.inet.co.th/tsunami
    - TTVI – Thailand Tsunami Victim Identification Information Management Center
        - www.csiphuket.com
    - Sanook – Sanook dot com
    - G2K – Gotoknow social network

The agencies were measured on the following three tasks;

1. tsunami disaster relief
2. future disaster relief
3. information society development

Rating of the success was on a scale of 1-7, with 1 representing complete disagreement with the critical role of an agency and 7 representing complete agreement. The results of success ratings of each agency in each task are shown in Table 4.4. The highest scoring agencies are listed on top.

Table 4.4
Success Ratings of ICT Agencies

Measure & Variable	**Agency Name**	**Mean**
Tsunami Disaster Relief		(N = 49)
NECTEC	National Electronics and Computer Technology Center	4.82
DDPM	Department of Disaster Prevention and Mitigation	4.73
TTVI	Thailand Tsunami Victim Identification Information	4.61
INET	Internet Thailand Public Company Limited	4.53
GCC	Government Contact Center	4.12
MICT	Ministry of Information and Communication Technology	4.00
Future Disaster Relief		(N = 44)
INET -OpenCARE	Internet Thailand Public Company Limited	4.91
NECTEC -EECV	National Electronics and Computer Technology Center	4.77
MICT-NDWC	Ministry of Information and Communication Technology	4.64
Information Society Development		(N = 42)
NECTEC	National Electronics and Computer Technology Center	5.48
NSTDA	National Science and Technology Development Agency	4.98
INET	Internet Thailand Public Company Limited	4.79
Sanook	Sanook Dot com	4.55
G2K	Gotoknow Social Network	4.50
MICT	Ministry of Information and Communication Technology	4.31
NTC	National Telecommunications Commission	4.12
SIPA	Software Industry Promotion Agency	4.10
SmartCard	National ID Smart Card	3.64

To verify which specific group of agencies has stronger effects on the success of each task, the Duncan's Multiple Range Test method was used. The results of the grouping are in line with the agencies' means shown in Table 4.4 and are used in the construction of independent variables in the regression analysis.

Analysis of Variance

Two-way ANOVAS were computed on two independent variables:

- "agency" – the agencies being measured in the tasks of tsunami disaster relief, future disaster relief, and information society development
- "respondent" – the respondent perceptions towards the responsiveness of the agencies in each task.

The analysis of variance is used to determine if both independent variables – agency and respondent – have a significant effect on the dependent variable – agency success or effectiveness.

The ANOVA figures shown in Table 4.5 indicate that there were significant differences at 0.01 level in the perceptions of respondents in all three tasks being measured namely Tsunami Disaster Relief: $F(44, 244) = 2.38$, Future Disaster Relief: $F(39, 90) = 2.85$, and Information Society Development: $F(37, 332) = 5.91$. The effect of respondents' perceptions seems to be stronger (F-value of 5.91) in Information Society Development than the other two tasks.

On the agency variable, there were significant differences in the effects of agencies in Information Society Development: $F(8,332) = 7.70$, $p < .01$ and Tsunami Disaster Relief: $F(5, 244) = 2.52$, $p < .05$. There were no significant differences in the effects of agencies in Future Disaster Relief.

Table 4.5
ANOVA of Variables: Respondent and Agency

Measure & Variable	*df*	*F*
Tsunami Disaster Relief		
Respondent	44	2.38**
Agency	5	2.52*
Error	244	
Future Disaster Relief		
Respondent	39	2.85**
Agency	2	0.33
Error	90	
Information Society Development		
Respondent	37	5.91**
Agency	8	7.70**
Error	332	

Note: * $p < .05$ ** $p < .01$

Tsunami Disaster Relief

The tsunami on December 26, 2004 was the first natural disaster mediated over the Internet in terms of global collaboration and response to the disaster. One of the relief efforts was providing information. The first section of the survey asked respondents how crucial the agencies were in disseminating up-to-date news, names and photos of tsunami survivors and missing persons.

Appendix K shows a decree issued on January 4, 2005 by the Secretariat of Cabinet appointing MICT (Ministry of Information and Communication Technology) to undertake the following tsunami related relief tasks:

1. Provide ICT infrastructure.
2. Receive donations.
3. Create and maintain official tsunami website: www.thaitsunami.com.
4. Transfer tasks from a Call Center at Thammasart University.
5. Have property damage and community need surveyed by National Statistics Office – an agency under MICT.
6. Set up a standardized disaster victims' data collection form.
7. Create "Password" for foreign embassies and provincial governors to access "GCC 1111" – a Government Contact Center website to access photos and names of tsunami victims.
8. Collect disaster relief related information from other public agencies and publish the information on www.thaitsunami.com.
9. Be a "Contact Point" in collecting tsunami related information from government agencies.
10. Be a coordinator and data center in tsunami related information

Table 4.4 shows the success ratings of agencies in Tsunami Disaster Relief task ascending from 4.0 to 4.82 with government ICT institutions such as MICT (4.0) and GCC (4.12) at the lower end of the scale. Specialized ICT agencies including NECTEC (4.82) and DDPM (4.73) received a highest rating respectively. Two private-sector institutions – TTVI (4.61) and INET (4.53) received relatively higher rating than MICT and GCC.

At the time of the survey, roughly three years after the 2004 tsunami, all tsunami disaster relief websites hosted by NECTEC, DDPM, TTVI, INET and GCC are accessible. Only MICT's thaitsunami.com website is no longer active.

The results from "Duncan's Multiple Range Test" reveal that respondents perceived the efforts of specialized ICT semi-government and for-profit agencies – NECTEC, DDPM, TTVI, and INET to be stronger than ICT governing body – MICT and GCC's in the success of providing tsunami disaster relief information.

Future Disaster Relief

Timely information can be a vital form of aid and a life-saving resource. The second section of the survey asked respondents to rate effectiveness of three institutions, namely MICT, NECTEC, and INET, in their initiatives – NDWC, EECV, and OpenCARE – to provide better and timely ICT infrastructure in future disaster events.

Thailand became the first country hit by the December 26, 2004 tsunami to launch a natural disaster early warning system. The National Disaster Warning Center (NDWC) was established in May 2005 to have the ability to detect and warn of an impending tsunami. Meanwhile, Emergency and Educational Communication Vehicle (EECV) – an initiative by NECTEC – launched in May 2006 was deployed in central Thailand's flooded provinces during August to October 2006. Finally, OpenCARE – an Open Exchange for Collaborative Activities in Response to Emergencies, an information middleware of open source platform – is conducing a pilot study.

From the success rating scores shown in Table 4.4, survey respondents perceived OpenCARE (4.91), EECV (4.77) and NDWC (4.64) respectively as crucial in providing future disaster relief.

The results from Duncan's Multiple Range Test do not reveal stronger effects among these three agencies in providing future disaster relief. This is in line with the results of ANOVA

shown in Table 4.5 that there were no significant differences in the effects of agencies in Future Disaster Relief.

Information Society Development

The third section asked respondents to rate the roles of agencies as crucial in the development of information society in Thailand from 1991 to 2008. Information society is defined as a socioeconomic structure that demonstrates high employment of information-related occupations and widespread use of ICT.

The Duncan's Multiple Range Test method was used to verify which specific group of agencies has stronger effects on the effectiveness of the development of the Thai information society. The results revealed three groups:

- Specialized ICT semi-government agencies: NECTEC and NSTDA
- For-profit agencies: INET, Sanook, G2K and MICT
- ICT governing body: NTC, SIPA and SmartCard

As show in Table 4.4, the respondents gave a highest rating to NECTEC (5.48) and NSTDA (4.98) – two specialized agencies established in December 1991. The National Electronics and Computer Technology Center (NECTEC) – an agency under the National Science and Technology Development Agency (NSTDA) drafted the first National IT policy "IT 2000" in 1996. Subsequent National IT policy "IT 2010" had also been drafted by NECTEC in 2002. IT 2010 had become a framework for the first ICT Master Plan (2002-2006) and a subsequent second ICT Master Plan (2009-2012) which was drafted in 2008.

The second highest scoring groups were INET (4.79), Sanook (4.55), G2K (4.50), and MICT (4.31). Internet Thailand Public Company Limited (INET) was the first Internet service provider in Thailand and has been in operation since 1995. Sanook.com is a Thai language

content provider. It was the most visited website in Thailand from 2005 to 2006 (Koanantakool, 2007b). The “Gateway of Thailand's Online Knowledge Management” (G2K), created in 2001, is aimed as a “community of practice” for Thai bloggers.

The lowest scoring group consisted of NTC (4.12), SIPA (4.10), and SmartCard (3.64). The National Telecommunications Commission (NTC), established since 2004, is an independent state telecommunications regulator. Its duties and responsibilities are to regulate all telecommunication services in the country through formulating a master plan on Telecommunications activities. The Software Industry Promotion Agency (SIPA), established in 2003 under MITC, is responsible for the promotion of Thailand’s software industry. National ID Smart Card was conceived as a multi-purpose identity card project by MICT in 2003.

Tsunami Disaster Effects

Thirty-five of the survey respondents were at the disaster site and had participated in some form of rescue work and relief efforts such as DVI data collection. Those that were not on site had provided other relief aids such as on-line assistance in disseminating disaster victim information and donations. The second set of questions asked respondents how these efforts affected their personal life.

The tsunami disaster effects on personal life were classified into three areas:

- Financial, in terms of income, job security, and wealth.
- Social life, in terms of family members, friends, and social interaction.
- Physical and emotional, in terms of emotional, physical, and future well-being.

Rating was on a scale of 1-7, with 1 representing complete disagreement with the disaster relief effects on the queried area and 7 representing complete agreement.

The mean values of these ratings as well as their factor loadings are shown in Table 4.6. The respondents seemed to be least affected on items like wealth (2.44), job security (2.50), income (2.56) and physical (2.92) as these items received the lowest ratings. Respondents seemed to be more affected on items such as emotional (4.89), future interaction with society (3.50), members of family (3.25), and social life with friends (3.22). Nevertheless, on a scale in which 4.0 is neutral, only disaster effect item emotional received scores above 4.0.

Table 4.6
Tsunami Disaster Effect Items and Factors Identified

Factor & Variable	**Mean N = 36**	**Factor Loading**
Job Security Factor		
My wealth was affected	2.44	0.93
My job security was affected	2.50	0.89
My income was affected	2.56	0.89
I was physically affected	2.92	0.75
Variance explained: 3.97%		
Cronbach's Alpha: 0.94		
Society & Family Factor		
I was emotionally affected	4.89	0.87
My future interaction with society was affected	3.50	0.82
Members of my family were affected	3.25	0.67
My social life with friends was affected	3.22	0.85
Variance explained: 2.88%		
Cronbach's Alpha: 0.88		
My future well-being was affected	2.78	0.45

Factor Analysis

This research used the Principal Components and Varimax Rotation methods, commonly used in factor analysis, to identify representative factors for all disaster effect items. On the basis of Eigenvalues larger than 1.0, two factors were extracted (see Table 4.6).

Results show that factor loadings of all component items were above the minimum threshold of 0.50. Table 4.6 shows the two factors – Job Security and Society and Family – each with four associated variables. The variables physical and emotional in the original physical and emotional area, were associated with factors Job Security, and Society and Family, respectively. The future well-being item with factor loading of 0.45 and Eigenvalues less than 1.0, was not loaded onto either factor.

The variance explained due to Job Security, and Society and Family factors were 3.97% and 2.88%. The Cronbach's Alphas for the two factors were 0.94 and 0.88 respectively, suggesting that the disaster effect items in each factor were correlated and that internal consistency and reliability of these variables were high.

Regression Analysis Model

Regression analysis was performed to investigate how respondents' characteristics, as well as the two identified disaster-effect factors, would affect the perceived success ratings of agencies in tsunami disaster relief, future disaster relief, and information society development tasks. The results from Duncan's Multiple Range Test were used to group agencies whose means are not significantly different into specific groups. In this way, the dependent variables in the perceived success ratings of agencies in the identified tasks are:

1. Tsunami Disaster Relief
    a. NECTEC + DDPM + TTVI + INET (Model I)

b. MICT + GCC (Model II)

2. Future Disaster Relief
    a. INET + NECTEC + MICT (Model III)
3. Information Society Development
    a. NSTDA + NECTEC (Model IV)
    b. INET + Sanook + G2K + MICT (Model V)
    c. NTC + SIPA + SmartCard (Model VI)

Whereas the independent variables are:

1. Respondents' characteristics
    a. Organization (work place category)
    b. Age
    c. Education
    d. Work experience
    e. Gender
2. The factor score of disaster effects in
    a. Job security
    b. Society and family
3. Future well being score

Results of regression analysis are shown in 6 models – with I, II for tsunami disaster relief, III for future disaster relief, and IV, V, VI for information society development (see Table 4.7).

By ranking according to its level of importance (i.e. beta coefficients), organization showed the highest coefficients in all models. Both government and education were coded as

dummy variables and were compared to for-profit organizations. The coefficients of government and education organizations were highly significant in models I, II, IV, V and VI.

In other words, with the exception of model III, the respondents' organizations were significant. This suggests that the types of respondents' employment institutions in government, education, or for-profit have significantly different effects on their perceptions of agencies success ratings. Specifically, it implies that institutions have impact on the perceptions of the individuals under their employment.

Other respondents' characteristics such as age, academic degree, and experience of respondents (with the exception of gender) seemed to significantly affect their perceptions of agencies success ratings as well.

In all models, the regression analysis showed that job security and society-family factors along with future well-being were significant at levels .01, .05 and .10 (see Table 4.7). The regression coefficients of the two disaster-effect factors in stronger effects (from Duncan's Multiple Range Test) models I, III, and V were consistent with the results shown in Tsunami Disaster Effects section. That is, the perceptions of the respondents seemed to be less affected by the job security factor than by the society-family factor. The negative coefficients in future wellbeing suggested a conversely relationship and indicated that respondents did not feel any negative effects of tsunami disaster in their future well-being.

With the exception of model IV, R-squares in all other models were in the 20% to 41%, which were considered significant. This suggests that the two disaster-effect factors are essential and need to be taken into account in formulating disaster relief policy in order to improve the perceptions of agencies success ratings.

Table 4.7
Regression Analysis: Agency Measures and Predictors

Measure, Model & Variable		Regression Coefficient	*t*
Tsunami Disaster Relief			
I. NECTEC + DDPM + TTVI + INET			
$R^2 = 0.41$	Organization		
	- Government vs. For-Profit	0.81***	4.41
	- Education vs. For-Profit	0.05***	2.85
	Age	0.46***	5.40
	Education	-0.31***	-3.82
	Experience	-0.32***	-4.28
	Gender	-0.17	-1.23
	Disaster Effects Factor		
	- Job Security	0.09*	1.71
	- Society & Family	0.14***	2.93
	Future Well Being	-0.34***	-8.69
II. MICT + GCC			
$R^2 = 0.29$	Organization		
	- Government vs. For-Profit	1.11***	5.07
	- Education vs. For-Profit	-0.18	-0.79
	Age	0.30***	2.91
	Education	-0.13	-1.34
	Experience	-0.14	-1.53
	Gender	0.18	1.07
	Disaster Effects Factor		
	- Job Security	0.14**	2.22
	- Society & Family	-0.04	-0.69
	Future Well Being	0.00	0.07

(table continues)

Table 4.7 *(continued).*

Measure, Model & Variable		Regression Coefficient	*t*
Future Disaster Relief			
III. INET + NECTEC + MICT			
$R^2 = 0.20$	Organization		
	- Government vs. For-Profit	0.69	1.56
	- Education vs. For-Profit	0.63	1.41
	Age	0.36*	1.76
	Education	-0.16	-0.77
	Experience	-0.41**	-2.21
	Gender	-0.37	-1.11
	Disaster Effects Factor		
	- Job Security	0.26**	2.02
	- Society & Family	0.88	0.73
	Future Well Being	-0.23***	-2.48
Information Society Development			
IV. NSTDA + NECTEC			
$R^2 = 0.07$	Organization		
	- Government vs. For-Profit	0.62***	2.79
	- Education vs. For-Profit	0.59***	2.63
	Age	0.13	1.27
	Education	-0.23**	-2.27
	Experience	0.01	0.11
	Gender	-0.14	-0.88
	Disaster Effects		
	- Job Security Factor	-0.16**	-2.43
	- Society & Family Factor	0.17***	2.77
	Future Well Being	-0.11**	-2.44

(table continues)

Table 4.7 *(continued).*

Measure, Model & Variable		Regression Coefficient	*t*
Information Society Development			
V. INET + Sanook + G2K + MICT			
R^2 = 0.31	Organization		
	- Government vs. For-Profit	0.79***	5.43
	- Education vs. For-Profit	1.2***	8.15
	Age	0.17***	2.59
	Education	-0.16**	-2.36
	Experience	-0.25***	-4.31
	Gender	0.26**	2.49
	Disaster Effects Factor		
	- Job Security	0.08*	1.91
	- Society & Family	0.10**	2.48
	Future Well Being	-0.06**	-2.12
VI. NTC + SIPA + SmartCard			
R^2 = 0.22	Organization		
	- Government vs. For-Profit	0.87***	4.53
	- Education vs. For-Profit	0.77***	4.00
	Age	0.11	1.22
	Education	-0.18**	-2.12
	Experience	-0.25***	-3.21
	Gender	0.26*	1.87
	Disaster Effects Factor		
	- Job Security	0.22***	3.78
	- Society & Family	-0.09*	-1.66
	Future Well Being	-0.12**	-3.07

Note: * p < .10 ** p < .05 *** p < .01

CHAPTER V

CONCLUSIONS

Introduction

This final chapter of this dissertation restates the research problems and reviews the major methods used in the study. The major sections of this chapter summarize the results and discuss their implications. This chapter concludes with the discussion of policy implications and recommendations for future research.

Summary and Discussion

The objective of this dissertation is to determine whether the establishment of the highest level ICT governing body such as a Ministry of Information and Communication Technology (MICT) compared to other, less authoritative, ICT agencies can increase the effectiveness of information society development. The dissertation investigates four major issues.

1. The development of the information society in Thailand, from the perspective of information workforce, and information and communication technologies. To accomplish this, this dissertation measures:
    a. Participation of the Thai population in the information workforce.
    b. The level of ICT diffusion in Thailand.
2. Factors influencing information workforce growth and the diffusion of ICT in Thailand, including the explanation of information workforce growth and ICT diffusion in the political economy frameworks of strategic restructuring and structural causality model.
3. The degree to which theories of social shaping of technology (SST) and the diffusion of innovation contribute to understanding the specifics of technological innovation in response to the tsunami disaster, defining the mutual shaping lens of the social shaping of

technology (SST) and the diffusion of innovation that enables the joint processes of technological and social change in the specifics of technological innovation in response to the tsunami disaster.

4. The effectiveness of ICT institutions in responding to the tsunami disaster.

The study reported here was a case study of the development of the information society in Thailand. As a case study, this research built on a political economy theoretical framework and used a qualitative perspective to unfold factors influencing the development of the Thai information society. The case study covered the development of the information society in Thailand from 1971 to 2006 and the role of the Thai information society in response to the Indian Ocean tsunami disaster in December 2004.

The case study relied largely on documentary research, interviews, and survey analysis. The researcher conducted extensive documentary research using secondary sources and statistical data. Five semi-structured interviews with four ICT industry leaders were conducted from October 2006 to December 2007. During February 2008 to June 2008, an Internet-based survey was issued to Thai IT professional message boards, and suggested groups of tsunami disaster volunteers and survivors.

Summary of Findings

First, throughout the analysis of the development of the Thai information society from 1971 to 2006, there is evidence that the Thai information sector is growing.

- In 1971, the Information sector employed 581,000 workers and comprised 3 % of all employment. By 2006, the Information sector rose to 5 million workers and accounted for 15 % of all employment.

- Over the 35-year span, the share of information, service, and industry occupations in Thailand has increased while the agriculture share has steadily decreased.
- During the 1997-98 Asian economic crisis period, when Thailand's GDP per capita growths were at their lowest points (-2.47 and -11.48), there were a substantial number (over 700,000) of jobs added to the information and service sectors.

In addition, there is strong and continued growth in the level of ICT diffusion in Thailand.

- Despite Thailand's impressive and high-growth in penetration rates of mobile cellular and Internet subscribers, fixed telephone lines and broadband subscribers were lower than the ICT penetration rates of countries in the Asia and the Pacific region.
- The number of mobile cellular subscriptions surpassed that of fixed telephone lines in 2001 – the same happened in Africa in 2000 and globally in 2002.
- Thailand's mobile cellular subscriptions continued to grow substantially reaching a total of 79 million and exceeding the number of Thai population by the end of 2007.
- From 1999 to 2007, the country added over 10 million Internet users. The number of Internet users per 100 inhabitants increased from 2.5 to 21 during this period.
- Fixed broadband Internet services were fist launched in Thailand in 2001. By 2007, the country had 913,000 fixed broadband subscribers or 1.4 % which is lower than that of Asia and the Pacific region (3.5 %).
- Mobile broadband was not commercially available by the end of 2007.
- Since 1999, the number of Internet subscribers has surpassed the number of personal computers. This pattern suggests that Internet subscribers access the Internet from outside the home either from a cybercafé or from public locations.

- Since the introduction of broadband local access in 2001, the international Internet bandwidth increased remarkably to 22 Gbps. From 2001 to 2006, the number of bits per person ascended from 16 to 345.

Secondly, the information workforce growth and the diffusion of ICT in Thailand were influenced by both political and economic factors. The weight of these two factors varied differently according to three development phases.

- Phase I: State-building, 1971-1980
    - Political factors weighed greatly as the Thai military were the primary ICT users who kept control over the allocation of ICT resources through the monopoly of domestic and international telecom services.
    - Fixed telephone line penetration was less than 1 %.
    - Six percent of workers were employed in the information workforce.
- Phase II: Infrastructure building for economic development, 1981-1990
    - Economic variables are generally weighted more than the political variables in the ICT diffusion during this phase.
    - Thailand's buildup of ICT infrastructure coincided with the country's period of major political and economic changes.
    - The export-led policy gave ways to investments from multinational corporations which, in turn, created demand for ICT infrastructure.
    - Thailand's politics were still overshadowed by the military and the telecom sector was on the verge of reform. There was evidence that telecom privatization during this period was a major cause of political corruption and gave rise to political parties

- Thailand's adoption of ICT during this phase was not only based on economic profitability, but also influenced by political desirability.
- Fixed telephone line and mobile cellular penetrations were 2.4 % and 1.1 %.
- Eight percent of workers were employed in the information workforce.

- Phase III: Maturity, 1991-2000
  - The private sector was the main consumer of ICT systems.
  - Thailand's ICT growth was affected by two factors.
    - The telecommunications policy shift by TOT and CAT in the early 1990s towards awarding telecom concessions to private owned companies under Build- Transfer-Operate (BTO) agreements. The reform enabled the supply of the ICT systems to keep pace with the economic demand from the private sector.
    - The 1997-98 financial crisis slowed down the growth in network development and mobile subscribers.

Thirdly, the Thai information society responded to the tsunami disaster as follows:

- Mass fatality management
  - Volunteers from the information sector were crucial in collecting DVI data.
  - There were no systems and protocols for managing information about the dead and missing. There was no designated authority to oversee the management of this information.
  - There were misuses of information including using photographs of the dead and missing for personal gain.
  - Health and emotional risks to volunteers were largely ignored.

- Dissemination of disaster relief information
    - The type of media that was most successful in providing real-time information about the disaster was not the mainstream news media, but mobile phones and amateur-run web boards.
    - In creating tsunami disaster relief websites, the Thai information workforce pursued different technological venues such as Thai language only web boards and/or searchable multi-language web sites in disseminating disaster and humanitarian information.
- Technological Innovation

Lastly, statistical procedures were used to assess the perceptions of 49 survey respondents towards the effectiveness of ICT institutions. The findings are as follows:

- Specialized ICT semi-government and private agencies such as NECTEC, DDPM, TTVI, and INET were more effective in providing tsunami disaster relief information than ICT governing bodies such as MICT and GCC.
- There were no significant differences in the perceived abilities of ICT institutions to provide future disaster relief.
- The order effect on the perceived effectiveness of ICT institutions in the development of the Thai information society, from strongest to weakest:
    1. Specialized ICT semi-government agencies: NECTEC and NSTDA
    2. Private institutions such as INET, Sanook, and G2K as well as MICT
    3. ICT governing body: NTC, SIPA and SmartCard

Thirty-five of the survey respondents were on the disaster site and had participated in rescue work and DVI data collection. The respondents felt less affected from a job security factor

including wealth, income and physical well being than from a society and family factor including emotional well being, future interaction with society and social life.

Discussion

Information Workforce Growth

For the past three decades, high growth in the information sector as a proportion of all employment has indicated a growing information society in Thailand. Even so, in absolute numbers, employment in the information workforce remains smaller than that of other sectors of employment. Nevertheless, the Thai information sector growth pattern is typical of developing countries' patterns. From 1970 to 2006, information, service, and industry occupations in Thailand have increased while agriculture occupations have steadily decreased. This pattern is in contrast with that of developed countries such as the United States in which the information and service sectors were growing between 1954 to 1980, while both the agriculture and industrial sectors were declining (Porat, 1977). In all, this finding of the Thai's information sector development pattern confirmed a key difference between development patterns of information sectors in developed and developing countries (Katz, 1988).

Furthermore, while the formation of information societies in developed countries is driven by the economic need to promote greater efficiency in the production of goods and services, the increase of information workers in developing countries such as Thailand, was not directly influenced by economic growth. During the 1997-98 Asian economic crisis period when Thailand was at the epic center of the economic crisis and the country's GDP per capita growths were at their lowest points (-2.47 and -11.48), there were over 700,000 jobs added to the information and service sectors. There was no corresponding expansion in the private manufacturing and service sectors as the industrial sector lost over 600,00 jobs during the

economic crisis. Thus, the increase of information workers can be suggested as having been influenced by the expansion of the Thai government during that time.

This finding confirmed Katz's (1988) argument (see Chapter 2, Figure 2.2) that the increasing number of information workers is due more to the expansion of government which is needed to support delivery of basic services and the oversupply of educated labor force. This study also suggests the expansion of information workers in Thailand during the 1997-98 financial crisis resulted from the expansion of the Thai government.

Strong ICT Development

The diffusion of ICT in Thailand was strongly influenced by political and economic factors. During the 22-year period, from 1958 until 1980, the Thai state was under an 18-year military control. Domestic and international telecommunication services were monopolized by state-owned enterprises. The implementation of export-led industrial policies in the mid 1980s allowed an influx of investment from multinational corporations who in turn demanded the provision of an efficient ICT infrastructure.

Thailand's buildup of ICT infrastructure coincided with the country's period of major political and economic changes. In 1988, the military finally lost control over the premiership, while the country's economy peaked and transformed to newly industrialized. Nevertheless, telecommunication privatization during this period was considered a major cause of political corruption and gave rise to political parties (Niyomsilpa, 2000). Accordingly, Thailand's expansion of ICT infrastructure during this period was influenced not only on the basis of economic profitability, but also by political desirability. This finding confirmed a characteristic of ICT diffusion in developing countries which tend to face the challenges of state building and economic development at the same time (Katz, 1988).

The BTO concession awards to privately owned companies essentially remedied the telecom monopoly by the state-owned agencies and enabled the supply of the ICT systems to keep pace with the extraordinary economic demand from the private sector. Even during the 1997-98 economic crisis, after a slow growth in network development and a decline in mobile subscribers, ICT infrastructure expansion was quickly reestablished. By the end of 2000, Thailand had reached a fixed-line penetration rate of 9.2% and the number of mobile cellular subscribers exceeded that of fixed-line users by the end of 2001.

Political corruption and power struggles between interest groups of political parties hindered the development of an information society (Castells, 1996). Thaksin Shinawatra – the 23rd Prime Minister who won a general election in January 2001 by landslide – was ousted in September 2006, by a military coup on the basis of the PM's personal gain from the profit in the sale of Shin Corp – Thailand's leading mobile cellular operator. He was considered "an opportunistic politician, for whom ideas are simply a means to an end. He is not animated by the pursuit of ideas, but by the pursuit of wealth and power. Thaksin's greatest achievement is the creation of a formidable political and economic power network" (McCargo & Pathmanand, 2005).

Nevertheless, the PM established the Ministry of ICT – the highest level of ICT governing body – and the country's ICT indicators were strong and impressive. By the end of 2007, the penetration rates for mobile cellular and Internet subscribers were 124 % and 21 %, respectively.

Tsunami Disaster Relief Information

The 2004 Boxing Day Tsunami was a tragedy to citizens of many nations. The immediate relief and aid after the incident was information. People need real-time information about the

disaster. In the tsunami case, people made use of the information on a fundamental level as a resource (Braman, 1989) to locate relief and to aid their anxiety over friends and family.

In southern Thailand on December 26, 2004, people were seeking information on missing persons – victims of the disaster. There were no systems and protocols for managing information about the dead and missing. There was no designated authority to oversee the management of dead bodies. There were misuses of information, including photographs of the dead and missing taken for personal gain. In this case, tsunami disaster relief information was a commodity (Braman, 1989; Schiller, 1988) and possessed some economic power.

Nine days after the tsunami, the Ministry of ICT was appointed by the Secretariat of Cabinet to create the Government's Official Tsunami & Disaster Center. In other words, the MICT was granted power "to shape the production, distribution, and use of information as a commodity" (Mosco, 1988). The MICT cooperated with the IBM Crisis Response Team to construct a "Disaster Portal" which never materialized (see Tsunami Disaster Relief section in Chapter 4). The tasks were implemented by Thailand's information champions – Trin Tantsetthi, Hugh Thaweesak Koanantakool and his team at NECTEC.

During that time, there were at least 18 public and private agencies' websites which contained tsunami disaster relief information. The INET Tsunami Relief Information section in Chapter 4 shows link between the development of technological artifacts and their planned and actual diffusion. In creating tsunami disaster relief websites, the Thai information workforce pursued different technological venues such as Thai language only web boards and/or searchable multi-language web sites in disseminating disaster and humanitarian information. Technological artifacts such as the Thai web boards could not be sustained and were deemed unusable by English speaking information seekers. Thus, English language searchable websites were created

to meet those needs. The outcomes in web technology influenced information workers to improve the production of real time and consistent information, as well as to look for new technological venues such as the use of open source software. The shaping and diffusion of technological artifacts are closely tied and should be seen as "the two sides of the same innovation coin" (Boczkowski, 2004).

The Ministry of ICT

This study shows that the Ministry of ICT – the highest level ICT governing body, compared to other less authoritative ICT agencies – failed to effectively provide the tsunami disaster relief efforts. In addition, the MICT, compared to other less authoritative ICT agencies, was not perceived favorably on their effectiveness in the development of the information society either. Therefore, on the specific findings of this study, the establishment of the Ministry of ICT did not increase the effectiveness of the Thai information society development.

Nevertheless, the MICT has continued to be responsible for implementing strategies and plans to lead the Thai nation to a knowledge-based society, to improve the nation's competitiveness through the use of ICT, and to promote e-Government – the use of ICT in the management and service provision of the government. Further evaluation on MICT's initiatives are needed to determine a long term effect of the MICT to the Thai information society.

Policy Implications

This section presents the policy implications of the literal and theoretical findings of the thesis. Other important lessons learned during this research and analysis will also be presented.

Internet-Mediated Disaster Recovery

The findings of this study seconded a recent study (Kivikuru, 2006) that the type of media that was most successful in providing the real-time information was not the mainstream news media, but mobile phones and the Web.

Thailand's current information workforce and ICT infrastructure provide the country with the ability to form multi-organizational information networks in order to rapidly and effectively provide humanitarian aid and disaster recovery effort.

Networks of Volunteers in Global and Collaborative Effort

The Web was used in a variety of ways to aid recovery in the aftermath of disasters such as the December 2004 Southeast Asian tsunami and the August 2005 Hurricane Katrina. In addition to the online assistance of formal aid organizations, the recovery efforts included attempts to provide help through collaboration among distributed networks of volunteers.

This study finds that volunteers were crucial in aiding in the DVI data collection as well as creating amateur-run web boards and disseminating data-driven relief information.

- The ability to rapidly form multi-organizational networks among formal aid organizations and a distributed network of volunteers is crucial to humanitarian aid and disaster relief.
- The Web is U.S.-centric and English is the language of the Web. The support of multi-language Internet-mediated platforms is essential for global cooperation.
- Data-driven relief, such as identifying resources and persons, coordinating assistance to victims and publicizing services are areas that need to be addressed.

Open ICT Ecosystems

Open standards bind together open ICT ecosystems and drive interoperability. The Berkman Center for Internet & Society at Harvard University has outlined framework in creating open ICT ecosystems to include development, access, and ownership of technologies necessary in coping with innovation in politics, health care, and disaster management (Berkman, 2006).

Open standards and open source software (OSS) are parts of an open ICT ecosystem. It is a good ICT strategy for developing countries to use open source software (OSS) to gain knowledge about the technology itself, and to create technology products that fit their specific needs (Câmara & Fonseca, 2007).

In this case, to facilitate multi-agency handling of emergency situations and to support multiple languages, a scalable ICT infrastructure such as OpenCARE is being developed using open source software (OSS). Particularly, open source software – produced by distributed networks of mostly volunteer computer programs – contain the following characteristics (Weber, 2004):

- Source code must be distributed with the software or otherwise made available for no more than the cost of distribution.
- Anyone may redistribute the software for free, without royalties or licensing fees to the author.
- Anyone may modify the software or derive other software from it, and then distribute the modified software under the same terms.

These characteristics need to be taken into consideration when creating and diffusing technological artifacts such as OpenCARE.

Mass Fatality Management

Mass fatality incidents result in a large number of bodies that stretch the community beyond its resources. When formulating disaster relief policy, policy makers need to take the following into consideration:

- Technical guidelines for managing mass fatalities and information available about post-disaster management of the dead following large natural disasters.
- Systems and protocols for managing information about the dead and missing.
- A standardized disaster victims (DVI) data collection form.
- A designated data center authority to coordinate and support the forensic and data collection teams.
- Volunteers are crucial in aiding disaster relief efforts. Their health and emotional risks need to be taken into consideration.

Distance Learning

Distance learning refers to the concept that instructor is in one location, while the students are in another – and each student may be in different location from one another. Through Web courses leading to Emergency Management Certificate, participating students can acquire basic knowledge of mass fatality management issues such as special treatment of bodies, logistics of recovering bodies, needs of surviving family members, and psychological issues of professional and volunteer emergency workers and their family members. In addition, cultural and religious issues need to be emphasized.

Public Access to the Internet

Thailand's first ICT survey was conducted by the National Statistical Office (NSO) in 2004. Figure 5.1 shows a digital divide by region of population in Bangkok metropolitan and other regions in the country.

While Bangkok is the capital city with 11 % of the population, the area has the highest ICT uses in the Internet (28%), computer (40%) and mobile cellular (64%). The digital divide reflects the divide in income distribution of population in each region.

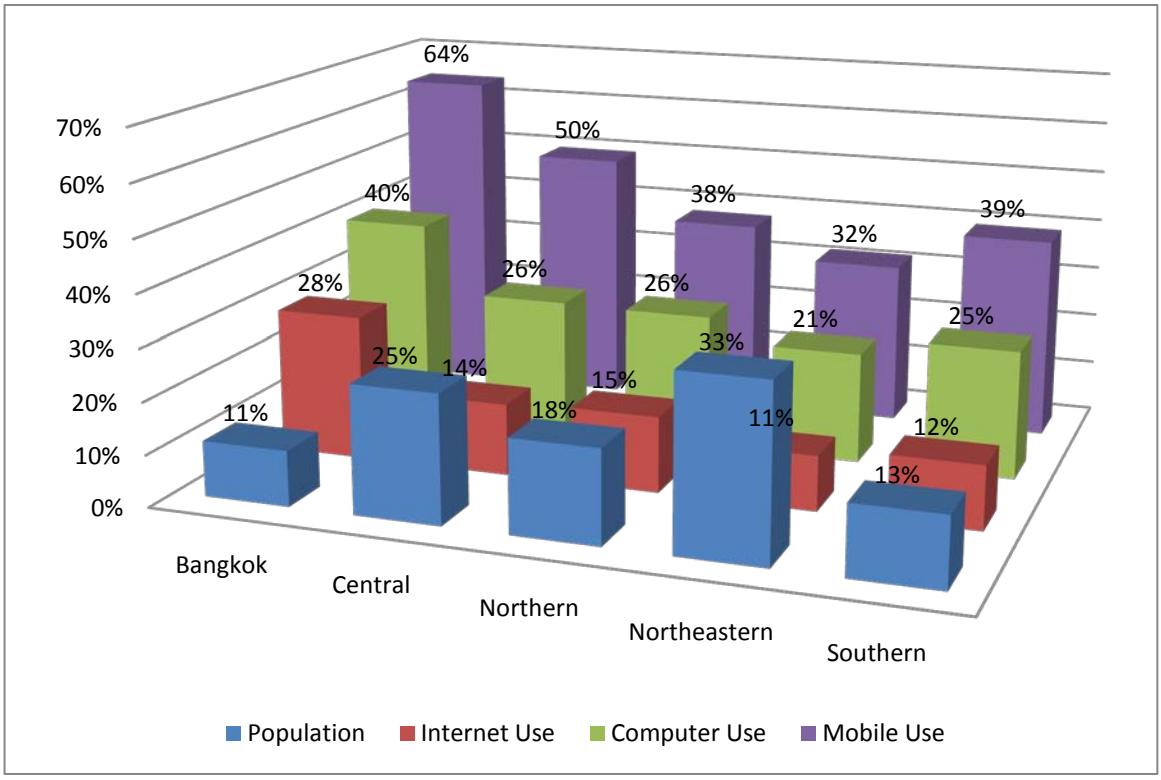


Figure 5.1. ICT use of Thai population 6 years and over by region in 2006 (Appendix P).

Therefore, it is important to provide public access to the Internet. Continued action is needed to boost Internet access through public facilities specifically in the Northeastern region.

Broadband Divide

The 2009 report on Information Society profiles in Asia and Pacific region (ITU, 2009b) has highlighted that broadband-based applications have the greatest impact on people, society, and businesses. Broadband makes the Internet always available at a fast speed. Individuals enjoy a faster and more pleasant Internet surfing experience and the ability to use bandwidth-intensive applications, such as those related to high quality video and audio streaming. Broadband also enhances a range of socially desirable and valuable online services in areas such as government, education, and health.

Despite Thailand's impressive and high-growth in penetration rates of mobile cellular and Internet subscribers, fixed telephone lines and broadband subscribers were lower than the average levels of the countries in the Asia and the Pacific region.

Fixed and Mobile Broadbands

There are a number of challenges for the development of fixed broadband in Thailand. The limited number of fixed telephone lines constrains the deployment of broadband access via ADSL and largely limits it to urban areas.

Fixed broadband Internet services were fist launched in Thailand in 2001. By 2007, the country had 913,000 fixed broadband subscribers – or 1.4 % which is lower than that of the countries in the Asia and the Pacific region (3.5 %).

Of particular concern is that mobile broadband was not commercially available in Thailand by the end of 2007.

Future Research

Political Economy of the Information Society

Measurements and analysis of the information workforce in developing countries remains disappointingly scarce. This study has added only one-country specific study to the body of the information society literature. In addition, the international and global dimensions of the information society has yet to be explored (Wilson III, 2004).

To explain ongoing trends of the Thai information society, it is important to analyze in detail the impact of political variables on the transition of information-intensive societies (Katz, 1988). This has to be done at two levels: First, it is important to analyze political structures as information-processing entities that generate demand for both information workers and

information and communication technologies. Second, it is important to analyze the influence of policymaking processes on the deployment of information and communication technologies.

Information Society Comparative Analysis

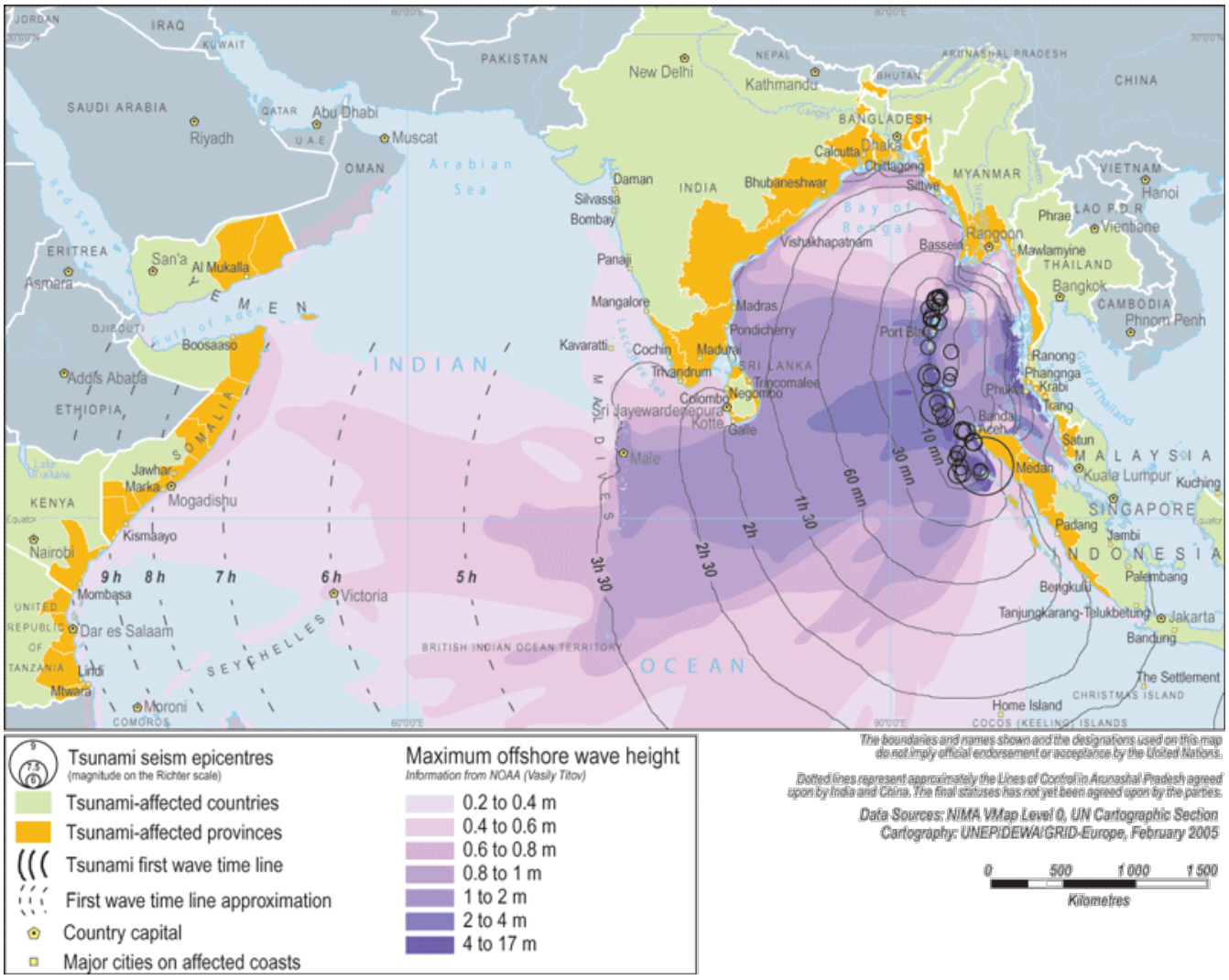
A comparative analysis of the information workforce of countries in the Asia and Pacific region is important for policy makers to assess the countries' competitiveness compared to their neighboring countries. The workforce classification used in this study contains an appropriate tool for producing cross-national comparisons of growth trends in the workforce structure.

The Mutual Shaping of Technology and Society

Research on the mutual shaping of technology and society in the adoption of media artifacts and their social construction remains scarce. This thesis has only scratched the surface, in terms of explaining the creation of technological artifacts for a specific social construct. Two areas of research are particular important to cover. First, the use of open source software (OSS) in creating technological artifacts is important to consider. OSS possesses a set of characteristics that differ from traditional software, posing a different set of questions in its diffusion. In addition, cultural and language acceptability dimensions need to be taken into consideration in the coordination of our global society. Second, comparative studies in a different settings of the diffusion of media and technological artifacts might reveal patterns of the diffusion of innovations and their social factors.

APPENDIX A

PROPAGATION OF THE INDIAN OCEAN TSUNAMI



Source: Maps and Satellite Image Analysis produced by GRID-Europe: South Asia Earthquakes and Tsunami Crisis Response (UNEP, 2006)

APPENDIX B

INTERNATIONAL STANDARD CLASSIFICATION OF OCCUPATIONS

(ISCO-1968)

International Standard Classification of Occupations (ISCO-1968)
Major Group 0/1 Professional, technical and related workers
0-1 Physical scientists and related technicians
0-2/3 Architects, engineers and related technicians
0-4 Aircraft and ships' officers
0-5 Life scientists and related technicians
0-6/7 Medical, dental, veterinary and related workers
0-8 Statisticians, mathematicians, systems analysts and related technicians
0-9 Economists
1-1 Accountants
1-2 Jurists
1-3 Teachers
1-4 Workers in religion
1-5 Authors, journalists and related writers
1-6 Sculptors, painters, photographers and related creative artists
1-7 Composers and performing artists
1-8 Athletes, sportsmen and related workers
1-9 Professional, technical and related workers not elsewhere classified
Major Group 2 Administrative and managerial workers
2-0 Legislative officials and government administrators
2-1 Managers
Major Group 3 Clerical and related workers
3-0 Clerical supervisors
3-1 Government executive officials
3-2 Stenographers, typists and card- and tape-punching machine operators
3-3 Bookkeepers, cashiers and related workers
3-4 Computing machine operators
3-5 Transport and communications supervisors
3-6 Transport conductors
3-7 Mail distribution clerks
3-8 Telephone and telegraph operators
3-9 Clerical related workers not elsewhere classified
Major Group 4 Sales workers
4-0 Managers (wholesale and retail trade)
4-1Working proprietors (wholesale and retail trade)

International Standard Classification of Occupations (ISCO-1968)
4-2 Sales supervisors and buyers
4-3 Technical salesmen, commercial travelers and manufacturers' agents
4-4 Insurance, real estate, securities and business services salesmen and auctioneers
4-5 Salesmen, shop assistants and related workers
4-9 Sales workers not elsewhere classified
Major Group 5 Service workers
5-0 Managers (catering and lodging services)
5-1 Working proprietors (catering and lodging services)
5-2 Housekeeping and related service supervisors
5-3 Cooks, waiters, bartenders and related workers
5-4 Maids and related housekeeping service workers not elsewhere classified
5-5 Building caretakers, char workers, cleaners and related workers
5-6 Launderers, dry-cleaners and pressers
5-7 Hairdressers, barbers, beauticians and related workers
5-8 Protective service workers
5-9 Service workers not elsewhere classified
Major Group 6 Agriculture, animal husbandry and forestry workers, fishermen and hunters
6-0 Farm managers and supervisors
6-1 Farmers
6-2 Agriculture and animal husbandry workers
6-3 Forestry workers
6-4 Fishermen, hunters and related workers
Major Group 7/8/9 Production and related workers, transport equipment operators and laborers
7-0 Production supervisors and general foremen
7-1 Miners, quarrymen, well drillers and related workers
7-2 Metal processors
7-3 Wood preparation workers and paper makers
7-4 Chemical processors and related workers
7-5 Spinners, weavers, knitters, dyers and related workers
7-6 Tanners, fell mongers and pelt dressers
7-7 Food and beverage processors
7-8 Tobacco prepares and tobacco product makers
7-9 Tailors, dressmakers, sewers, upholsterers and related workers
8-0 Shoemakers and leather goods makers

International Standard Classification of Occupations (ISCO-1968)
8-1 Cabinetmakers and related woodworkers
8-2 Stone cutters and carvers
8-3 Blacksmiths, toolmakers and machine-tool operators
8-4 Machinery fitters, machine assemblers and precision instrument makers (except electrical)
8-5 Electrical fitters and related electrical and electronics workers
8-6 Broadcasting station and sound equipment operators and cinema projectionists
8-7 Plumbers, welders, sheet metal and structural metal prepares and erectors
8-8 Jewelers and precious metal workers
8-9 Glass formers, potters and related workers
9-0 Rubber and plastics product makers
9-1 Paper and paperboard products makers
9-2 Printers and related workers
9-3 Painters
9-4 Production and related workers not elsewhere classified
9-5 Bricklayers, carpenters and other construction workers
9-6 Stationary engine and related equipment operators
9-7 Material-handling and related equipment operators, dock workers, and freight handlers
9-8 Transport equipment operators
9-9 Laborers not elsewhere classified
Major Group X Workers not classifiable by occupation
X-1 New workers seeking employment
X-2 Workers reporting occupations unidentifiable or inadequately described
X-3 Workers not reporting any occupation

Source: International Standard Classification of Occupations (ILO, 1969)

APPENDIX C

CORE LIST OF ICT INDICATORS

I. Core indicators on ICT infrastructure and access

Basic core

A1	Fixed telephone lines per 100 inhabitants
A2	Mobile cellular subscribers per 100 inhabitants
A3	Computers per 100 inhabitants
A4	Internet subscribers per 100 inhabitants
A5	Broadband Internet subscribers per 100 inhabitants
A6	International Internet bandwidth per inhabitant
A7	Percentage of population covered by mobile cellular telephony
A8	Internet access tariffs (20 hours per month), in US$, and as a percentage of per capital income
A9	Mobile cellular tariffs (100 minutes of use per month), in US$, and as a percentage of per capita income
A10	Percentage of localities with public Internet access centers (PIACs) by number of inhabitants (rural/urban)

Extended core

A11	Radio sets per 100 inhabitants
A12	Television sets per 100 inhabitants

II. Core indicators on access to, and use of, ICT by households and individuals

Basic core

HH1	Proportion of households with a radio
HH2	Proportion of households with a TV
HH3	Proportion of households with a fixed line telephone
HH4	Proportion of household with a mobile cellular telephone
HH5	Proportion of households with a computer
HH6	Proportion of individuals who used a computer (from any location) in the last 12 months
HH7	Proportion of households with Internet access at home
HH8	Proportion of individuals who used the Internet (from any location) in the last 12 months

II. Core indicators on access to, and use of, ICT by households and individuals

HH9	Location of individual use of the Internet in the last 12 months: (a) at home; (b) at work; (c) place of education; (d) at another person's home; (e) community Internet access facility; (f) commercial Internet access facility; and (g) others.
HH10	Internet activities undertaken by individuals in the last 12 months: • Getting information: (a) about goods or services; (b) related to health or health services; (c) from government organizations/public authorities via websites or email; and (d) other information or general • Web browsing • Communicating • Purchasing or ordering goods or services • Internet banking • Education or learning activities • Dealing with government organizations/public authorities • Leisure activities: (a) playing/downloading video or computer games; (b) downloading movies, music or software; (c) reading/downloading electronic books, newspapers or magazines; and (d) other leisure activities

Extended core

HH11	Proportion of individuals with use of a mobile telephone
HH12	Proportion of households with access to the Internet by type of access: Categories should allow an aggregation to narrowband and broadband, where broadband excludes slower speed technologies, such as dial-up modem, ISDN and most 2G mobile phone access. Broadband will usually have an advertised download speed of at least 256 kbit/second.
HH13	Frequency of individual access to the Internet in the last 12 months (from any location): (a) at least once a day; (b) at least once a week but not every day; (c) at least once a month but not every week; and (d) less than once a month

Reference indicator

HHR1	Proportion of households with electricity

III. Core indicators on access to, and use of, ICT by business

Basic core

B1	Proportion of businesses using computers
B2	Proportion of employees using computers
B3	Proportion of businesses using the Internet
B4	Proportion of employees using the Internet
B5	Proportion of businesses with a Web presence
B6	Proportion of businesses with an intranet
B7	Proportion of businesses receiving orders over the Internet
B8	Proportion of businesses placing orders over the Internet

Extended core

B9	Proportion of businesses using the Internet by type of access: Categories should allow an aggregation to narrowband and broadband, where broadband excludes slower speed technologies, such as dial-up modem, ISDN and most 2G mobile phone access. Broadband will usually have an advertised download speed of at least 256 kbit/second.
B10	Proportion of businesses with a Local Area Network (LAN)
B11	Proportion of businesses with an extranet
B12	Proportion of businesses using the Internet by type of activity • Sending and receiving email • Getting information: (a) about goods or services; (b) from government o organizations/public authorities via websites or email; and (c) other information searches or research activities • Performing Internet banking or accessing other financial services • Dealing with government organizations/public authorities • Providing customer services • Delivering products online

IV. Core indicators on the ICT sector and trade in ICT goods

Basic core

ICT1	Proportion of total business sector workforce involved in the ICT sector
ICT2	Value added in the ICT sector (as a percentage of total business sector value added)
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total exports

Source: Core ICT Indicators (UN, 2005a)

APPENDIX D

SUCCESSION OF THAI GOVERNMENTS SINCE 1958

Government	Start	End	Duration in Months
Sarit Thanarat	October 1958	December 1963	**62**
Thanom Kittikachorn I	December 1963	March 1968	**51**
Thanom Kittikachorn II	March 1968	November 1971	**44**
Thanom Kittikachorn*	November 1971	December 1972	**13**
Thanom Kittikachorn III	December 1972	October 1973	**10**
Sanya Dharmasakti I	October 1973	May 1974	**7**
Sanya Dharmasakti II	May 1974	January 1975	**8**
Seni Pramoj I	February 1975	March 1975	**1**
Kukrit Pramoj	March 1975	April 1976	**13**
Seni Pramoj II	April 1976	October 1976	**6**
Thanin Kraivixien	October 1976	October 1977	**12**
Sangad Charloryu*	October 1977	November 1977	**1**
Kriangsak Chomanand I	November 1977	May 1979	**18**
Kriangsak Chomanand II	May 1979	February 1980	**9**
Kriangsak Chomanand III	February 1980	February 1980	**0**
Prem Tinsulanonda I	March 1980	January 1981	**10**
Prem Tinsulanonda II	January 1981	December 1981	**11**
Prem Tinsulanonda III	December 1981	April 1983	**16**
Prem Tinsulanonda IV	May 1983	August 1986	**39**
Prem Tinsulanonda V	August 1986	April 1988	**20**
Chatchai Choonhavan	April 1988	February 1991	**34**
Sunthorn Kongsompong*	February 1991	March 1991	**1**
Anand Panyarachun I	March 1991	April 1992	**13**
Suchinda Kraprayoon	April 1992	May 1992	**1**
Anand Panyarachun II	June 1992	September 1992	**3**
Chuan Leekpai I	September 1992	July 1995	**34**
Banharn Silpa-Archa	July 1995	November 1996	**16**
Chavalit Yongchaiyuth	November 1996	November 1997	**12**
Chuan Leekpai II	November 1997	February 2001	**39**
Thaksin Shinawatra I	February 2001	March 2005	**49**
Thaksin Shinawatra II	March 2005	September 2006	**18**
Sondhi Boonyaratkalin*	September 2006	October 2006	**1**
Surayuth Julanond	October 2006	February 2008	**16**
Samak Sundaravej	February 2008	September 2008	**7**
Somchai Wongsawat	September 2008	December 2008	**3**
Abhisit Vejjajiva	December 2008	Present	

Source: Adapted and extended from Pasuk and Baker (1995: Table 10.2, p.339) (Phongpaichit & Baker, 1995); and (Niyomsilpa, 2000); and (Secretariat of Cabinet, 2009) ;

* Military coup leader

APPENDIX E

THAILAND'S GDP PER CAPITA GROWTH

1970-2007

1970-1982 (annual %)	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
GDP per capita growth	8.42	2.16	1.64	7.53	1.98	2.55	6.89	7.48	8.02	3.29	3.19	4.01	3.56
1983-1995 (annual %)	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
GDP per capita growth	3.87	4.11	3.10	4.04	8.03	11.81	10.78	9.80	7.26	6.83	7.02	7.76	8.01
1996-2007 (annual %)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	
GDP per capita growth	4.71	(2.47)	(11.48)	3.38	3.76	1.29	4.49	6.36	5.60	3.80	4.38	4.12	

Source: World Development Indicators (World Bank, 2008, 2009)

APPENDIX F

THAILAND TSUNAMI VICTIM IDENTIFICATION FACILITIES

TTVI Buildings in Phuket Province

Temporary Morgues in Phang-nga Province

Source: Tsunami Victim Identification in Thailand (Sribanditmongkol, 2005)

APPENDIX G

INTERVIEW QUESTIONS

Phase I

October 2006

Topic: Role & Perception

1. What is the role and participation of the interviewee in the tsunami disaster relief?
2. What is the perception and evaluation of the interviewee to the role and participation of the Thai government and MICT?
3. What is the perception and evaluation of the interviewee to the role and participation of the international aid agencies?

Topic: What data/information collected, processed and disseminated

4. What is the data/information collected, processed, and disseminated?
5. What is the most valuable data/information?

Topic: How data/information collected, processed and disseminated?

6. How are the data/information collected, processed, and disseminated?
7. What are the driving forces to the success?

Topic: Problems during data collection, processing, and dissemination

8. What are the problems and "bottlenecks" that the interviewee encountered?
9. What is deemed the biggest problem?
10. What should be the solutions?

Topic: Open-ended on views on emergency response relief, digital divide

11. What other views would you like to add on policies or social change?

Phase II

November 2007

Topic: Change to the ICT infrastructure after the tsunami disaster

1. What are ICT infrastructure initiatives after the tsunami disaster to provide better and timely information and communication for future disaster relief.
2. What are the roles of Ministry of Information and Communication Technology (MICT), National Science and Technology Development Agency (NSTDA), Thailand, National Electronics and Computer Technology Center (NECTEC), and other non-state institutions in these initiatives?
3. What are the impact of these initiatives to disaster preparedness and management?

APPENDIX H

SURVEY INSTRUMENTS

Study Introduction

February 2008

The objectives of the study are to examine the development of the information society* in Thailand and its role in the tsunami disaster relief efforts from December 26, 2004 to February 3, 2005.

Your participation in the survey questionnaire will help with the study. The questionnaire consists of five short forms:

(1) Tsunami Disaster Relief
(2) Future Disaster Relief
(3) Information Society Development
(4) Tsunami Disaster Effects
(5) Personal Information

I thank you in advance for your participation and completion of the survey.

Sincerely,

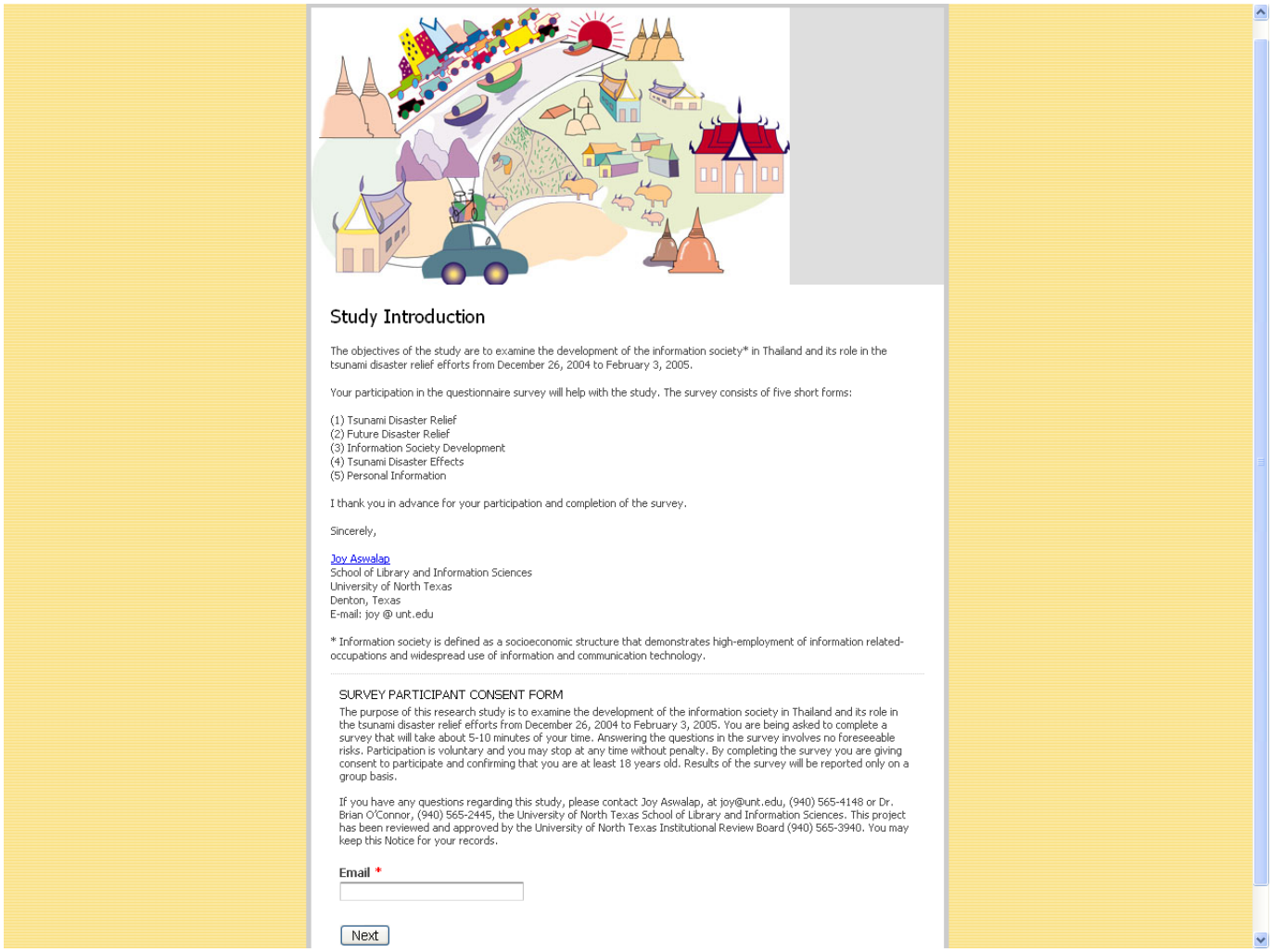
Joy Aswalap
School of Library and Information Sciences
University of North Texas
Denton, Texas
E-mail: joy @ unt.edu

* Information society is defined as a socioeconomic structure that demonstrates high-employment of information related-occupations and widespread use of information and communication technology.

Survey Participant Consent Form

The purpose of this research study is to examine the development of the information society in Thailand and its role in the tsunami disaster relief efforts from December 26, 2004 to February 3, 2005. You are being asked to complete a survey that will take about 5-10 minutes of your time. Answering the questions in the survey involves no foreseeable risks. Participation is voluntary and you may stop at any time without penalty. By completing the survey you are giving consent to participate and confirming that you are at least 18 years old. Results of the survey will be reported only on a group basis.

If you have any questions regarding this study, please contact Joy Aswalap, at joy@unt.edu, (940) 565-4148 or Dr. Brian O'Connor, (940) 565-2445, the University of North Texas School of Library and Information Sciences. This project has been reviewed and approved by the University of North Texas Institutional Review Board (940) 565-3940. You may keep this Notice for your records.



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Email *

Next

Website in November 2009: http://jaswalap.wufoo.com/forms/study-introduction/

Questionnaire

Form (1) Tsunami Disaster Relief

The tsunami on December 26, 2004 was the first natural disaster mediated over the Internet in terms of global collaboration and response to the disaster.

One of the relief efforts was providing information. The below agencies used websites to disseminate information such as news, names and photos of survivors and missing persons, and guides to donations.

I find these agencies and their efforts to be crucial in providing tsunami disaster relief.

No.	Agency	Website	Answer disagree ⇔ agree 1 2 3 4 5 6 7
1	Ministry of Information and Communication Technology (MICT) กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร	Government's Official Tsunami & Disaster Center *Domain no longer active*	
2	Ministry of Information and Communication Technology (MICT) กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร	Government Contact Center (GCC) ศูนย์บริการข้อมูลภาครัฐเพื่อประชาชน	
3	Department of Disaster Prevention and Mitigation (DDPM) กรมป้องกันและบรรเทาสาธารณภัย	Tsunami Help & Recovery Information System (THRIS) ระบบฐานข้อมูลภัยพิบัติการช่วยเหลือ และแก้ไขปัญหาจากธรณีพิบัติใน 6 จังหวัดภาคใต้	
4	National Electronics and Computer Technology Center (NECTEC) ศูนย์เทคโนโลยีอิเล็กทรอนิกส์และคอมพิวเตอร์ แห่งชาติ (เนคเทค)	Official Website of Thailand for Missing Persons Registration ระบบลงทะเบียนผู้สูญหายจากเหตุการณ์อุบัติภัย สึนามิในประเทศไทย	
5	Thailand Tsunami Victim Identification Information Management Centre (TTVI)	Official Thai Tsunami Information Centre ศูนย์กลางข้อมูลผู้ประสบภัยสึนามิ	
6	Internet Thailand Public Company Limited (INET) บริษัท อินเทอร์เน็ตประเทศไทย จำกัด (มหาชน)	Tsunami Relief Information	

Form (2) Future Disaster Relief

Information can be a vital form of aid and a life-saving resource. In an attempt to provide better and timely information and communication, these agencies initiated information and communication infrastructure as described in the websites.

I find these agencies and their initiatives to be crucial in providing future disaster relief efforts.

No.	Agency	Website	Answer disagree ⇔ agree 1 2 3 4 5 6 7
7	Ministry of Information and Communication Technology (MICT) กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร	National Disaster Warning Center (NDWC) ศูนย์เตือนภัยพิบัติแห่งชาติ Launched: May 31, 2005 *Website under construction*	
8	National Electronics and Computer Technology Center (NECTEC) ศูนย์เทคโนโลยีอิเล็กทรอนิกส์และคอมพิวเตอร์ แห่งชาติ (เนคเทค)	Emergency and Educational Communication Vehicle รถสื่อสารฉุกเฉิน EECV Launched: May 25, 2006. Deployed in central Thailand's flooded provinces during Aug-Oct 2006.	
9	Internet Thailand Public Company Limited (INET) บริษัท อินเทอร์เน็ตประเทศไทย จำกัด (มหาชน)	Open Exchange for Collaborative Activities in Response to Emergencies (OpenCARE) เครือข่ายแลกเปลี่ยนข้อมูลข่าวสารและ การแจ้งเตือนภัยพิบัติ Launched: December 21, 2007	

Form (3) Information Society Development

I find these agencies and their roles to be crucial in the success of the development of information society in Thailand from 1991 to present.			
No.	**Agency**	**Established**	**Answer** **disagree ⇔ agree** **1 2 3 4 5 6 7**
10	Ministry of Information and Communication Technology (MICT) กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร	October 03, 2002	
11	Software Industry Promotion Agency (SIPA) สำนักงานส่งเสริมอุตสาหกรรมซอฟต์แวร์แห่งชาติ	September 24, 2003	
12	National ID Smart Card บริษัทไทยสมาร์ทคาร์ด จำกัด	April 01, 2004	
13	National Science and Technology Development Agency (NSTDA) สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยี แห่งชาติ	December 29, 1991	
14	National Electronics and Computer Technology Center (NECTEC) ศูนย์เทคโนโลยีอิเล็กทรอนิกส์และคอมพิวเตอร์ แห่งชาติ (เนคเทค)	December 30, 1991	
15	National Telecommunications Commission (NTC) คณะกรรมการกิจการโทรคมนาคมแห่งชาติ	October 01, 2004	
16	Internet Thailand Public Company Limited บริษัท อินเทอร์เน็ตประเทศไทย จำกัด (มหาชน)	Since 1995	
17	Sanook.com สารบัญเว็บไทย (Entertainment Portal)	Since 1996	
18	Gotoknow.org เครือข่ายสังคม)Social Network)	Since 2006	

Form (4) Information Society Development

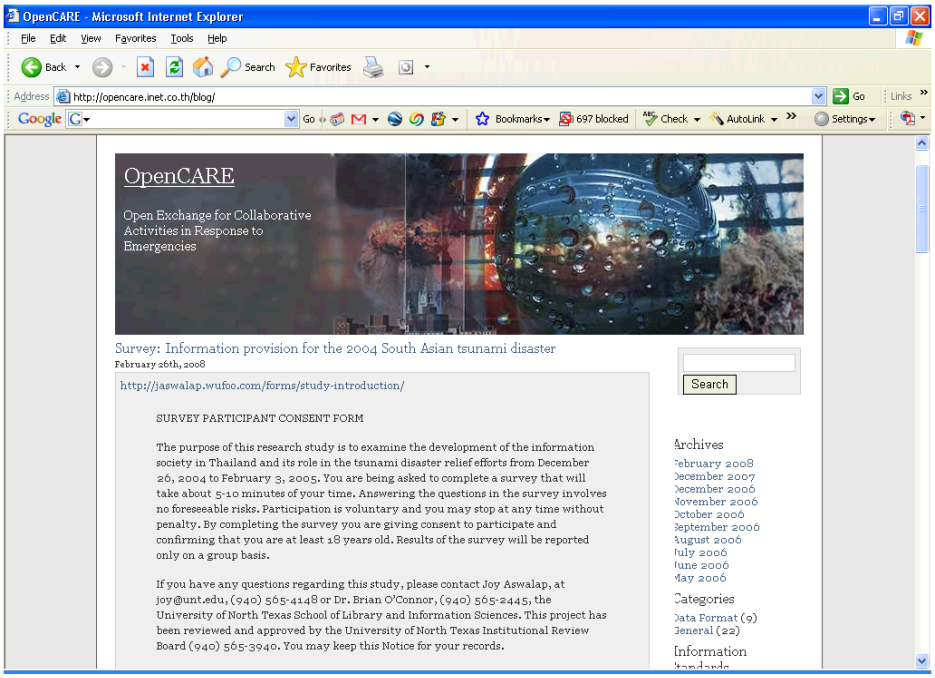
Please answer how you assisted in providing tsunami disaster relief efforts.		
No.	**Participation**	**Answer Yes / No**
19	On-site assistance via disaster victim identification data collection	
20	On-line assistance via disaster victim information dissemination	
21	Other assistance: please specify	
Please answer how providing tsunami disaster relief efforts affecting your personal life.		
No.	**I was affected financially.**	**Answer disagree ⇔ agree 1 2 3 4 5 6 7**
22	My income was affected.	
23	My job security was affected.	
24	My wealth was affected.	
No.	**My social life with family and friends was affected.**	**Answer disagree ⇔ agree 1 2 3 4 5 6 7**
25	Members of my family were affected.	
26	My social life with friends was affected.	
27	My future interaction with society was affected.	
No.	**I was affected physically and emotionally.**	**Answer disagree ⇔ agree 1 2 3 4 5 6 7**
28	I was emotionally affected.	
29	I was physically affected.	
30	My future well-being was affected.	

Form (5) Personal Information

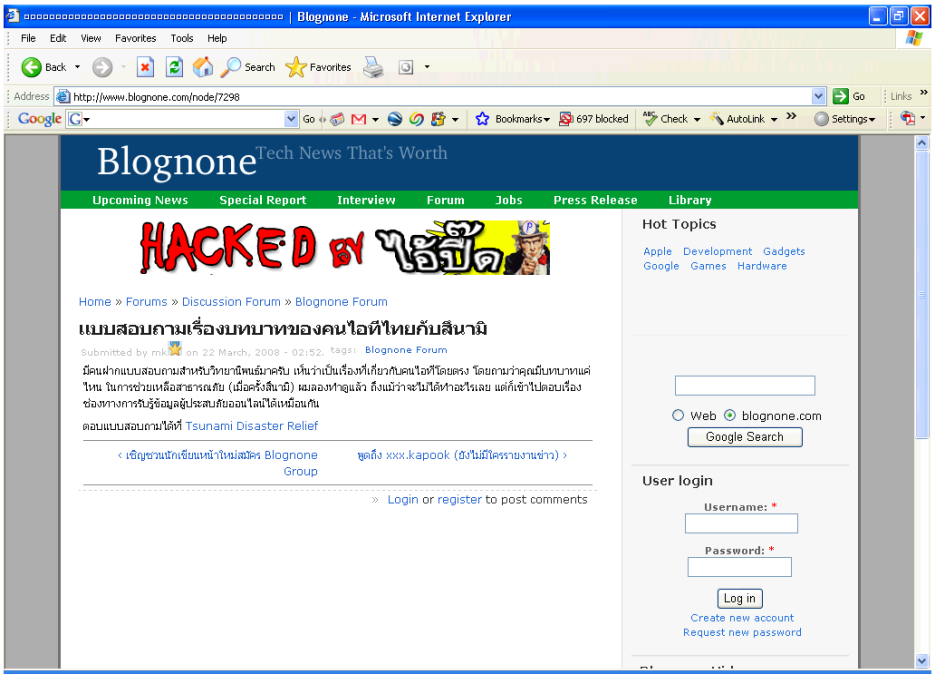
No.	Personal Information		Answer
31	Your age	1. 19 and under 2. 20 - 29 3. 30 - 39 4. 40 – 49 5. 50 – 59 6. Over 60	1 2 3 4 5 6
32	Are you	1. Female 2. Male	1 2
33	Your occupation	1. Academic 2. Administrative Assistant/Secretary 3. Administrator/Manager 4. Designer 5. Director/VP/Chief Executive 6. IT Consultant 7. IT Professional 8. Journalist 9. Student 10. Technical expert 11. Writer 12. Other, please specify	1 2 3 4 5 6 7 8 9 10 11 12
34	Number of years in your career	1. 1 – 3 2. 4 – 6 3. 7 – 9 4. 10 – 20 5. Over 20	1 2 3 4 5
35	Your degree	1. Associate's 2. Bachelor's 3. Master's 4. PhD 5. Professional Certification	1 2 3 4 5
36	Your organization	1. For-Profit 2. Government 3. Education 4. International 5. Not-For-Profit 6. State-Owned Enterprise	1 2 3 4 5 6

Call for Survey Participation

On February 26, 2008 – posted on http://opencare.org/blog.html forum – a Thai and English language web forum on Open Exchange for Collaborative Activities in Response to Emergencies



On March 21, 2008 – posted on www.blognone.com – Thai language web forum for Thai IT professionals.



```
/*************************************************************/
/* SAS Program created on August 08, 2008                    */
/* Joy Aswalap mod on (1) March 02, 2009, (2) March 23, 2009 */
/*                    (3) April 14, 2009, (4) May 05, 2009   */
/*************************************************************/

DM "Log;Clear;OUT;Clear;" ;
options pageno=min nodate formdlim='-' mprint;

PROC IMPORT OUT= WORK.Tsunami1
     DATAFILE= "E:\Web_Survey\Joy_WebSurvey3.xls"
     DBMS=EXCEL2000 REPLACE;
     RANGE="1StudyIntro$";
     GETNAMES=Yes;
RUN;
PROC IMPORT OUT= WORK.Tsunami2
     DATAFILE= "E:\Web_Survey\Joy_WebSurvey3.xls"
     DBMS=EXCEL2000 REPLACE;
     RANGE="2TsunamiRelief$";
     GETNAMES=Yes;
RUN;
PROC IMPORT OUT= WORK.Tsunami3
     DATAFILE= "E:\Web_Survey\Joy_WebSurvey3.xls"
     DBMS=EXCEL2000 REPLACE;
     RANGE="3FutureDisaster$";
     GETNAMES=Yes;
RUN;
PROC IMPORT OUT= WORK.Tsunami4
     DATAFILE= "E:\Web_Survey\Joy_WebSurvey3.xls"
     DBMS=EXCEL2000 REPLACE;
     RANGE="4InformationSociety$";
     GETNAMES=Yes;
RUN;
PROC IMPORT OUT= WORK.Tsunami5
     DATAFILE= "E:\Web_Survey\Joy_WebSurvey3.xls"
     DBMS=EXCEL2000 REPLACE;
     RANGE="5DisasterEffects$";
     GETNAMES=Yes;
RUN;
PROC IMPORT OUT= WORK.Tsunami6
     DATAFILE= "E:\Web_Survey\Joy_WebSurvey3.xls"
     DBMS=EXCEL2000 REPLACE;
     RANGE="6PersonalInfo$";
     GETNAMES=Yes;
RUN;
%Let MyDataSetName = Tsunami;
/* proc print data= &MyDataSetName.2; */
%macro getnumbers(DataSetNumber,var1);
Data &MyDataSetName.&DataSetNumber;
Set  &MyDataSetName.&DataSetNumber;

If &var1 = "Strongly Agree" then &var1.L = 7;
If &var1 = "Agree" then &var1.L = 6;
If &var1 = "Somewhat Agree" then &var1.L = 5;
```

```
If &var1 = "Neutral" then &var1.L = 4;
If &var1 = "Somewhat Disagree" then &var1.L = 3;
If &var1 = "Disagree" then &var1.L = 2;
If &var1 = "Strongly Disagree" then &var1.L = 1;
If &var1 = "I Don't Know" then &var1.L = 4;
/**This program makes Neutral equivalent to Don't know"**/
If &var1 = "No" then &var1.L = 0;
If &var1 = "Yes" then &var1.L = 1;
/*Drop &var1;*/
%mend getnumbers;

%macro ChangeVariablesToLikert(DataSetNumber);
%If &DataSetNumber = 2 %then %do;
   %getnumbers(&DataSetNumber,MICT)
   %getnumbers(&DataSetNumber,GCC)
   %getnumbers(&DataSetNumber,DDPM)
   %getnumbers(&DataSetNumber,NECTEC)
   %getnumbers(&DataSetNumber,TTVI)
   %getnumbers(&DataSetNumber,INET)
   %getnumbers(&DataSetNumber,OnSite)
   %getnumbers(&DataSetNumber,Online)
   %getnumbers(&DataSetNumber,Income)
   %getnumbers(&DataSetNumber,JobSecurity)
   %getnumbers(&DataSetNumber,Wealth)
   %getnumbers(&DataSetNumber,Family)
   %getnumbers(&DataSetNumber,Social_Life)
   %getnumbers(&DataSetNumber,Fut_Society)
   %getnumbers(&DataSetNumber,Emotional)
   %getnumbers(&DataSetNumber,Physical)
   %getnumbers(&DataSetNumber,Fut_Well_Being)
%End;
%If &DataSetNumber = 3 %then %do;
   %getnumbers(&DataSetNumber,MICT)
   %getnumbers(&DataSetNumber,NECTEC)
   %getnumbers(&DataSetNumber,INET)
   %getnumbers(&DataSetNumber,OnSite)
   %getnumbers(&DataSetNumber,Online)
   %getnumbers(&DataSetNumber,Income)
   %getnumbers(&DataSetNumber,JobSecurity)
   %getnumbers(&DataSetNumber,Wealth)
   %getnumbers(&DataSetNumber,Family)
   %getnumbers(&DataSetNumber,Social_Life)
   %getnumbers(&DataSetNumber,Fut_Society)
   %getnumbers(&DataSetNumber,Emotional)
   %getnumbers(&DataSetNumber,Physical)
   %getnumbers(&DataSetNumber,Fut_Well_Being)
%End;
%If &DataSetNumber = 4 %then %do;
   %getnumbers(&DataSetNumber,MICT)
   %getnumbers(&DataSetNumber,SIPA)
   %getnumbers(&DataSetNumber,SmartCard)
   %getnumbers(&DataSetNumber,NSTDA)
   %getnumbers(&DataSetNumber,NECTEC)
   %getnumbers(&DataSetNumber,NTC)
   %getnumbers(&DataSetNumber,INET)
   %getnumbers(&DataSetNumber,Sanook)
   %getnumbers(&DataSetNumber,Gotoknow)
```

```
   %getnumbers(&DataSetNumber,OnSite)
   %getnumbers(&DataSetNumber,Online)
   %getnumbers(&DataSetNumber,Income)
   %getnumbers(&DataSetNumber,JobSecurity)
   %getnumbers(&DataSetNumber,Wealth)
   %getnumbers(&DataSetNumber,Family)
   %getnumbers(&DataSetNumber,Social_Life)
   %getnumbers(&DataSetNumber,Fut_Society)
   %getnumbers(&DataSetNumber,Emotional)
   %getnumbers(&DataSetNumber,Physical)
   %getnumbers(&DataSetNumber,Fut_Well_Being)

%End;
%If &DataSetNumber = 5 %then %do;
   %getnumbers(&DataSetNumber,OnSite)
   %getnumbers(&DataSetNumber,Online)
   %getnumbers(&DataSetNumber,Income)
   %getnumbers(&DataSetNumber,JobSecurity)
   %getnumbers(&DataSetNumber,Wealth)
   %getnumbers(&DataSetNumber,Family)
   %getnumbers(&DataSetNumber,Social_Life)
   %getnumbers(&DataSetNumber,Fut_Society)
   %getnumbers(&DataSetNumber,Emotional)
   %getnumbers(&DataSetNumber,Physical)
   %getnumbers(&DataSetNumber,Fut_Well_Being)
%End;
%mend ChangeVariablesToLikert;
%macro GetLongFormofData(DataSetNumber);

/* I find these agencies and their efforts to be crucial in providing TSUNAMI
DISASTER RELIEF */

%If &DataSetNumber = 2 %then %do;
 Data &MyDataSetName.&DataSetNumber.Long;
 set  &MyDataSetName.&DataSetNumber;
 JobSecFactor = (IncomeL + JobSecurityL + WealthL + PhysicalL)/4;
 SocietyFamFactor = (EmotionalL + FamilyL + Social_LifeL + Fut_SocietyL)/4;
 resp = MICTL; FactorLevel = 1; output;
 resp = GCCL; FactorLevel = 2; output;
 resp = DDPML; FactorLevel = 3; output;
 resp = NECTECL; FactorLevel = 4; output;
 resp = TTVIL; Factorlevel = 5; output;
 resp = INETL; FactorLevel = 6; output;
%end;

/* I find these agencies and their initiatives to be crucial in providing
FUTURE DISASTER RELIEF */

%If   &DataSetNumber = 3 %then %do;
 Data &MyDataSetName.&DataSetNumber.Long;
 set  &MyDataSetName.&DataSetNumber;
 JobSecFactor = (IncomeL + JobSecurityL + WealthL + PhysicalL)/4;
 SocietyFamFactor =(EmotionalL +FamilyL +Social_LifeL +Fut_SocietyL)/4;
 resp = MICTL; FactorLevel = 1; output;
 resp = NECTECL; FactorLevel = 2; output;
 resp = INETL; FactorLevel = 3; output;
%end;
```

```
/* I find these agencies and their roles to be crucial in
/* the success of the DEVELOPEMENT OF INFORMATION SOCIETY IN THAILAND FROM
1991 TO PRESENT */

%If &DataSetNumber = 4 %then %do;
 Data &MyDataSetName.&DataSetNumber.Long;
 set  &MyDataSetName.&DataSetNumber;
 JobSecFactor = (IncomeL + JobSecurityL + WealthL + PhysicalL)/4;
 SocietyFamFactor = (EmotionalL + FamilyL + Social_LifeL + Fut_SocietyL)/4;
 resp = MICTL; FactorLevel = 1; output;
 resp = SIPAL; FactorLevel = 2; output;
 resp = SmartCardL; FactorLevel = 3; output;
 resp = NSTDAL; FactorLevel = 4; output;
 resp = NECTECL; Factorlevel = 5; output;
 resp = NTCL; FactorLevel = 6; output;
 resp = INETL; FactorLevel = 7; output;
 resp = SanookL; Factorlevel = 8; output;
 resp = GotoKnowL; FactorLevel = 9; output;
%end;

%mend GetLongFormofData;
%macro GetANOVA(DataSetNumber);

Proc Glm data = &MyDataSetName.&DataSetNumber.Long;
Class FactorLevel Entry_ID;
Model resp = Entry_ID FactorLevel;
Means FactorLevel / Alpha = .05 Duncan Tukey LSD SNK;
title " ANOVA and Multiple Comparisons for
&MyDataSetName.&DataSetNumber.Long";
run;
%mend GetANOVA;

%ChangeVariablesToLikert(2)
%ChangeVariablesToLikert(3)
%ChangeVariablesToLikert(4)
%ChangeVariablesToLikert(5)

%GetLongFormofData(2)
%GetLongFormofData(3)
%GetLongFormofData(4)
%GetLongFormofData(6)

%GetANOVA(2)
%GetANOVA(3)
%GetANOVA(4)

/* proc print data= &MyDataSetName.2Long  (obs = 1); title "PrintOut of
DataSet &MyDataSetName.2Long ";
run; */

proc factor data=&MyDataSetName.5 corr
      scree method=prin n=2 rotate=varimax /*rotate= quartimax */
      rotate = promax outstat=factcorr reorder /*plot*/
      msa Fuzz = .4;
      var IncomeL JobSecurityL WealthL FamilyL Social_LifeL Fut_SocietyL
      EmotionalL PhysicalL Fut_Well_BeingL;
```

```
      Title "Factor Analysis: Financial, Social, and Physical & Emotional
      Variables";
run;
proc corr data=&MyDataSetName.5 alpha;
      var IncomeL JobSecurityL WealthL PhysicalL;
      Title "Control Pearson correlation statistics: Compute Cronbach's
      coefficient alpha";
run;
proc corr data=&MyDataSetName.5 alpha;
      var FamilyL Social_LifeL Fut_SocietyL EmotionalL ;
      Title "Control Pearson correlation statistics: Compute Cronbach's
      coefficient alpha";
run;
proc corr data=&MyDataSetName.5 alpha; var Fut_Well_BeingL ;
      Title "Control Pearson correlation statistics: Compute Cronbach's
      coefficient alpha";
run;

Data Tsunami2_forRegTop;
Set &MyDataSetName.2Long;
AgencyVals = (DDPML + NECTECL + TTVIL + INETL)/4;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;

Proc Reg data = Tsunami2_forRegTop;
      Model  AgencyVals = Org_Edu Org_Gov Gender AgeLevel EducLevel
      JobLevel_Years
JobSecFactor SocietyFamFactor Fut_Well_BeingL;
      title  "Regression using &MyDataSetName.2Long";
      title2 "To Predict AgencyVals DDPML + NECTECL + TTVIL + INETL";
      title3 "With JobSecFactor SocietyFamFactor Fut_Well_BeingL";
      title4 "And Org_Class Gender AgeLevel EducLevel JobLevel_Years";
run;

Data Tsunami2_forRegAfterTop;
      Set &MyDataSetName.2Long;
      AgencyVals = (MICTL + GCCL)/2;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;
Proc Reg data = Tsunami2_forRegAfterTop;
Model  AgencyVals = Org_Edu Org_Gov Gender AgeLevel EducLevel JobLevel_Years
JobSecFactor SocietyFamFactor Fut_Well_BeingL;
      title  "Regression using &MyDataSetName.2Long";
      title2 "To Predict AgencyVals(MICTL + GCCL)";
      title3 "With JobSecFactor SocietyFamFactor Fut_Well_BeingL";
      title4 "And Org_Class Gender AgeLevel EducLevel JobLevel_Years";
run;

Data Tsunami3_forReg; Set &MyDataSetName.3Long;
AgencyVals = (MICTL + NECTECL + INETL)/3;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;

Proc Reg data = Tsunami3_forReg;
```

```
Model  AgencyVals = Org_Edu Org_Gov Gender AgeLevel EducLevel JobLevel_Years
JobSecFactor SocietyFamFactor Fut_Well_BeingL;
      title  "Regression using &MyDataSetName.3Long";
      title2 "To predict AgencyVals with MICTL + NECTECL + INETL";
      title3 "With JobSecFactor SocietyFamFactor Fut_Well_BeingL";
      title4 "With Org_Class Gender AgeLevel EducLevel JobLevel_Years";
run;

Data Tsunami4_forReg_TOP;
Set &MyDataSetName.4Long;
AgencyVals = (NSTDAL + NECTECL )/2;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;

Proc Reg data = Tsunami4_forReg_TOP;
Model  AgencyVals = Org_Edu Org_Gov Gender AgeLevel EducLevel JobLevel_Years
JobSecFactor SocietyFamFactor Fut_Well_BeingL;
      title "Regression using &MyDataSetName.4Long";
      title2 "To predict AgencyVals with NSTDAL + NECTECL ";
      title3 "With JobSecFactor SocietyFamFactor Fut_Well_BeingL";
      title4 "With Org_Class Gender AgeLevel EducLevel JobLevel_Years";

run;

Data Tsunami4_forReg_2ndfromTop;
Set &MyDataSetName.4Long;
AgencyVals = (INETL + SanookL + GotoKnowL + MICTL )/4;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;

Proc Reg data = Tsunami4_forReg_2ndfromTop;
Model  AgencyVals = Org_Edu Org_Gov Gender AgeLevel EducLevel JobLevel_Years
JobSecFactor SocietyFamFactor Fut_Well_BeingL;
      title "Regression using &MyDataSetName.4Long";
      title2 "To predict AgencyVals with INETL + SanookL + GotoKnowL + MICTL
      ";
      title3 "With JobSecFactor SocietyFamFactor Fut_Well_BeingL";
      title4 "With Org_Class Gender AgeLevel EducLevel JobLevel_Years";

run;

Data Tsunami4_forReg_3ndfromTop;
Set &MyDataSetName.4Long;
AgencyVals = (NTCL + SIPAL + SmartCardL )/3;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;

Proc Reg data = Tsunami4_forReg_3ndfromTop;
Model  AgencyVals = Org_Edu Org_Gov Gender AgeLevel EducLevel JobLevel_Years
JobSecFactor SocietyFamFactor Fut_Well_BeingL;
      title "Regression using &MyDataSetName.4Long";
      title2 "To predict AgencyVals with NTCL + SIPAL + SmartCardL  ";
      title3 "With JobSecFactor SocietyFamFactor Fut_Well_BeingL";
      title4 "With Org_Class Gender AgeLevel EducLevel JobLevel_Years";
```

```
run;
/* proc print data= &MyDataSetName.3; proc print data= &MyDataSetName.4;
proc print data= &MyDataSetName.5;proc print data= &MyDataSetName.6;*/

Data Tsunami2_RespondentsProfile;
Set &MyDataSetName.2;
      if Org_Class = 1 then Org_Edu = 1; else Org_Edu = 0;
      if Org_Class = 2 then Org_Gov = 1; else Org_Gov = 0;
      if Org_Class = 3 then Org_Com = 1; else Org_Com = 0;

proc freq  data= Tsunami2_RespondentsProfile;
tables AgeLevel Gender JobLevel_Years EducLevel Organization OnSite
          Org_Class Org_Edu Org_Gov Org_Com Thai Online IT_Profession ;
    title " Survey Participants Profile ";
run;
proc tabulate data= &MyDataSetName.2;
      CLASS Organization Gender AgeLevel EducLevel JobLevel_Years OnSite;
      /*VAR AgeLevel EducLevel;*/
      TABLE AgeLevel ,  Organization * Gender;
      TABLE EducLevel,  Organization * Gender;
      TABLE JobLevel_Years,  Organization * Gender;
      TABLE OnSite (ALL) , Organization * Gender;
run;
quit;
```

APPENDIX I

FOUR-SECTOR AGGREGATION OF THE THAI EMPLOYMENT

1971-2006

(1971 – 1990)
(in thousands)

Group	Sector	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
0-1, 2, 3	Information	581	657	710	922	783	737	933	1,016	1,148	1,246
4, 5	Service	1,610	1,845	2,008	2,394	2,075	1,806	2,193	2,302	2,417	2,477
6	Agriculture	12,771	11,245	11,743	9,117	10,782	11,284	12,306	13,237	12,367	15,960
7,8,9	Industry	1,636	2,290	2,283	2,967	2,537	2,286	2,705	2,660	3,089	2,841
	Total Employment	16,597	16,037	16,744	15,401	16,177	16,113	18,137	19,215	19,020	22,523

Group	Sector	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
0-1, 2, 3	Information	1,427	1,597	1,777	1,705	1,658	1,942	2,093	2,218	2,195	2,353
4, 5	Service	2,629	3,086	3,036	3,055	3,106	3,414	3,789	3,736	3,665	3,796
6	Agriculture	13,396	13,249	14,435	15,386	17,717	17,825	18,245	19,578	20,431	19,755
7,8,9	Industry	3,420	3,679	3,660	3,653	3,363	3,484	3,931	3,923	4,303	4,909
	Total Employment	20,872	21,611	22,908	23,799	25,843	26,664	28,057	29,455	30,594	30,814

(continued)

(continued)

(1991 – 2006)
(in thousands)

Group	Sector	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0-1, 2, 3	Information	2,621	2,884	3,151	3,313	3,577	3,530	3,799	3,907	4,143	4,180
4, 5	Service	4,278	4,188	4,588	4,542	5,015	5,193	5,458	5,522	5,850	5,955
6	Agriculture	18,808	19,700	18,295	18,002	17,021	16,171	16,765	16,493	15,620	16,178
7,8,9	Industry	5,420	5,589	6,103	6,230	6,961	7,329	7,110	6,211	6,465	6,681
	Total Employment	31,127	32,361	32,137	32,087	32,573	32,222	33,131	32,132	32,077	32,994

Group	Sector	2001	2002	2003	2004	2005	2006
0-1, 2, 3	Information	4,643	4,677	4,817	5,062	5,320	5,424
4, 5	Service	5,333	5,368	5,652	6,105	6,219	6,198
6	Agriculture	14,092	14,598	14,299	13,666	13,893	13,894
7,8,9	Industry	9,401	9,607	9,895	10,856	10,830	10,769
	Total Employment	33,469	34,249	34,663	35,689	36,262	36,285

Source: Compiled from International Labour Office (ILO) Bureau of Statistics (ILO, 2008)

APPENDIX J

GROWTH RATE OF THE FOUR-SECTOR EMPLOYMENT

1972-2006

(1972 – 1990)

Sector	1972	1973	1974	1975	1976	1977	1978	1979	1980
Information	0.13	0.08	0.30	-0.15	-0.06	0.27	0.09	0.13	0.08
Service	0.15	0.09	0.19	-0.13	-0.13	0.21	0.05	0.05	0.03
Agriculture	-0.12	0.04	-0.22	0.18	0.05	0.09	0.08	-0.07	0.29
Industry	0.40	0.00	0.30	-0.14	-0.10	0.18	-0.02	0.16	-0.08
Total Employment	-0.03	0.04	-0.08	-0.05	0.00	0.13	0.06	-0.01	0.18

Sector	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Information	0.15	0.12	0.11	-0.04	-0.03	0.17	0.08	0.06	-0.01	0.07
Service	0.06	0.17	-0.02	0.01	0.02	0.10	0.11	-0.01	-0.02	0.04
Agriculture	-0.16	-0.01	0.09	0.07	0.15	0.01	0.02	0.07	0.04	-0.03
Industry	0.20	0.08	-0.01	0.00	-0.08	0.04	0.13	0.00	0.10	0.14
Total Employment	-0.07	0.04	0.06	0.04	0.09	0.03	0.05	0.04	0.01	0.01

(continued)

(continued)

(1991 – 2006)

Sector	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Information	0.11	0.10	0.09	0.05	0.08	-0.01	0.08	0.03	0.06	0.01
Service	0.13	-0.02	0.10	-0.01	0.10	0.04	0.05	0.01	0.06	0.02
Agriculture	-0.05	0.05	-0.07	-0.02	-0.05	-0.05	0.04	-0.02	-0.05	0.04
Industry	0.10	0.03	0.09	0.02	0.12	0.05	-0.03	-0.13	0.04	0.03
Total Employment	0.01	0.04	-0.01	0.00	0.02	-0.01	0.03	-0.03	0.00	0.03

Sector	2001	2002	2003	2004	2005	2006
Information	0.11	0.01	0.03	0.05	0.05	0.02
Service	-0.10	0.01	0.05	0.08	0.02	0.00
Agriculture	-0.13	0.04	-0.02	-0.04	0.02	0.00
Industry	0.41	0.02	0.03	0.10	0.00	-0.01
Total Employment	0.01	0.02	0.01	0.03	0.02	0.00

Source: Calculated from Appendix I.

APPENDIX K

INDICATORS ON ICT INFRASTRUCTURE AND ACCESS IN THAILAND

1991-2007

(1991 – 1998)
(per 100 inhabitants)

	Basic Core	1991	1992	1993	1994	1995	1996	1997	1998
A1	Fixed telephone lines	2.83	3.22	3.94	4.84	6.05	7.15	8.20	8.47
A2	Mobile cellular subscribers	0.22	0.45	0.74	1.30	2.26	3.17	3.75	3.32
A3	Computers	0.55	0.81	1.01	1.20	1.41	1.72	2.04	2.19
A4	Internet subscribers	0	0	0.01	0.04	0.08	0.12	0.37	1.13
A5	Broadband Internet subscribers	0	0	0	0	0	0	0	0
A6	International Internet bandwidth per inhabitant (bits per person)	0	0	0	0	0.08	0.18	0.55	0.62

(continued)

(continued)

(1999 – 2007)
(per 100 inhabitants)

	Basic Core	1999	2000	2001	2002	2003	2004	2005	2006	2007
A1	Fixed telephone lines	8.68	9.22	9.89	10.63	10.68	10.89	11.17	11.15	11.00
A2	Mobile cellular subscribers	3.89	5.04	12.34	16.49	35.14	43.76	49.42	64.19	123.87
A3	Computers	2.30	2.83	3.27	3.99	4.87	5.94	7.00	8.24	9.71
A4	Internet subscribers	2.50	3.79	5.72	7.78	9.66	11.14	15.73	17.99	21.02
A5	Broadband Internet subscribers	0	0	0	0.02	0.07	0.12	0.17	0.8	1.43
A6	International Internet bandwidth per inhabitant (bits per person)	1.97	4.41	10.49	16.39	23.14	48.04	108.06	156.19	345.80

Source: World Development Indicators (World Bank, 2008, 2009)

(1991 – 1998)
(millions)

ICT infrastructure	1991	1992	1993	1994	1995	1996	1997	1998
Fixed telephone lines	1,553,160	1,790,029	2,214,519	2,750,839	3,481,997	4,160,158	4,826,684	5,037,549
Mobile cellular subscriptions	123,551	250,584	413,557	737,283	1,297,826	1,844,627	2,203,905	1,976,957
Personal computers	300,000	450,000	570,000	680,000	810,000	1,000,000	1,200,000	1,300,000
Internet subscribers	30	200	8,000	23,000	45,000	70,000	220,000	670,000
Fixed broadband subscribers	-	-	-	-	-	-	-	-
International Internet bandwidth (Mbps)	-	0.06	0.13	0.13	4.77	10.25	32.50	37.00

(continued)

(continued)

(1999 – 2007)
(millions)

ICT infrastructure	1999	2000	2001	2002	2003	2004	2005	2006	2007
Fixed telephone lines	5,215,636	5,591,084	6,049,129	6,557,023	6,632,409	6,811,615	7,034,662	7,071,633	7,024,049
Mobile cellular subscriptions	2,339,401	3,056,000	7,550,000	10,171,550	21,828,180	27,378,660	31,136,540	40,723,180	79,065,760
Personal computers	1,382,000	1,714,000	2,003,000	2,461,000	3,024,000	3,716,000	4,408,000	5,421,840	6,668,863
Internet subscribers	1,500,000	2,300,000	3,500,000	4,800,000	6,000,000	6,970,000	9,909,000	11,413,000	13,416,000
Fixed broadband subscribers	-	-	1,613	15,000	45,000	75,000	105,000	509,000	913,000
International Internet bandwidth (Mbps)	118.25	267.50	642.00	1,010.63	1,437.69	3,005.88	6,807.87	9,909.00	22,073.00

Source: World Development Indicators (World Bank, 2008, 2009)

APPENDIX L

THE 2004 TSUNAMI'S TEMPORARY MORGUE AND DATA CENTER

Images reproduced with permission from
Khun Akarawuth Tamrareang,
IT Director, Public Disaster Relief Volunteer Association of Thailand

Temporary Morgue

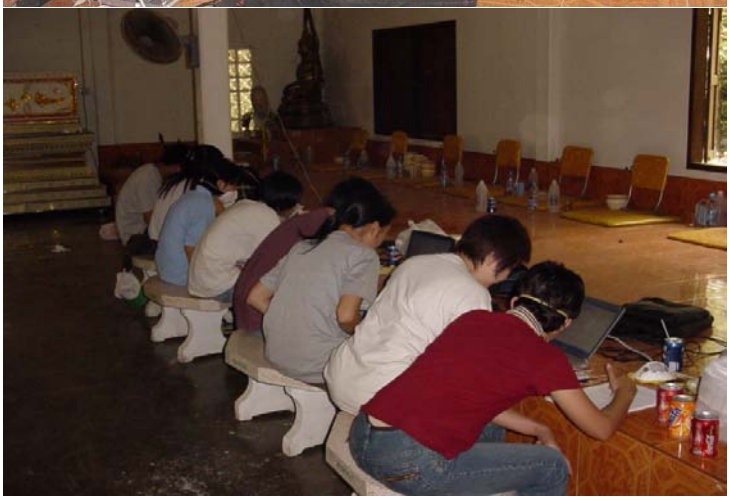
Wat Bang Muang
Phang-nga Province
Thailand

Data Center

Wat Bang Muang
Phang-nga Province
Thailand








APPENDIX M

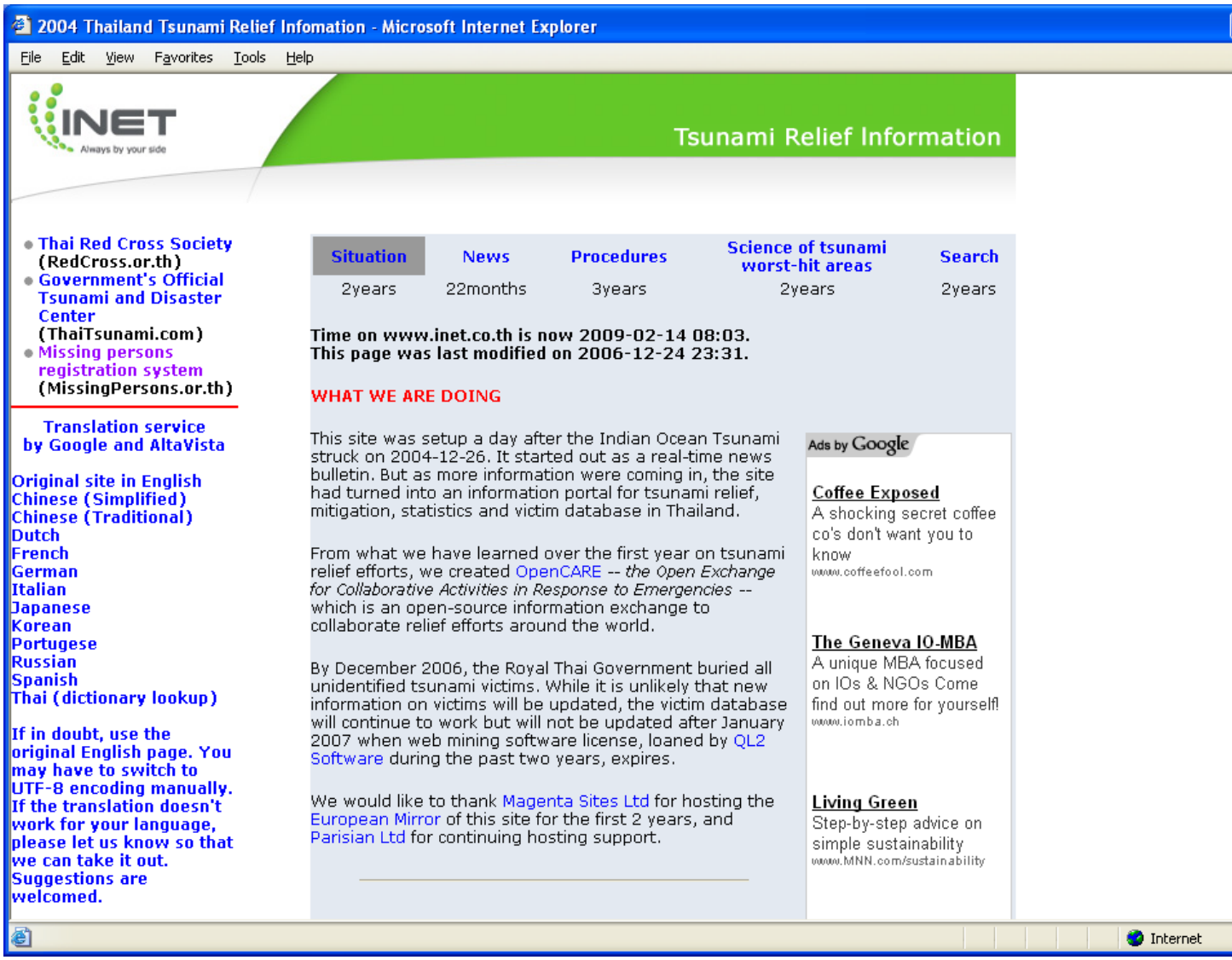
THE 2004 THAILAND TSUNAMI RELIEF INFORMATION

Images reproduced with permission from
Khun Trin Tantsetthi
Webmaster, INET Tsunami Relief

www.inet.co.th/tsunami

December 2004

by Trin Tantsetthi



“Universal Search Engine for Identified Tsunami Victims in Thailand” Page

This search facility compares fullname given below against 168,300 records from 18 "official" information sources of the 2004 Tsunami in Thailand. Don't worry about the abundant number of records; data from different sources duplicate. Search results give you clickable hyperlinks to information from the original sources that matches the name -- and that you can follow the lead from there.

If you cannot find a name using this engine, changes are that you will not be able to find the name anywhere else. And that picture search or other means should be employed. **Working through embassy or consulate is strongly recommended for any case**.

Fullname : Search [THAI]

Search results also give the **Reference** information where you can follow the link to the original source of information. Data sources keep evolving and we refresh our database on a daily basis in order to have the latest information available here.

If you cannot locate the person you are looking for, and you have registered the details at missingpersons.or.th, please take time to provide as much additional information plus pictures (or, better, dental X-ray films) if you can. Now you can update the information about your missing loved one. Type in full name in the search box on top-left of this page. Then select name from the list until full details of the missing person appears. At the end of the page, you can choose "Found" or "Add More Information".

SEARCHING for **guillet**

Source: mspsknown (2006-12-22 14:41)
GIVENNAME = Sophie
FAMILYNAME = GUILLET
FULLNAME = Sophie GUILLET
NATION = -
Reference = http://missingpersons.or.th/lostform_foundlistdetail.php?lost_id=200412312088

Search Results

February 2009

(1) Source: mspsknown : NECTEC's Missing Persons website

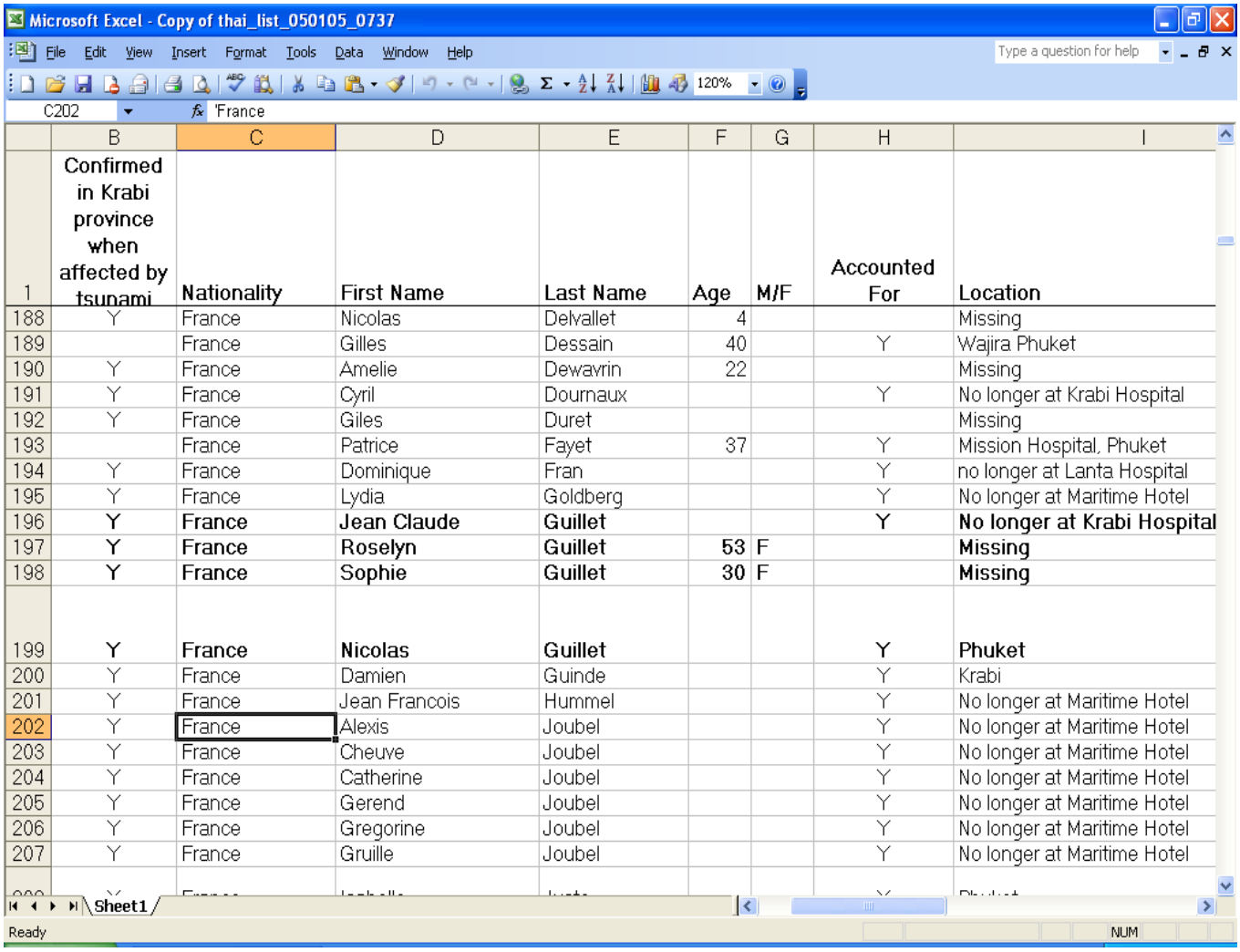
(www.missingpersons.or.th)

Title	Ms.
First Name	Sophie
Middle Name	-
Last Name	GUILLET
Nationality	-
Sex	Female
Age	30
Photograph	no picture
Date found	2005-01-24
Found by	PHUKETITCITY
Location Found	Detail of information at http://203.113.86.240/phuket/detail.php?id=43331
Status	GoHome
Finder Phone	www.phuketitcity.com
Finder Email	www.phuketitcity.com

Search Results

February 2009

(2) Source: krabihosp : Ministry of Public Health website (www.hospital.moph.go.th)



Microsoft Excel - Copy of thai_list_050105_0737

File Edit View Insert Format Tools Data Window Help

C202 'France

1	Confirmed in Krabi province when affected by tsunami	Nationality	First Name	Last Name	Age	M/F	Accounted For	Location
188	Y	France	Nicolas	Delvallet	4			Missing
189		France	Gilles	Dessain	40		Y	Wajira Phuket
190	Y	France	Amelie	Dewavrin	22			Missing
191	Y	France	Cyril	Dournaux			Y	No longer at Krabi Hospital
192	Y	France	Giles	Duret				Missing
193		France	Patrice	Fayet	37		Y	Mission Hospital, Phuket
194	Y	France	Dominique	Fran			Y	no longer at Lanta Hospital
195	Y	France	Lydia	Goldberg			Y	No longer at Maritime Hotel
196	Y	France	Jean Claude	Guillet			Y	No longer at Krabi Hospital
197	Y	France	Roselyn	Guillet	53	F		Missing
198	Y	France	Sophie	Guillet	30	F		Missing
199	Y	France	Nicolas	Guillet			Y	Phuket
200	Y	France	Damien	Guinde			Y	Krabi
201	Y	France	Jean Francois	Hummel			Y	No longer at Maritime Hotel
202	Y	France	Alexis	Joubel			Y	No longer at Maritime Hotel
203	Y	France	Cheuve	Joubel			Y	No longer at Maritime Hotel
204	Y	France	Catherine	Joubel			Y	No longer at Maritime Hotel
205	Y	France	Gerend	Joubel			Y	No longer at Maritime Hotel
206	Y	France	Gregorine	Joubel			Y	No longer at Maritime Hotel
207	Y	France	Gruille	Joubel			Y	No longer at Maritime Hotel

Sheet1

Ready NUM

APPENDIX N

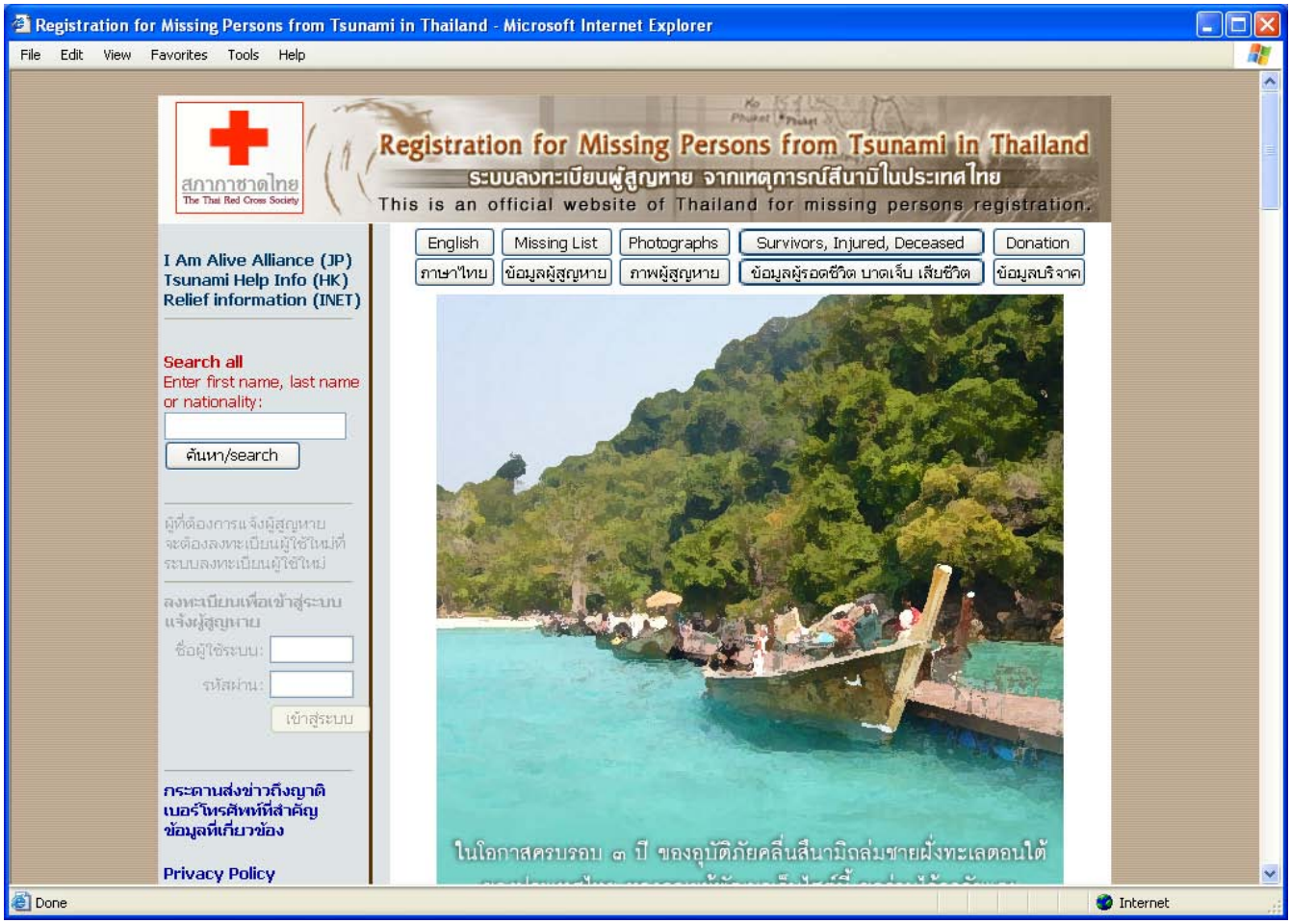
REGISTRATION FOR MISSING PERSONS FROM TSUNAMI IN THAILAND

Images reproduced with permission from
Dr. Pansak Siriruchatapong
Director, NECTEC

www.Missingpersons.or.th

December 2004

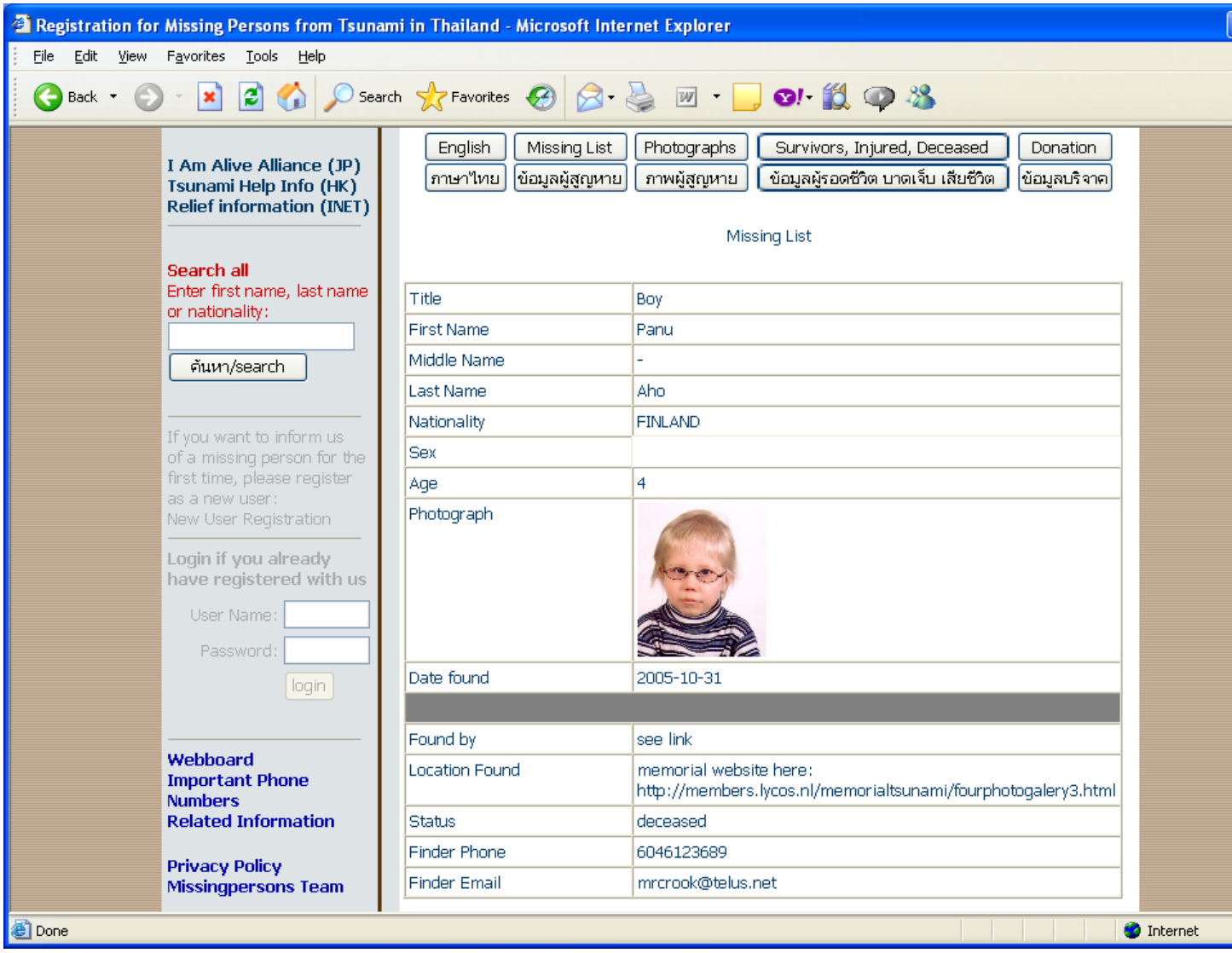
by National Electronics and Computer Technology Center (NECTEC).



"Missing Persons List"

Search "Finland" Nationality

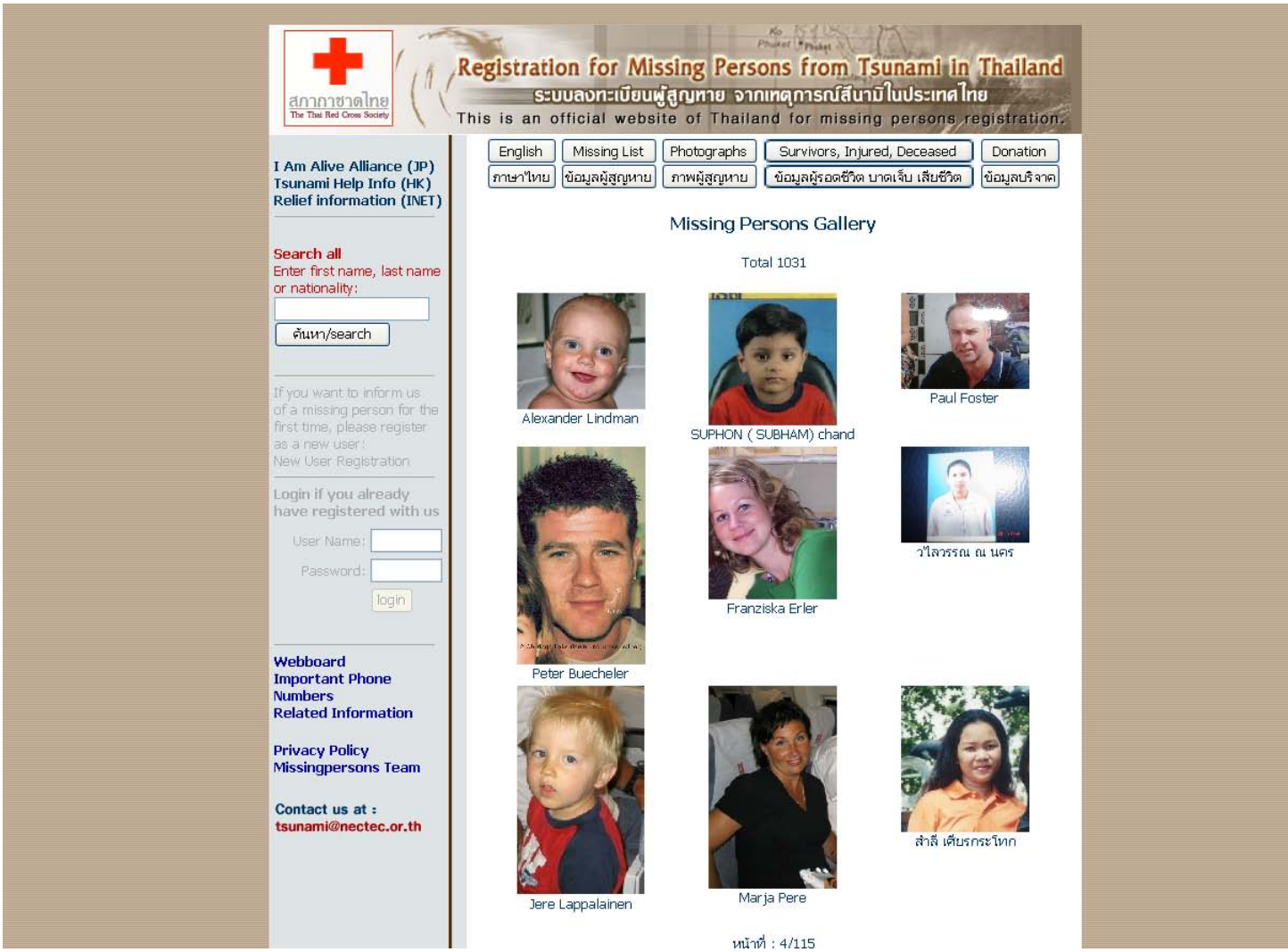
Results of Total Search for Finland: 36 persons



Photographs

“Missing Persons Gallery”

Page 4 of 115 Pages



APPENDIX O

THE EMERGENCY AND EDUCATIONAL VEHICLE

Images reproduced with permission from
Dr. Pansak Siriruchatapong
Director, NECTEC

Emergency.thai.net

May 2006

by National Electronics and Computer Technology Center

(NECTEC)

APPENDIX P

THE SECRETARIAT OF THE CABINET'S DECREE

On the tsunami disaster relief tasks of

Ministry of Information and Communication Technology

From December 26, 2004 to January 4, 2005

(In Thai)

ส่วนราชการเจ้าของเรื่อง ทก
วันที่มีมติ 04/01/2548

เรื่อง การดำเนินงานของ *MICT* เกี่ยวกับคลื่นสึนามิระหว่างวันที่ *26* ธันวาคม *2547* ถึง *4* มกราคม *2548*

คณะรัฐมนตรีมีมติตามที่กระทรวงเทคโนโลยีสารสนเทศและการสื่อสารเสนอ ดังนี้ รับทราบการดำเนินงานให้ความช่วยเหลือจังหวัดที่ประสบภัยคลื่นสึนามิของกระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร ระหว่างวันที่ 26 ธันวาคม 2547 ถึง 4 มกราคม 2548 ในส่วนของ

1. การให้ความช่วยเหลือด้านระบบสื่อสารโทรคมนาคม
2. การรับบริจาค
3. การสร้าง website : www.thaitsunami.com
4. การรับโอน Call Center ของมหาวิทยาลัยธรรมศาสตร์รังสิต รวมทั้ง
5. การส่งเจ้าหน้าที่จากสำนักงานสถิติแห่งชาติลงไปสำรวจความ เสียหายของทรัพย์สิน ความต้องการอย่างเร่งด่วนของประชาชน และ
6. การกำหนดแบบฟอร์มาตรฐานที่จะใช้ ในการกรอกรายละเอียดเกี่ยวกับผู้เสียชีวิต ผู้ที่สูญหาย ผู้ที่บาดเจ็บ และ
7. กำหนด Password ให้กับสถานทูตและผู้ว่าราชการจังหวัดของทุกจังหวัด และ GCC 1111 เพื่อให้ผู้ใช้สามารถมีสิทธิ์เข้าไปดูภาพถ่ายของ ผู้เสียชีวิต และ
8. เห็นชอบให้กระทรวงที่รับผิดชอบในการช่วยเหลือผู้ที่ประสบภัยส่งประกาศที่เกี่ยวข้องมาให้ กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร เพื่อที่จะได้นำข้อมูลดังกล่าวลงในเว็บไซต์ www.thaitsunami.com และ
9. ให้กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร เป็น Contact Point ในการรวบรวมข้อมูลจากทุกหน่วย
10. หากหน่วยงานใดมีความประสงค์ที่จะได้ข้อมูลในเรื่องใด ให้ประสานงานโดยตรงกับกระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร

สำนักเลขาธิการคณะรัฐมนตรี

Source: The Secretariat of the Cabinet http://www.cabinet.soc.go.th/soc/

APPENDIX Q

ICT USE OF THAI POPULATION 6 YEARS AND OVER

2006

By Region

	ICT Use	Population	Internet Use	Computer Use	Mobile Use	Population	Internet Use	Computer Use	Mobile Use
Region									
	Bangkok	6,345	1,774	2,516	4,057	11%	28%	40%	64%
	Central	14,587	2,028	3,827	7,223	25%	14%	26%	50%
	Northern	10,789	1,581	2,804	4,072	18%	15%	26%	38%
	Northeastern	19,847	2,103	4,264	6,274	33%	11%	21%	32%
	Southern	7,938	977	1,979	3,114	13%	12%	25%	39%

Source: Compiled from The National Statistical Office (in Thai) (NSO, 2006)

REFERENCES

AIS. (2009). *Investor relations fact sheet*. Bangkok: Advanced Info Service PLC.

Albala-Bertrand, J. M. (1993). *The political economy of large natural disasters: with special reference to developing countries*. New York: Oxford University Press.

Ash, R. (1997). *The top 10 of everything*. New York: DK Publishing, Inc.

Babe, R. (1993). Communication: Blindspot of western economics. In J. Wasko, V. Mosco & M. Pendakur (Eds.), *Illuminating the blindspots: Essays honoring Dallas W. Smythe*. Norwood, New Jersey: Ablex Publishing Corporation.

Baker, C., & Phongpaichit, P. (2005). *A history of Thailand*. Cambridge: Cambridge University Press.

Barnes, J., & Lamberton, D. M. (1976). The growth of the Australian information society. In D. M. Lamberton & M. Jussawalla (Eds.), *Communication Economics and Development*. New York: Pergamon Press.

Bell, D. (1973). *The coming of post-industrial society*. New York: Basic Books.

Bell, D. (1999). *The coming of post-industrial society: A venture in social forecasting* (Special anniversary ed.). New York: Basic Books.

Berkman. (2006). *Roadmap for open ICT ecosystems*: Berkman Center for Internet & Society at Harvard University.

Boczkowski, P. J. (2004). The mutual shaping of technology and society in videotex newspapers: Beyond the diffusion and social shaping perspectives. *Information Society, 20*, 255-267.

Braman, S. (1989). Defining information: An approach for policy-makers. *Telecommunications Policy, 13*(3), 233-242.

Câmara, G., & Fonseca, F. (2007). Information policies and open source software in developing countries. *Journal of the American Society for Information Science and Technology, 58*(1), 121-132.

Case, D. O. (1994). The social shaping of videotex: How information services for the public have involved. *Journal of the American Society for Information Science, 45*(7), 483-497.

Castells, M. (1996). *The rise of the network society*. Cambridge, Massachusetts: Blackwell Publishers.

CDC. (2005a). Health concerns associated with disaster identification after a tsunami - Thailand, December 26, 2004-March 31, 2005. *Morbidity and Mortality Weekly Report (MMWR),* 54(14), 349-352. US Department of Health and Human Services, Centers for Disease Control and Prevention.

CDC. (2005b). Rapid health response, assessment, and surveillance after a tsunami - Thailand, 2004-2005. *Morbidity and Mortality Weekly Report (MMWR),* 54(3), 61-64. US Department of Health and Human Services, Centers for Disease Control and Prevention.

Chongkittvorn, K. (2005). Taking on a traumatic reporting assignment in Southern Thailand. *Nieman Reports, Spring 2005,* 65-67.

CIA. (2003). *The world factbook.* Retrieved September 7, 2004, from http://www.cia.gov/cia/publications/factbook/

CIA. (2008). *The world factbook.* Retrieved October 10, 2008, from https://www.cia.gov/library/publications/the-world-factbook/geos/th.html

Corrales, J., & Westhoff, F. (2006). Information technology adoption and political regimes. *International Studies Quarterly, 2006*(50), 911-933.

Dearnley, J., & Feather, J. (2001). *The wired world : An introduction to the theory and practice of the information society*. London: Library Association Publishing.

Denning, P. J. (2006). Hastily formed networks. *Communications of the ACM, 49*(4), 15-20.

Dhar, A., & Banerjee, D. (2006, April 1, 2006). Thailand: A new ICT hub of ASEAN in the making: Interview Permanent Secretary, Ministry of Information and Communication Technology, Royal Thai Government. *e-Gov: www.egovonline.net*, *2*, 8-9.

Dordick, H. S., & Wang, G. (1993). *The information society: A retrospective view*. Newbury Park: Sage Publications.

Duff, A. S. (2000). *Information society studies*. London and New York: Routledge.

Evans, P. (1995). *Embedded autonomy: States and industrial transformation*. Princeton, New Jersey: Princeton University Press.

Funatsu, T., & Kagoya, K. (2003). The middle classes in Thailand: The rise of the urban intellectual elite and their social consciousness. *Developing Economies, XLI*(2), 243-263.

Girling, J. (1996). *Interpreting development: Capitalism, democracy, and the middle class in Thailand*. Ithaca, New York: Cornell Southeast Asia Program.

Griffin, P. (2005, January 28,). Internet helps search for victims. New Zealand Herald. Retrieved November 2, 2008, from http://www.nzherald.co.nz/section/story.cfm?c_id=5&objectid=10008353

Haggard, S. (1990). *Pathways from the periphery: The politics of growth in the newly industrializing countries*. Ithaca and London: Cornell University Press.

Harrington, A. (1995). Companies and capital in Asia-Pacific telecommunications. In J. Ure (Ed.), *Telecommunications in Asia: Policy, planning and development*. Hong Kong: Hong Kong University Press.

Hewison, K. (1997). Introduction: Power, oppositions and democratisation. In K. Hewison (Ed.), *Political change in Thailand: Democracy and participation*. London and New York: Routledge.

Horn, R. (2006). 60 years of Asian heroes: King Bhumibol Adulyadej [Electronic Version]. *TIME Asia* from http://www.time.com/time/asia/2006/heroes/in_adulyadej.html.

IFRC. (2005). *World disasters report 2005*. Geneva: International Federation of Red Cross and Red Crescent Societies.

ILO. (1969). *Yearbook of labour statistics, revised edition, 1968*. Geneva: International Labour Organization.

ILO. (2008). LABORSTA Internet. Retrieved March 3, 2008, from http://laborsta.ilo.org/

INTERPOL. (1997). Disaster victim identification guide. Retrieved November 2, 2008, from http://www.interpol.int/Public/DisasterVictim/guide/default.asp

ITU. (2001). The Internet in South East Asia. Retrieved September 8, 2003, from http://www.itu.int/asean2001/reports/index.html

ITU. (2002). *Bits and bahts: Thailand Internet case study*. Geneva: International Telecommunication Union.

ITU. (2006). *World telecommunication/ICT development report 2006: Measuring ICT for social and economic development*. Geneva: International Telecommunication Union.

ITU. (2009a). *Information Society statistical profiles 2009: Africa*. Geneva: International Telecommunication Union.

ITU. (2009b). *Information Society statistical profiles 2009: Asia and the Pacific*. Geneva: International Telecommunication Union.

ITU/UNTCD. (2007). *World information society report: Beyond WSIS*. Geneva: International Telecom Union/United Nations Conference on Trade and Development.

Jones, C., & Mitnick, S. (2006, May 2006). Open source disaster recovery: Case studies of networked collaboration. *First Monday* Retrieved May 5, 2006, from http://www.firstmonday.org/issues/issue11_5/jones/index.html

Jussawalla, M. (1999). The impact of ICT convergence on development in the Asian region. *Telecommunications Policy*, *23*, 217-234.

Karnjanatawe, K. (2002). ICT Ministry gets Senate nod, will be set up next week. Retrieved October 1, 2002, from http://www.bangkokpost.com

Karunaratne, N., & Jussawalla, M. (1988). Information economies of Indonesia, Malaysia and Thailand. In M. Jussawalla, D. M. Lamberton & N. D. Karunaratne (Eds.), *The cost of*

thinking: Information economies of ten Pacific countries. Norwood, New Jersey: Ablex Publishing Corporation.

Katz, R. L. (1988). *The information society: An international perspective*. New York: Praeger.

Kivikuru, U. (2006). Tsunami communication in Finland: Revealing tensions in the sender-receiver relationship. *European Journal of Communication, 21*(4), 499-520.

Koanantakool, T. (2006, 12 – 15 December 2006). *Emergency and educational communication vehicle (EECV).* Paper presented at the ITU/ESCAP Disaster Communications Workshop, Bangkok, Thailand.

Koanantakool, T. (2007a, February 7, 2007). A brief history of ICT in Thailand. *The Bangkok Post*.

Koanantakool, T. (2007b). Important Internet statistics of Thailand [Electronic Version]. Retrieved May 9, 2009, from http://internet.nectec.or.th/document/pdf/20070824_Important_Intenet_Statistics_of_Thailand.pdf.

Koanantakool, T., & Udomvitid, K. (2008). Thailand: Digital review of Asia Pacific 2007-2008. Retrieved August 8, 2009, from http://www.idrc.ca/panasia/ev-127181-201-1-DO_TOPIC.html

Kraemer, K. L., & Dedrick, J. (2001). *Payoffs from investment in information technology: Lessons from the Asia-Pacific region*. Irvine: Center for Research on Information Technology and Organizations, University of California, Irvine.

Krairit, D. (2001). *Liberalizing development: Effects of telecommunication liberalization in Thailand and the Philippines.* Unpublished Dissertation, Massachusetts Institute of Technology, Cambridge.

Krootkaew, C. (2003). *Government ICT development in Thailand*. Bangkok: National Electronics and Computer Technology Center (NECTEC).

Krugman, P. (2000). All fall down: Asia's crash. In *The return of depression economics*. New York: W.W. Norton.

Kuo, E. C. Y., & Chen, H.-t. (1987). Toward an information society: Changing occupational structure in Singapore. *Asian Survey, 27*(3), 355-370.

Kuo, E. C. Y., & Low, L. (2001). Information economy and changing occupational structure in Singapore. *The Information Society, 17*, 281-293.

Kvanli, A. H., Pavur, R. J., & Keeling, K. B. (2002). *Introduction to business statistics: A Microsoft Excel, integrated approach* (6th ed.): Thomson South-Western.

Laothamatas, A. (1996). A tale of two democracies: Conflicting perceptions of elections and democracy in Thailand. In R. H. Taylor (Ed.), *The politics of elections in Southeast Asia*. Cambridge, New York, Melbourne: Woodrow Wilson Center Press and Cambridge University Press.

Lievrouw, L. A. (2002a). Determination and contingency in new media development: Diffusion of innovations and social shaping of technology perspectives. In L. A. Lievrouw & S. Livingstone (Eds.), *The Handbook of New Media*. London, Thousand Oaks, New Delhi: SAGE Publications.

Lievrouw, L. A. (2002b). Information Society. In J. R. Schement (Ed.), *Encyclopedia of Communication & Information* (Vol. 2, pp. 430-437). New York: Macmillian Reference.

Lunenburg, F. C., & Irby, B. J. (2008). *Writing a successful thesis or dissertation*. Thousand Oaks, California: Corwin Press, Inc.

Machlup, F. (1962). *The production and distribution of knowledge in the United States*. Princeton, New Jersey: Princeton University Press.

Mackinzie, D. A., & Wajcman, J. (1999). *Social shaping of technology* (2 ed.). Philadelphia: Open University Press.

Mansell, R., & Wehn, U. (1998). *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press.

Martin, S. B. (1998). Information technology, employment, and the information sector: trends in information employment 1970-1995. *Journal of the American Society for Information Science, 19*(12), 1053-1069.

Masuda, Y. (1980). *The information society as post-industrial society*: Institute for the Information Society.

McCargo, D., & Pathmanand, U. (2005). *The Thaksinization of Thailand*. Copenhagen: NIAS Press.

McIntire, D. A. (2007). *Disaster response and recovery: Strategies and tactics for resilience*. New Jersey: John Wiley & Sons, Inc.

MICT. (2005). *Annual report 2005: Ministry of information and communication technology*. Bangkok: Ministry of Information and Communication Technology.

MICT. (2006). *Annual report 2006: Ministry of information and communication technology*. Bangkok: Ministry of Information and Communication Technology.

MICT. (2007). *Annual report 2006: Ministry of information and communication technology*. Bangkok: Ministry of Information and Communication Technology.

Milner, H. V. (2006). The digital divide: The role of political institutions in technology diffusion. *Comparative Political Studies, 39*(2), 176-199.

Morgan, O. W., Sribanditmongkol, P., Perera, C., Sulasmi, Y., Van Alphen, D., & Sondorp, E. (2006). Mass fatality management following the South Asian tsunami disaster: Case studies in Thailand, Indonesia, and Sri Lanka. *Plos Medicine, 3*(6), e195.

Mosco, V. (1992). Dinosaurs alive: Toward a political economy of information. *The Canadian Journal of Information Science, 17*(1), 41-51.

Mosco, V. (1999). New York.Com: A political economy of the "Informational" city. *The Journal of Media Economics, 12*(2), 103-116.

Mydans, S. (2006, November 3, 2006). Weeks past coup, Thais want to pick up pace of change. *The New York Times*.

NDI. (2000). *Combatting corruption at the grassroots: The Thailand experience*. Washington, D.C.: National Democratic Institute for International Affairs (NDI).

NECTEC. (2005). Registration for missing persons from tsunami in Thailand. Retrieved September 9, 2009, from http://missingpersons.or.th/index.en.html

NECTEC. (2009). Background, national electronics and computer technology center. Retrieved June 20, 2009, from http://www.nectec.or.th/2008/nectec-info.html

Niyomsilpa, S. (2000). *The poliltical economy of telecommunications reforms in Thailand*. London and New York: Frances Pinter Publishers.

Nora, S., & Minc, A. (1980). *The computerization of society: A report to the president of France*. Cambridge, MA: The MIT Press.

NSO. (2006). *Information and communication technology survey, 2006*. Bangkok: The National Statistical Office (NSO).

NTC. (2009). The national telecommunications commission today. Retrieved 06/20/2009, 2009, from http://eng.ntc.or.th/index.php

OECD. (1981). *Information activities, electronics and telecommunications technologies: impact of employment, growth and trade*. Paris: Office of Economics Council Development.

OECD. (2005). *Working party on indicators for the information society: Guide to measuring the information society*. Paris: Organisation for Economic Co-operation and Development.

ONI. (2007). Thailand: Country profile. Retrieved August 8, 2009, from http://opennet.net/research/profiles/thailand

ONI. (2008, March 13, 2008). YouTube and the rise of geolocational filtering. Retrieved August 8, 2009, from http://opennet.net/blog/2008/03/youtube-and-rise-geolocational-filtering

Palasri, S., Huter, S., & Wenzel, Z. (1999). The history of the Internet in Thailand. Retrieved March 19, 2005, from http://www.nsrc.org/case-studies/thailand/english/index.html

Petrazzini, B. A. (1995). *The political economy of telecommunication reform in developing countries: Privatization and liberalization in comparative perspective*. Westport, Connecticut: Praeger.

Phongpaichit, P., & Baker, C. (1995). *Thailand economy and politics*. Oxford Singapore New York: Oxford University Press.

Phongpaichit, P., & Baker, C. (1997). Power in transition: Thailand in the 1990s. In K. Hewison (Ed.), *Political change in Thailand: Democracy and participation*. London and New York: Routledge.

Phongpaichit, P., & Baker, C. (2000). *Thailand's crisis*. Chiangmai: Silkworm Books.

Phongpaichit, P., & Baker, C. (2005). *Thaksin: The business of politics in Thailand*. Chiangmai: Silkworm Books.

Platt, J. (2007). Case study. In W. Outhwaite & S. P. Turner (Eds.), *The SAGE handbook of social science methodology*. Los Angeles, London, New Delhi, Singapore: SAGE Publications.

Pool, I. d. S. (1998). Tracking the flow of information. In L. S. Etheredge (Ed.), *Politics in wired nations*. New Brunswick, New Jersey: Transaction Publishers.

Porat, M. U. (1977). *The information economy: Definition and measurement*. Washington, D.C.: U.S. Department of Commerce, Office of Telecommunications.

Ramos, M., & Piper, P. S. (2005, May 2005). Web waves. *Searcher, 13*, 32-39.

Reporter. (2003, September 7, 2003). Govt forces ISPs to block 'inappropriate' websites. *Bangkok Post*.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

RSF. (2006). *Thailand - annual report 2006*: Reporters without borders: Reporters Sans Frontieres.

Samarajiva, R. (2005). Mobilizing information and communications technologies for effective disaster warning: lessons from the 2004 tsunami. *New Media & Society, 7*(6), 731-747.

Sambandaraksa, D. (2007a, February 7, 2007). 20 years of missed milestones. *Bangkok Post*.

Sambandaraksa, D. (2007b, February 7, 2007). MICT's slowed down Thai IT industry. *Bangkok Post*.

Sambandaraksa, D. (2007c, February 7, 2007). MICT has been a disaster and should be disbanded. *Bangkok Post*.

Sambandaraksa, D. (2007d, February 7, 2007). Mother of the Internet is gloomy. *Bangkok Post*.

Sambandaraksa, D. (2007e, August 29, 2007). Opportunity lost: The failed experiment of the ICT Ministry. *Bangkok Post*.

Saunders, R. J., Warford, J. J., & Wellenius, B. (1994). *Telecommunications and economic development* (2nd ed.). Baltimore: The Johns Hopkins University Press.

Schiller, D. (1988). How to think about information. In V. Mosco & J. Wasko (Eds.), *The political economy of information*. Madison: The University of Wisconsin Press.

Secretariat of Cabinet. (2009). The succession of Thai governments (In Thai). Retrieved August 12, 2009, from http://www.cabinet.thaigov.go.th/bb_main11.htm

Sribanditmongkol, P. (2005). General aspects regarding management of dead bodies: Tsunami victim identification in Thailand. Retrieved December 1, 2007, from www.paho.org/English/DD/PED/PungrukWHO_Lima.ppt

Statistics Canada. (2007). ICT definition. Retrieved September 15, 2007, from http://www.statcan.ca/english/freepub/81-004-XIE/def/ictdef.htm

Sulistiyanto, P. (2002). *Thailand, Indonesia and Burma in comparative perspective*. Hampshire, England: Ashgate Publishing.

Sussman, G. (1999). Introduction: Special issue on the political economy of communications. *The Journal of Media Economics, 12*(2), 85-87.

Talero, E. (1997). National information infrastructure in developing economies. In B. Kahin & E. J. W. III (Eds.), *National Information Infrastructure Initiatives*. Cambridge, Massachusetts, and London, England: The MIT Press.

Tantsetthi, T. (2006, September 9, 2009). OpenCARE specifications. Retrieved September 9, 2009, from http://opencare.org/spec.html

Thajchayapong, P., Reinermann, H., Goodman, S. E., & Pipe, G. R. (1997). Social equity and prosperity: Thailand information technology policy into the 21st century. *The Information Society, 13*, 265-286.

UN. (2005a, November 2005). Core ICT indicators: Partnership on measuring ICT for development. Retrieved December 1, 2007, from http://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators.pdf

UN. (2005b). *Tsunami Thailand: One year later: National response and contribution of international partners*. Bangkok: United Nations.

UNEP. (2006). Maps and satellite image analysis produced by GRID-Europe: South Asia Earthquakes and Tsunami Crisis Response. Retrieved January 31, 2007, from http://www.grid.unep.ch/activities/assessment/indianocean_crisis/maps.php

Ure, J. (1995). Telecommunications in ASEAN and Indochina. In J. Ure (Ed.), *Telecommunications in Asia: Policy, Planning and Development*. Hong Kong: Hong Kong University Press.

USGS. (2004). Magnitude 9.0 Sumatra-Andaman islands earthquake FAQ. Retrieved January 31, 2007, from http://earthquake.usgs.gov/eqcenter/eqinthenews/2004/usslav/faq.php

Wade, T. (2005). MIT backs open source in Brazil computers for poor. Retrieved March 18, 2005, from http://www.reuters.com/

Waltham, T. (2003). Connecting the people: Information technology. *Bangkok Post Year End Economic Review 2003*.

Wancharoen, S. (2004, April 2, 2004). Thousands queue in vain on 1st day of applications. *Bangkok Post*, p. 2.

Weber, S. (2004). *The success of open source*. Cambridge, Massachusetts, and London, England: Harvard University Press.

Webster, F. (2003). Information Society. In J. Feather & R. P. Sturges (Eds.), *International encyclopedia of information and library science* (2nd ed., Vol. 2, pp. 1338-1357). London; New York: Routledge.

Wellenius, B., Braga, C. A. P., & Qiang, C. Z.-W. (2000). Investment and growth of the information infrastructure: Summary results of a global survey. *Telecommunications Policy, 24*, 639-643.

Williams, R., & Edge, D. (1996). The social shaping of technology. *Research Policy, 25*, 856-899.

Wilson III, E. J. (2004). *The information revolution and developing countries*. Cambridge, Massachusetts: MIT Press.

Woodworth, B. (2005). *WHO conference on health aspects of tsunami sisaster in Asia*. Phuket, Thailand: World Health Organization.

World Bank. (1998). *East Asia: The road to recovery*. Washington D.C.: The World Bank.

World Bank. (2000). *East Asia: Recovery and beyond*. Washington D.C.: The World Bank.

World Bank. (2007). World development indicators. Retrieved November 1, 2007, from http://devdata.worldbank.org/dataonline/

World Bank. (2008). World development indicators. Retrieved October 10, 2008 from http://devdata.worldbank.org/dataonline/

World Bank. (2009). World development indicators: The World Bank Group.

Yin, R. K. (2003a). *Applications of case study research* (3rd ed.). Thousand Oaks, London, New Delhi: Sage publications.

Yin, R. K. (2003b). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, London, New Delhi: Sage publications.