ICT and Economic Development:

Analyzing Thailand’s Path to the Information Economy

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Abstract

This analysis of the development of Thailand’s information economy places particular emphasis on its ICT and social infrastructure development. Drawing upon lessons learned from similar development trajectories in Ireland, China, and India we develop a set of guidelines for Thailand to consider as it continues its information economy development. From the policy perspective, Thailand, similar to other countries, plans to use ICT as an enabler to develop a knowledge-based society. From the infrastructure perspective, some challenges that Thailand faces are unequal infrastructure development across regions, a small skilled workforce, and low R&D expenditures in the ICT sector. Case studies of ICT sector development in Ireland, India, and China suggest several important strategies and actions that Thailand could emphasize. These include facilitating ICT sector work, ensuring a supply of qualified workforce, exploiting the country’s distinctive capacities, and reconfiguring and adapting its information policy to changes in the global ICT market.

1. Introduction

The development of a sustainable information economy has become a worldwide goal. Developed countries have established national policies regarding strong investment in information and communications technology (ICT) to maintain their leadership positions and to increase their competitiveness in the global information economy. Similarly, developing countries recognize this opportunity to enhance their economic capability by developing a workforce more attuned to the needs of the information economy.

In the information economy, information and knowledge are not only the main inputs but are also the main outputs of production (Castells, 2000). Thus, there is a strong linkage between the development and diffusion of ICT and the development and sustainability of an information economy. Based on the work of Porat (1977), Trauth (2000) categorized the information economy into the primary information sector – consisting of organizations engaged in the production of information technology hardware, software, and services – and the secondary information sectors – consisting of organizations that utilize ICTs and require information and knowledge as important resources in the business processes.

Heeks (2006) pointed out that while ICT production, particularly software production and information technology enabled services, offers greater economic returns, there is little research on ICT production in developing countries compared to research on ICT diffusion and adoption in developed countries. Together with other scholars (Kambhampati, 2002; Carmel, 2003; Sahay et al., 2003), Heeks (2006) argued that for those late entrants, particularly developing countries, their entry barriers into some software markets are not very high and their entry barriers into the services markets are equally low. At the same time, the development of an active ICT sector will not only generate economic impacts, but also drive the developmental momentum of other sectors and produce social goods.
Tessler et al. (2003) suggested that every nation develops a unique ICT industry\(^1\) which is shaped by its own resources, situations, policies, and by the particular global opportunities presented at the time. Therefore, it is important to consider how socio-cultural factors shape the development of the ICT sector and the information economy of a given country, at a time period.

In addition, the ICT market\(^2\) is increasingly globalized. The ICT sector development of a given country is not an isolated activity but rather is closely connected to the global ICT market. Such connections have been manifested in the success stories of those established software exporters such as Ireland and India. As noted by Friedman (2005), because the world is becoming flat, the development of country’s information economy is not sustainable if it remains contained within its own national boundaries.

In this paper, we employ the theoretical model developed by Trauth (2000) in her examination of the development of the Irish information economy to analyze the contextual factors influencing Thailand’s information economy development. We place a particular focus on the influence of national policies and infrastructures on the development of Thailand’s information economy. In our analysis and discussion, we compare the case of Thailand with that of Ireland, India and China in order to gain perspective on the opportunities and challenges facing Thailand as it competes in the global ICT market.

In its effort to develop a sustainable information economy, Thailand has been actively seeking ways to develop its ICT sector, attract foreign investment, foster domestic entrepreneurship, and establish its position as a software exporter and service provider in the global information technology offshore outsourcing market. However, the global offshoring market is highly competitive and Thailand is facing a variety of challenges, from both the established exporters such as Ireland and India and the emerging players such as China and the Philippines. Therefore, there is a need to: 1) explore ways in which socio-cultural factors in the environment affect ICT sector development in Thailand; 2) identify the gaps between Thailand and other countries; and 3) consider how Thailand can learn from other nations’ experiences.

We use Ireland, India and China as referent cases for two reasons. First, the Republic of Ireland has been crowned as the Celtic Tiger analogous to the “East Asian Tigers” (South Korea, Singapore, Hong Kong, and Taiwan), in reference to its rapid economic growth in the 1990s (ÓRiain, 1997). Ireland’s leapfrogging from a traditional agrarian economy to an information economy has been largely attributed to the development and maturation of Irish ICT sector (Tallon and Kraemer, 2000; Trauth, 2000). Thailand, together with Vietnam, the Philippines and Malaysia, is considered to be one of the Four New Asian Tigers. As a country whose traditional economy was based on agriculture, Thailand is currently undergoing the same sort of leapfrogging experienced by Ireland in the 1990s. We believe that drawing on the experience of Ireland will provide rich insights for analyzing Thailand’s path. Second, Thailand is one of the developing countries situated in the Southern-Eastern Asia who share similar geo-political features with India and China. India and China show clear divergence in their development of the ICT sectors with some similarities with respect to the two nations’ stage of economic development. We expect that including the experiences of India and China will provide additional perspectives regarding viable paths available to nations for building their information economies.

This paper proceeds with a description of Trauth’s theoretical framework, followed by a detailed analysis of Thailand’s national policy and infrastructure development. In the discussion section, we use the cases of Ireland, India and China to discuss the unique opportunities and challenges of Thailand in its development of an active ICT sector. We conclude this paper with a discussion of our future research agenda.

2. Theoretical Framework

2.1. The Influence-Impact Model

The factors that are explored in this paper are drawn from the theoretical framework developed by Trauth in a grounded theory examination of the influence of environmental factors on the evolution of Ireland’s information

\(^1\) In this paper, the ICT industry or ICT sector refers to the primary information sector, including the production of ICT hardware, software and services.

\(^2\) The participants of ICT market include both the primary information sector (the producers of ICT hardware, software and services) and the secondary information sector (the consumers of various ICT products).
This ethnographic study of the socio-cultural context within which Ireland’s information economy was emerging resulted in a framework of the reciprocal relationship between socio-cultural factors in the environment and the way in which the ICT sector developed. This Influence-Impact Model (Figure 1) shows the relationship between environmental influences -- expressed as: culture, economy, infrastructure and policy -- and the evolution of the information economy in Ireland.

![Figure 1: Influence-Impact Model](image)

2.2. Applications of Research Model

Following the derivation of the model, Trauth then applied it to specific aspects of Irish society including: the role of economic development policy (Trauth, 2001), workforce development (Trauth, 1999, 1993), multinational influences (Trauth, 1996), telecommunications infrastructure (Trauth and Pitt, 1992), IT workforce management (Weisinger and Trauth, 2003, 2002), women in the ICT workforce (Trauth, 1995), and the development of the software industry (Heavin et al., 2003). This model has also been applied to other contexts. These include: examination of socio-cultural influences on the diffusion of electronic data interchange in the Netherlands (Trauth et al., 1993, 1998), examination of knowledge economy potential in central California (Yeo and Trauth, 2004; Yeo et al., 2004; Huang et al., 2006), the influence of economic and cultural factors on women in the American ICT workforce (Trauth et al., forthcoming), and case studies of socio-cultural factors influencing the sustainability of a knowledge economy in western Ireland, central California and Singapore (Yeo, forthcoming). In this paper we apply this framework as a sensitizing device to facilitate examination of two dimensions of the Influence-Impact Model: policy and infrastructure. We do this by examining data from secondary sources as they relate to both of these themes in Thailand.

3. The Case of Thailand

The economic development of Thailand has gone through several major phases. It has been noted that Thailand was one of the world’s poorest countries at the end of World War II (Warr, 1999). Then, through a half century of reforming and building, Thailand was among the fastest growing economies from 1988-1996 (Warr, 1999). The 1997 economic crisis put a stop to Thailand’s further economic growth, however. Since then, the Thai government has attempted to refocus its economic development initiatives in the direction of building an information- and knowledge-intensive economy. This new direction is reflected in several recent IT policies and plans including IT2000, ICT Master plan 2002-2006, and IT2010. In this section, we discuss Thailand’s policies that are intended to foster an active and productive ICT sector and harness information technology for development.

3.1. ICT and National Policy

3.1.1. The historical perspective

In the late 20th century, the economic structure of Thailand gradually shifted from the agrarian based economy to an information based economy (Intarakunnerd and Panthawi, 2003; Kojima, 2004). For centuries Thailand had been an agricultural economy dependent upon the domestic production and trading of agricultural commodities. In the early 1800s, Thailand developed diplomatic relations with Western countries for trading and began to adopt some Western ideas about commercialization and technology. At the end of the 19th century King Chulalongkorn (Rama V, 1868-1910) brought considerable change to Thailand. The king modernized the civil service, executed the emancipation of slavery,
initialized the basic education system, formed the cabinet government, established a standing army, and piloted the free-trade policies (Paitoonpong and Abe, 2004).

In the latter part of the 20th century Thailand issued the first national economic master plan referred to as the \textit{National Economic and Social Development Plan (1961-1966)} (Dixon, 1999, p. 81). The objective of this plan was to motivate economic growth. Unfortunately, the implementation was not that successful because the necessary societal infrastructure was not yet in place. However, this plan was refined over time and the educational and ICT infrastructures have been increasingly emphasized. As of 2007, Thailand has completed nine economic and social development plans (1961 – 2006) and is currently undergoing the tenth plan that embraces, among other things, human and social capital development, community strengthening, economic restructuring, environmental diversity, and good governance (Paitoonpong and Abe, 2004).

Due to the continuous efforts to reorient the economy, Thailand has experienced a tremendous change in the past 20 years (Paitoonpong and Abe, 2004). This has resulted in Thailand’s increasing rank in growth rate, even topping Japan and the Philippines. Investment in economic growth has been directed at upgrading education, and at skill training in order to raise the productivity and competitiveness of the country (Kojima, 2004). In this regard, Thailand’s knowledge-based labor market has grown while the labor-intensive segment has become smaller.

3.1.2. Policies on science and technology (S&T) development

Thailand’s government has intensively implemented technological development plans through several science and technology initiatives (Itoga, 1998). This reflects the government’s commitment to developing the nation’s scientific and technological capabilities in order to sustain the nation’s economic and social development. This is to be achieved by promoting collaboration between the public and private sectors.

Several new organizations and research centers have been developed to support economic development. They include Thailand’s Ministry of Information and Communication Technology, the National Center for Genetic Engineering and Biotechnology (BIOTEC), the National Metal and Materials Technology Center (MTEC), the National Nanotechnology Center (NANOTEC), the National Electronics and Computer Technology Center (NECTEC), and the Technology Management Center (TMC). In addition, two new entities -- the software park and the software industry promotion agency (SIPA) -- were specifically created to aggressively develop the competitiveness of the Thai software industry in the global market.

Since 2001, the Thai software park’s mission is to improve the quality of software developed by local companies, promote technology transfer, and identify new international market opportunities for local companies. The software park provides many services related to ICT development such as seminars, training, capability maturity module integration (CMMI) appraisal, facilities, office spaces, and consulting. According to the software park’s Web site (http://www.swpark.or.th), as of 2007, more than 300 software companies hire over 40,000 qualified ICT professionals across all regions of Thailand. The software industry promotion agency has played a central role to promote Thai software industry and advance the software market nationally and internationally. Currently, SIPA gives priority to three areas including technology transfer, marketing promotion, and tackling industry development problems.

Thailand has set an aggressive goal to accelerate the technological growth and development to compete with other developed countries by the year 2020 (Wonglimpiyarat, 2006). To reach this goal, the country has invested heavily in science and technology development where the budget has skyrocketed from less than 500 million Baht ($12.5 million) in 1992 to the estimated 2,400 million Baht ($60 million) in 2008 (as shown in Figure 2).
Another indicator of Thailand’s investment in S&T development is the extent of government supported scholarships for Thais to study abroad. The goal is to have these well-educated human resources return to Thailand and serve in government agencies and high-level educational institutions. Table 1 shows the number of scholarships supported by the Thai government.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Coverage-year</th>
<th>Scholarships issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarship to study aboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1990 – 1995</td>
<td>789</td>
</tr>
<tr>
<td>2</td>
<td>1996 – 2004</td>
<td>1199</td>
</tr>
<tr>
<td>3 (current phase)</td>
<td>2005 – 2009</td>
<td>1400</td>
</tr>
<tr>
<td>Domestic scholarship</td>
<td>N/A</td>
<td>200</td>
</tr>
</tbody>
</table>

Source: [http://stscholar.nstda.or.th](http://stscholar.nstda.or.th), last accessed on March 25, 2007

### 3.1.3. Policies on ICT sector development

In 1992, the Thai government established the National IT Committee (NITC) whose members are executives working in relevant public and private sector agencies. In February 1996, NITC developed the first national IT Policy “IT2000” which covered the period from 1996 to 2000. The IT2000 plan focused on three main objectives (Bhattarakosol, 2003):

1. To develop an equitable national information infrastructure
2. To increase investment in human resource and develop skilled IT workforce
3. Utilize IT to deliver public services and governmental operations

In response to the IT2000, various government agencies launched a number of programs. Thuvasethakul and Koanantakool (2002) summarized the success of the IT2000 plan in Table 2.
Table 2: Selected achievements under IT2000 plan

<table>
<thead>
<tr>
<th>Successful Initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. National Internet Exchange Points. The domestic interconnection architecture that allows all domestic Internet traffic to be exchanged within the country.</td>
</tr>
<tr>
<td>2. SchoolNet Thailand. Over 4,300 schools across the country were connected to the internet via dial-up connection free of charge. This initiative encouraged and promoted the Internet use in teaching and remote learning.</td>
</tr>
<tr>
<td>3. Government Information Network. The network facilitates government communications and data exchange among government agencies via high-speed virtual private network (VPN) and through the use of secure access methods including digital ID and public-key infrastructure (PKI).</td>
</tr>
<tr>
<td>4. Development of Legal Infrastructure. The first Electronic Transactions Bills was approved by the Parliament and enacted on December 14, 2001 and came into effect on April 3, 2002.</td>
</tr>
</tbody>
</table>


Thailand is currently pursuing the IT2010 plan, a ten-year National IT Policy for the years 2001 – 2010. The new plan aims to develop towards the knowledge-based society and to follow His Majesty the King’s “Sufficient Economy”. In particular, this long-term plan focuses on promoting innovation, building human capital, and strengthening the information infrastructure and the information industry. The ICT usage is classified into five areas including e-Government, e-commerce, e-industry, e-education, and e-society. The specific quantifiable goals of IT2010 are:

1. To increase technological capability with the goal to shift the country from being in the dynamic adopters category in which innovation diffusion is slow to the potential leader category in which a country has highly skilled human resources and wide technology diffusion, according to the UNDP technological achievement Index.
2. To increase the proportion of “knowledge workers” from 12% in 2001 to 30% in 2010.
3. To increase the proportion of “knowledge-based industries” to 50% of the overall economy of the country.

Some studies identified five key success factors for Thailand to achieve its goals (Intarakumnerd and Panthawi, 2003; Thuvasethakul and Koanantakool, 2002). These factors are:

1. Development of information, contents, and knowledge: To establish the sustainable knowledge-based economy, information, content, and knowledge are as important as physical ICT infrastructure.
2. Continuous development of human capital: This process should be executed through formal, non-formal, and voluntary education systems.
3. Closing the digital divide: Comprehensive action plans to narrow ICT infrastructure divide, literacy divide, cultural divide, and management divide should be considered.
4. Leadership in national ICT development: The country leader and administration is imperative to the success of the plan.
5. Linkage between the policy makers and the policy implementers: The convergence of action and technology is important to optimize and utilize the nation’s resources.

In addition to the long-term plan, Thailand also developed the five-year medium-term ICT master plan (2002-2006) that lays out specific objectives, strategies, and activities that the country plans to achieve during the first five years of the IT2010 plan. The ICT master plan emphasizes the development of the ICT industry, particularly the software industry, to become a regional leader, the use of ICT among small and medium enterprises, government operations and services, and the development of entrepreneurial and R&D capacities in the ICT sector (NECTEC, 2003).

3.1.4. Some of the results

Thailand, at present, has reached the middle point of the IT2010 plan. The results from the implementation of the previous ICT plans are important inputs for the next development phases. According to Thuvasethakul and Pooparadi (2003) in their study of ICT Human Resource Development within Thailand, the percentages of PC ownership and internet access may seem slightly low. However, such figures show significant improvement in technology access when compared to those numbers from the past. There are several options for the population to gain access to PCs and the internet. Besides public libraries and schools, the internet cafés which are now appearing all over the country, especially in Bangkok – the capital city of Thailand -- can be regarded as another convenient, accessible, and affordable channel.
for Thai people to access to ICT. These new channels of access, to some extent, counterbalance the low percentage of PC penetration and internet access.

According to the prediction by SIPA, Thailand’s ICT market growth appears to be on the rise (SIPA, 2006). Figure 3 presents the estimated growth of Thailand’s ICT market from 2005-2008. The market was predicted to grow from 425 billion Baht (approximately $10.6 billion) in 2005 to 734 billion Baht (approximately $18.4 billion) in 2008. This represents a significant growth of 73% across those four years. Note that, among other ICT sectors, the communications sector has the largest share of 74% of Thailand’s ICT market (SIPA, 2006).

![Figure 3: Thailand’s ICT market trajectory (as of 2005)
(Source: SIPA, 2006)](image)

3.2. ICT and Social Infrastructure Development

ICT is the critical backbone of the information economy. The networked readiness index is defined as a country’s degree of preparation to participate in and benefit from ICT development (World Economic Forum, 2004). It is a composite index of the economic and regulatory environment for ICT, and the readiness and usage of ICT among individuals, business, and government. Thailand’s networked readiness was ranked 34 in 2005. This is relatively high compared to other emerging economies such as India (ranked 40), China (ranked 50), and Mexico (ranked 55). The technology achievement index published by the United Nations Development Program (UNDP) offers a slightly different interpretation of the ability of a country to participate in the information economy (UNDP, 2001). In particular, this index focuses on how well a country as a whole creates and uses ICT. According to the UNDP published report, Thailand was ranked 40 and was classified as dynamic adopters of ICT. China, India, Brazil, and the Philippines are among the countries in this group. Overall, these indexes indicate that Thailand has the market, institutional, and the ICT capabilities to participate in the information economy.

With respect to the extent of ICT adoption and usage across Thailand’s population, Table 3 provides the summary of the key ICT indicators in the year 2000 and 2004. It is clear that Thailand has very low fixed line penetration and, more importantly, the fixed phone lines per 100 inhabitants of 10.7 in 2004 shows very little improvement from 9.1 in the year 2000. However, its mobile phone subscribers experienced a substantial 760% increase from 5 to 43 subscribers per 100 inhabitants. This significant jump may compensate for the lack of access to the fixed phone lines (Kauffman and Techatassanasoontorn, 2005a; 2005b). Although the PCs per 100 inhabitants doubled from 2.8 in 2000 to 5.8 in 2004, Thailand’s PC penetration is very low. The significant increase of PC penetration can be explained in part by the fact that the ministry of ICT made the low-cost PCs available to the public in 2003. Similar to PCs, the Internet users per 100 inhabitants tripled from 3.7 in 2000 to 11.0 in 2004. Although the extent of Internet adoption is quite low, the trend is reassuring that the country is on its way to enhance access to basic ICTs.
The distribution of ICT adoption and usage can indicate the extent of equitable ICT diffusion and associated economic and social development. Table 4 presents the distribution of ICT adoption across Thailand’s five geographical regions in 2003. The statistics across technologies clearly illustrate that Bangkok and other surrounding cities are more advanced than other regions of the country in terms of technology adoption. Take the Internet, for example, in 2003, there were 27 internet users per 100 inhabitants in the greater Bangkok which is roughly three times of those numbers elsewhere in the country. Similarly, technology use among business is concentrated among those that are located in greater Bangkok area. For example, 23% of business in greater Bangkok has computers while much fewer businesses ranging from 8% in the North and Northeast to 10% in the South have computers. The same pattern is also observed in the access to the Internet and the presence of Web sites. In sum, these numbers illustrate at least two problems related to ICT usage. First, there is a relatively wide gap regarding ICT access and use that might lead to an even wider digital divide if it is left unchanged. Second, Thailand needs to make significant progress in e-commerce development in order to participate in the global information economy.

Education and the availability of a skilled workforce are important prerequisites to building innovation capacity and to supporting the growth of the information economy. Table 5 presents Thailand’s ICT workforce and R&D expenditures and personnel in 2001. It was reported that there were around 280,000 ICT workers in 2001 or 9 ICT workers per 1,000 workers (NECTEC, 2005). This small ICT workforce reflects relatively low economic development around ICT. In addition, the relatively low proportion of highly skilled ICT workers (27%) will pose a significant challenge for Thailand to reach its goal to become a regional leader in ICT industry, particularly the software industry that requires highly technical and managerial skilled workers. Thailand produced 61,439 science and technology graduates in 2001 but this number is inclusive of all science and technology disciplines. It was reported that data on ICT graduates is not yet available because it is difficult to draw the boundary of what might be considered ICT curriculum.
Table 5: ICT workforce and R&D expenditures and personnel, 2001

<table>
<thead>
<tr>
<th>INDICATORS</th>
<th>HIGHLY SKILLED WORKERS</th>
<th>LOW SKILLED WORKERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT workforce</td>
<td>27%</td>
<td>73%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science and technology graduates</td>
<td>61,439</td>
<td></td>
</tr>
<tr>
<td>Research and Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D expenditure</td>
<td>0.22% of GDP</td>
<td></td>
</tr>
<tr>
<td>R&amp;D expenditure in ICT</td>
<td>3.7% of total R&amp;D expenditure</td>
<td></td>
</tr>
<tr>
<td>R&amp;D personnel</td>
<td>55,748</td>
<td></td>
</tr>
<tr>
<td>R&amp;D personnel in ICT</td>
<td>750</td>
<td></td>
</tr>
</tbody>
</table>

(Source: NECTEC, 2005)

Research and development expenditures and personnel are related to a country’s innovative capability. Thailand has low R&D expenditure, compared with the international standard. Furthermore, the R&D expenditure in ICT was less than 4% of the overall R&D spending. In addition to the small number of R&D personnel in ICT, more than 60% of these workers work for the government and educational institutions. As a result, it is less likely that their innovation will be reflected in commercialization of ICT products or services. Given the importance of innovation in the development of ICT and the long-term economic growth, Thailand still needs significant investment in building a country’s innovative capability.

In summary, Thailand has made great progress towards infrastructure building. To understand Thailand’s development trajectory towards the information economy, it is important that we evaluate its overall competitiveness rankings, its ability to participate in the information economy and its ICT and social infrastructure development. Table 6 presents Thailand’s competitiveness ranking and its overall ICT development. We will first look at the World Economic Forum competitiveness index, an aggregate index of the set of market, infrastructure, innovation, education, institutions, and policies that are critical to influencing productivity and competitiveness (World Economic Forum, 2006). Thailand is ranked 35 in 2006, which is relatively high compared to many other developing countries such as India (ranked 43), China (ranked 54), and Mexico (ranked 58). In addition, Thailand is positioned as a country that is transitioning from the World Economic Forum’s classification of a factor-driven economy that competes primarily on unskilled labor to an efficiency-driven economy in which efficient production and increased product quality are more important. In this kind of market, competitiveness will be increasingly driven by higher education and training, efficient markets, and the ability to exploit ICTs (World Economic Forum, 2006).

Table 6: Thailand’s competitiveness and level of ICT development

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>YEAR</th>
<th>RANK</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall competitiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global competitiveness rank</td>
<td>2006-07</td>
<td>35</td>
<td>World Economic Forum</td>
</tr>
<tr>
<td>ICT development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networked readiness rank</td>
<td>2005</td>
<td>34</td>
<td>World Economic Forum</td>
</tr>
<tr>
<td>Technology achievement index</td>
<td>2001</td>
<td>40</td>
<td>UNDP</td>
</tr>
</tbody>
</table>

4. Discussion

After reviewing the policy initiatives and infrastructure development of Thailand with respect to the development of a vibrant ICT sector and a sustainable information economy, some questions remain:

- What are the differences in the developmental trajectories between Thailand and other countries?
- What are the challenges Thailand is facing in the global competitive environment?
- As a late entrant to the information economy, what are the gaps between Thailand and other early entrants?
- How can Thailand leverage its distinctive characteristics to bridge those gaps?
The evidence has suggested that there is no one-size-fits-all path of information economy development (Trauth, 2000; D’Costa, 2006). The developmental trajectories play out differently in different countries, regions, political and time settings. At the same time, we argue that there are some general themes that are fundamentally important for developing a sustainable information economy. In this section, we draw on four themes highlighted in Trauth’s study (2000) of the Irish information economy to compare and contrast the developmental trajectory of ICT sector in Thailand with that of Ireland, India and China. These four themes are: facilitating ICT sector work, ensuring a supply of qualified workers, exploiting distinctive characteristics, and reconfiguring industrial and information policy. We summarize the key discussion points in Table 7.

### Table 7: The Comparison of Developmental Trajectories between Thailand, China, India and Ireland

<table>
<thead>
<tr>
<th>Themes</th>
<th>Ireland</th>
<th>India</th>
<th>China</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Understand the characteristics of the information economy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1. Facilitating ICT sector work</td>
<td>• World-class technical infrastructure</td>
<td>• Uneven infrastructure development between ICT clusters and other regions</td>
<td>• Good infrastructure</td>
<td>• Good infrastructure</td>
</tr>
<tr>
<td></td>
<td>• Strong support from government and active involvement of private sector</td>
<td></td>
<td>• Strong governmental commitment, investment, and control</td>
<td>• Software parks</td>
</tr>
<tr>
<td>A2. Ensuring a supply of qualified workforce</td>
<td>• Free secondary education</td>
<td>• Large supply of college graduates</td>
<td>• Large supply of college graduates</td>
<td>• Government sponsored scholarships</td>
</tr>
<tr>
<td></td>
<td>• Close linkage between academic and industry</td>
<td>• Skill gap</td>
<td>• Skill gap</td>
<td>• Talent shortage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mobile human capital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Leveraging socio-cultural characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1. Exploiting distinctive characteristics</td>
<td>• English speaking</td>
<td>• Good English skills</td>
<td>• Relatively low labor cost</td>
<td>• Low labor cost</td>
</tr>
<tr>
<td></td>
<td>• Member of European Union</td>
<td>• A relatively good cultural fit</td>
<td>• Great potential internal market</td>
<td>• Regional advantages and competitions</td>
</tr>
<tr>
<td></td>
<td>• The cultural fit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Adapting the vision along the way</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1. Reconfiguring industrial and information policy</td>
<td>• From multinational to indigenous ICT companies</td>
<td>• Focusing on software and service exports</td>
<td>• Hardware manufacturing</td>
<td>• Series of IT plans</td>
</tr>
<tr>
<td></td>
<td>• Focusing on the niche market</td>
<td></td>
<td>• Focusing on internal software market</td>
<td></td>
</tr>
</tbody>
</table>

### 4.1. Facilitating ICT Sector Work

To facilitate the work of the ICT sector, a well developed infrastructure is very important. Table 8 lists some of the key indicators of ICT infrastructure development in 2004. Ireland is in the leading position with respect to infrastructure development among these four countries because of its early start, the strong support from the Irish government, and the active involvement of the private sector (Heavin et al., 2003; Minevich and Richter, 2005). The indicators in Table 8 show that China is far more advanced than India with respect to ICT diffusion and infrastructure development. China and India are at similar developmental stage and carry similar developmental burdens such as large population and regionally skewed development. The advancement of China in terms of infrastructure development can be attributed to a considerable amount of investment, nation wide developmental strategy, strong interventions, and controls of the central government (ACM Report, 2006; Deloitte Report, 2006; Panagariya, 2007). In India, on the other hand, despite its domination in the global ICT services export market, the service industry is heavily concentrated around several major clusters including Bangalore, Mumbai, Chennai, Delhi and Hyderabad (Heeks and Nicholson, 2004). In these clusters, the infrastructure has been developed to facilitate ICT sector work. However, in India, the infrastructure in many rural areas is inadequately developed, lowering the national average indicators, which is projected to be the
bottleneck to the future growth (Worthen, 2007; Panagariya, 2007). As discussed in the previous section, Thailand has made steady progress towards infrastructure development, with many indicators close to or higher than those of China (indicated by data from Table 8).

Table 8: ICT Infrastructure Development, 2004

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Ireland</th>
<th>India</th>
<th>China</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Economic and Social Context</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1. Primary, secondary, tertiary school enrollment (% gross)</td>
<td>93</td>
<td>60</td>
<td>69</td>
<td>72</td>
</tr>
<tr>
<td>B. ICT Sector Structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1. Government prioritization of ICT (scale 1-7)</td>
<td>5.1</td>
<td>5.7</td>
<td>4.7</td>
<td>5.3</td>
</tr>
<tr>
<td>C. ICT Sector Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1. Telephone main lines (per 1000 people)</td>
<td>502</td>
<td>43</td>
<td>241</td>
<td>106</td>
</tr>
<tr>
<td>C2. Mobile subscribers (per 1000 people)</td>
<td>921</td>
<td>48</td>
<td>258</td>
<td>420</td>
</tr>
<tr>
<td>C3. Internet users (per 1000 people)</td>
<td>298</td>
<td>23</td>
<td>73</td>
<td>112</td>
</tr>
<tr>
<td>C4. Personal computers (per 1000 people)</td>
<td>510</td>
<td>11</td>
<td>40</td>
<td>74</td>
</tr>
<tr>
<td>C5. Broadband subscribers (per 1000 people)</td>
<td>34.4</td>
<td>0.6</td>
<td>16.5</td>
<td>0.2</td>
</tr>
<tr>
<td>C6. International Internet bandwidth (bits per person)</td>
<td>6,118</td>
<td>4</td>
<td>57</td>
<td>48</td>
</tr>
<tr>
<td>C7. Total telecommunications investment (% of revenue)</td>
<td>10.8</td>
<td>___</td>
<td>33.3</td>
<td>36.5</td>
</tr>
<tr>
<td>C8. ICT expenditure (% of GDP)</td>
<td>3.9</td>
<td>3.7</td>
<td>5.3</td>
<td>3.5</td>
</tr>
<tr>
<td>C9. Schools connected to the Internet (%)</td>
<td>99</td>
<td>___</td>
<td>___</td>
<td>37</td>
</tr>
<tr>
<td>C10. E-government readiness (scale 0-1)</td>
<td>0.66</td>
<td>0.57</td>
<td>0.41</td>
<td>0.53</td>
</tr>
</tbody>
</table>

(Source: World Development Indicators Database – http://web.worldbank.org/)

One of the important initiatives for facilitating ICT work in Thailand is the development of the software park, aiming at providing software development skill training to the workforce (Gray and Sanzogni, 2004). These developmental efforts account for Thailand’s rank of 35th in the world, according to the Global Competitiveness Index. As a late comer in participating in the global ICT market, Thailand can learn some valuable lessons from those early adopters such as Ireland, India and China, in several areas including continuing investing on ICT infrastructure, involving both public and private sectors in the development, focusing more on laying strong technical and human infrastructure (education and R&D expenditure), and promoting a balanced nation wide development.

4.2. Ensuring a Supply of Qualified Workers

One common lesson gained from the ICT sector and information economy development in many different countries is the criticality of ensuring a supply of a qualified knowledge workforce (Trauth, 2000, 2001; Farrell et al., 2005; ACM Report, 2006; Heeks, 2006). ÓRiain (1997) suggested that the introduction of free secondary schooling in the 1960s laid the foundations for supplying a technically sophisticated workforce for the first booming of the Irish ICT sector over the next decade that was primarily driven by major multinational ICT companies coming to Ireland. The university education was also made essentially free in Ireland since 1996, which keeps piping the supply of a skilled workforce (Cusumano, 2005). In addition to the government support, another unique aspect of the Irish software sector development is the close linkage between the academic institutions and the industry. Not only have some of Ireland’s most successful indigenous companies originated from the university environment, but also the innovative research outcomes from universities have been directly applied in some rapidly growing firms (Sands, 2005). Such close linkage is one of the factors that ensures Ireland’s dominance in the high-end offshoring outsourcing market.

There are many similarities between China and India in terms of the supply of skilled workers. Building on the base of large population in both nations, it is estimated that the size of India’s pool of young university graduates is
around 14 million, 1.5 times the size of China (Farrell et al., 2005); however, only 4 percent of India’s university educated workforce hold engineering degrees while that number is 33 percent for China (Farrell and Grant, 2005). For the software sector in particular, both countries are facing the challenge of skill gaps (Li and Gao, 2003; ACM Report, 2006). In India, the high education system is a mix of private institutions and state owned universities, among which the educational quality varies widely (ACM Report, 2006). In China, the traditional educational system is biased towards theory while it overlooks practical training (Farrell and Grant, 2005). It was not until 2001 that Chinese universities began to establish separate academic disciplines in software development domains (ACM Report, 2006). The majority of the software workforce in both countries is strong in terms of technical skills but weak in terms of general skills (such as communication skills) and business skills (such as management skills) (ACM Reports, 2006). While the educational systems in both countries strongly emphasize math and science, the workforce of India has a clear advantage over China with respect to English language skills. The lack of proficient English-speaking ICT workforce is considered one of the biggest disadvantages of China to compete with India in the global ICT offshore outsourcing market (Farrell and Grant, 2005).

In addition to reforming the education curriculum and improving the education quality, one of the strategies that both nations can leverage is the reverse brain-drain. Each year, a large number of Chinese and Indian college students come to the U.S. and other developed countries to pursue advanced degrees and careers. Saxenian’s (2006) study of the connection between Indians and Chinese working in Silicon Valley and the development of the Indian and Chinese information economies, suggested that those people are valuable human capital assets because they bring back skills, knowledge, and networking connections and opportunities when they return to their homelands. Therefore, it is important for India and China to turn the brain-drain into a brain-gain, provide incentives and opportunities to encourage returns, and cultivate the great potential of such mobile human capital.

The challenges China and India are currently facing in workforce supply are valuable lessons for Thailand. Some of the key ones are reforming the educational curriculum, emphasizing the language skill training, equally focusing on improving the technical skills, and general and business skills, taking advantage of the academic research capabilities to nurture the innovations in industry, and making sure that the mobile human capital (the government sponsored scholars in the case of Thailand) is properly utilized.

4.3. Exploiting Distinctive Characteristics

Each country has its own unique socio-cultural context. Therefore, it is important to explore the distinctive characteristics of a given country, leveraging the advantages and overcoming the barriers. In the case of Ireland, its distinct competitiveness comes from the well-trained English-speaking workforce, geographical proximity to other European Union nations, and a close cultural fit with western developed countries (ÓRiain, 2007; Trauth, 2000; Cusumano, 2005). In the case of India, the distinct advantages include a large workforce that is relatively well trained and English-speaking, and a relatively good cultural fit (Minevich and Richter, 2005). It is anticipated that India will remain in the lead position as the biggest exporter of software and services in the near future (Minevich and Richter, 2005). As far as China is concerned, although it is lagging behind those early entrants (Ireland, Israel and India) with respect to the share of the global ICT market, its tremendous opportunity in the internal market will keep attracting foreign investment. Furthermore, the labor cost is still relatively cheap in China. Minevich and Richter (2005) predicted that China will replace India to become the leader of the world’s most competitive and popular ICT outsourcing destinations in the next decade.

Similar to Ireland, the size of the qualified workforce in Thailand is quite small compared to the quantity of China and India. Similar to China, the English language skills will also be a challenge for Thailand. However, Thailand currently has the advantage of low labor costs. To increase their competitiveness, companies in India are seeking different ways of moving up in the value chain and saving costs by transferring some low-end jobs to a third country. Being geographically close to some of those active offshore outsourcing players may be beneficial for Thailand. However, at the same time, Thailand is facing some strong competition in the region as well, mainly from the Philippines and Malaysia. The Philippines has already established its position as one of major players among the second tier software exporters (Heeks and Nicholson, 2004). Therefore, it is very important for Thailand to carefully evaluate the global market trend and its distinctive characteristics to define its own developmental path.

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3 Ireland, India and Israel are often referred as the first tier software exporters, while China, Russia and the Philippines are referred as the second tier software exporters (Heeks and Nicholson, 2004).
4.4. Reconfiguring industrial and information policy

Because the ICT sector is fast changing in nature and the global ICT market is highly competitive, it is important for those countries who aim at developing a strong ICT sector to constantly adjust the developmental strategies and adapt the vision along the way. Taking Ireland as an example, the ICT industry of Ireland has gone through different phases (Sands, 2005). From the mid 1970s to the late 1980s, the active players in developing Irish ICT sector were those multinational hardware and software companies who intended to use Ireland as a platform for the European market (ÓRiain, 1997; Trauth, 2000; Sands, 2005). At the beginning, these multinational companies focused on hardware manufacturing and gradually added software development as one of their major activities in Ireland (Sands, 2005). The 1990s was the era of the indigenous software companies who gained critical mass and became the engine for development. Instead of competing with India in the service market, Ireland followed a different trajectory by entering the international niche market, specializing in systems software and enterprise systems development (Sands, 2005). Sands (2005) suggested that the emergence of indigenous Irish software companies is the key to stimulate the development of a sustainable national system. Since the mid 1990s, the entrepreneurial startups have increasingly become active in the software market. According to Sands (2005) and Cusumano (2005), most of those entrepreneurial start-ups are small and mid sized, with a focus on the international market.

India and China show clear divergence in their development trajectories of the ICT sector. From the very beginning, India set its vision at the global service market and has become the largest ICT-service provider in the world (ACM Report, 2006). It is projected that India’s software and services exports will be worth $ 50 billion by 2008 (Sahay et al., 2003). India’s dominance in the global software and services market is largely attributed to its policy liberation in the early 1990s and a large talented ICT workforce, who are skilled and fluent in English (Farrell et al., 2004; ACM Report, 2006). However, as the cost-saving margin gradually diminishes in India, India has to adapt its vision of development in order to sustain its leading position in the future. China is the world’s largest hardware manufacturing country, with a small share of the global software and services market (ACM Report, 2006; Dedrick and Kraemer, 2006). The national software strategy of China has traditionally focused on the domestic market (ACM Report, 2006). Some experts comment that it is difficult for China to compete in ICT services because its software industry structure is not well integrated and lacks needed expertise to capture large international projects (ACM Report, 2006). However, China has great potential to compete in global software and ICT service markets in the future, supported by its continuous infrastructure development, high education improvement, and reformed software strategies (Farrell et al., 2004).

According to its ICT master plan for 2002-2006, Thailand has set its goal of becoming one of the software and service exporters. A series of IT plans reflect the adaptation of Thai government in crafting its developmental targets, strategies, and priorities along the way. Experts suggested that Thailand’s export base is rather limited (ESCAP Report, 2004). Hardware production still dominates the ICT industry, accounting for 63% of Thailand’s ICT market in 2001 (ESCAP Report, 2004). At the same time, more than 70% of the domestic software demand of Thailand is being met by imports as a result of the immature local software development (ESCAP Report, 2004). Under these circumstances, the developmental strategies of Thailand need to be realistic, flexible and improvise with the emphasis on continuity of development plans.

5. Conclusion

In this paper, we assess the development of an information economy in Thailand from the policy and infrastructure perspectives, explore the distinctive characteristics and unique challenges of Thailand in comparison with some of those early entrants, and discuss how Thailand may overcome some of the developmental barriers in the future, based on the lessons learned from other countries and the particular socio-cultural context of Thailand.

This paper represents a preliminary effort to address the challenges of developing a sustainable information economy in Thailand from both the vertical (different perspectives of development) and horizontal (comparing across different countries) dimensions. The research framework, approach, and analytical themes utilized in this study can be applied in a variety of different settings.

In future research, we plan to incorporate more statistical data and explore some additional perspectives such as culture in order to further our systemic examination of the complex and dynamic phenomena of Thailand’s information economy.
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