The diamond model analysis of ICT cluster in Thailand

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ABSTRACT

Information and Communication Technology (ICT) has become an integral part of national competitiveness. Thailand was ranked 38th (out of 134 countries) in the global competitiveness report conducted by the World Economic Forum. It also was ranked well below the world average on all of the factors related to technology, despite the fact that information technology and telecommunications had been a major factor driving the competitiveness of the country. The main purpose of this study is to investigate the various issues related to ICT cluster in Thailand. The diamond model was used to analyze the ICT cluster in Thailand. The results from this study can be used to guide the policy to enhance the competitiveness of ICT cluster.

Keywords: ICT Cluster, ICT and Competitiveness, Development of ICT Cluster, Diamond Model

1. Introduction

ICT comprises of information and communication technology such as computing devices, software, technical skills, programming tools, web applications, network, Internet, mobile phone, broadband, etc that had the capability to improve or optimize the performance and value creation of people, organizations, and nations. National competitiveness increasingly depended upon the "technological readiness" factor because technology had become a critical driving factor for social and economic development. ICT development in any nation could create spillover effects to other economic sectors, therefore contributing to economic growth and prosperity. In general, the role of ICT for competitiveness of a nation included the following:

1. Enabling a government to efficiently provide services to citizen and businesses. For example, e-government could be used to provide efficient, fast delivery and high quality goods and services to citizens, businesses, government employees and government agencies by transforming existing processes more effectively and productively. It also motivated democracy, transparency, and citizen participation in the decision-making process, policy defining, and political activities as a result of available details on public sector activities and increasing inputs of citizens into the activities of government. For example, e-auctions encouraged transparent procurement processes. Citizen participation included online voting and opportunity to reach elected politicians online.

2. Providing an information infrastructure that enabled citizens and businesses to communicate and exchange information efficiently. As such, ICT had the potential to reduce transaction

costs by enabling organizations to exchange information easily and cheaply regardless of time and location.

3. Upgrading existing businesses either by creating value to products and services or by reducing the cost of doing business. ICT enabled digitization of products such as e-books, music, movies, and software. It also enabled digitization of services such as e-transaction, e-payment, e-banking, e-logistic, and customer relationship management.

4. Creating new business models such as e-commerce, social media, mobile applications, etc. ICT also enabled the creation of digital firms in which core business processes were accomplished through digital networks, thus creating greater flexibility in organization and management.

5. Creating quality in educational standards, thereby upgrading the labor skills of the workforce. In the past, teachers were often burdened with outdated teaching tools and had difficulty reaching students. ICT could be used to facilitate digital teaching and learning skills through the use of e-learning and computer-based learning. Several studies showed that students who had access to ICT have higher academic achievement than those without such access. For example, one such study by the Organization for Economic Cooperation and Development ("OECD") found that there was a strong correlation between the use of PCs at home and higher test scores (Microsoft, 2010).

A 2009 World Bank (Kim, Kelly, & Raja, 2010) report stated that ICT has an impact on social and economic development in many ways. For example, Internet and mobile networks increased a nation's ability to reach remote locations and a much wider population base, including persons with low income and literacy levels, enhancing their opportunities to acquire knowledge, share information, transact business, and receive services. In addition, ICT also created digital goods and services such as e-commerce and e-government that had sparked new business models and new job creation. The *2001 Human Development Report* of the United Nations Development Program ("UNDP") (Kim, et al., 2010) indicated that technological innovation could enhance human capabilities in the realms of health, knowledge, creativity, and participation in the social, economic, and political life of a community. Moreover, it proposed that ICT can have an impact on economic growth through productivity gains. In other words, the lack of ICT could be an important factor contributing to the widening of the gap between "developed" and "developing" countries.

In general, ICT had the potential to have both an economic and a social impact on a nation. In terms of economic impact, the World Bank (Kim, et al., 2010) found that in low- and middle-income countries for 10 percentage point increase in broadband penetration could accelerate economic growth by 1.38 percentage points. In a similar study, McKinsey & Company(Company, 2009) estimated that for every 10 percent increase in broadband penetration in household could boost a country's GDP anywhere from 0.1 percent to 1.4 percent. In addition, Booz & Company (Sabbagh, Sinha, & Sharma, 2010) found that a ten percent increase in broadband Internet penetration in a specific year is associated with 1.5 percent greater labor productivity growth over the following five years. Furthermore, the growth of Internet and mobile applications had created jobs and led to the creation of new businesses such as e-business, e-commerce, mobile applications, and social media. ICT also had impact on entrepreneurship because it provided opportunities to create new types of business models, as well as reduce the cost of doing business. To summarize, there is a direct link between ICT and economic development. Several finding from both The aforementioned World Bank and UN reports concluded that the more successful economies had more technologies and were better prepared for using them to enhance their competitiveness.

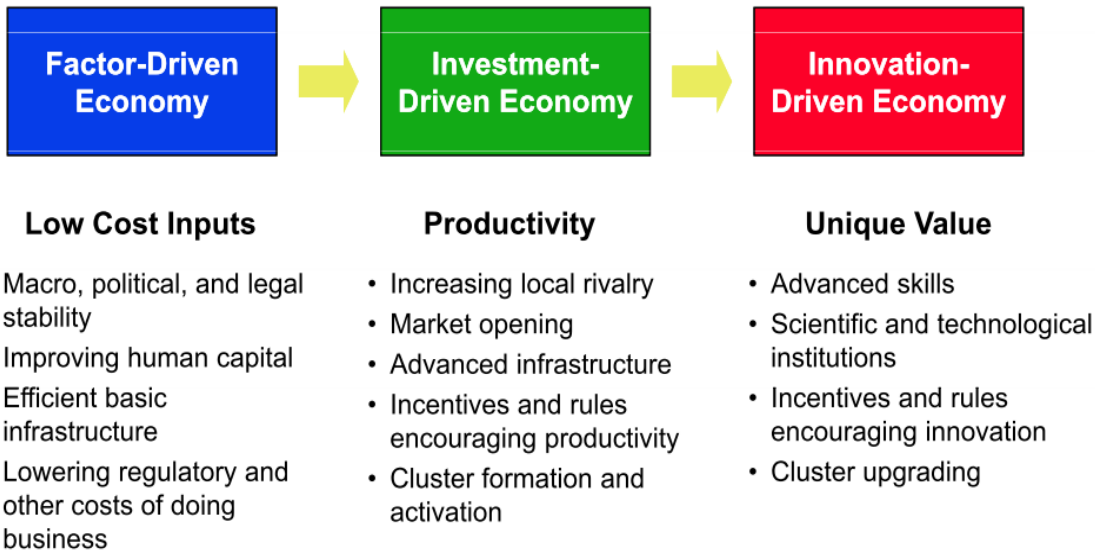
With respect to social impact, several studies indicated that ICT technologies generated social benefits by connecting consumers, businesses, and governments, as well as facilitating social

interaction. ICT had the capability to deliver information to individual and business, sustain good governance, and reinforce social capital. Moreover, ICT also conferred opportunities for democracy because it enabled an information-rich society in which citizens had access to a broad range of information from multiple sources. It also provided several channels for citizens to participate in the political process, as well as obtain information about the performance of governments and politicians that could become the basis for making governments and politicians more accountable. Finally, ICT supported the creation of social community and social ties among individuals. For example, social media like Facebook, Twitter, and LinkedIn, enabled people to form their own communities regardless of time and space. A 2004 Pew study (Kim, et al., 2010) found that Internet users were more likely to receive help on a range of key issues (such as medical condition, financial decision, and seeking a new job), with eighty-five percent of users receiving help compared with seventy-two percent of non-Internet users.

2. Literature Review

Competitiveness

Professor Michael Porter of the Harvard Business School defined competitiveness as *the productivity with which a nation utilizes its human, capital, and natural resources.* Productivity allows a nation to set standards of living (including wages, return on capital, and returns on natural resources) (Porter, 2008). Porter states that competitiveness does not depend on what industries in which a nation compete but on how it competes in those industries. Porter also posits that productivity in a nation is derived from the combination of domestic and foreign firms. A nation competes to provide "the most productive environment for business."



Stages of National Competitive Development

According to Porter, there are three stages of competitive development for a nation, with different nations having different conditions for competitiveness.

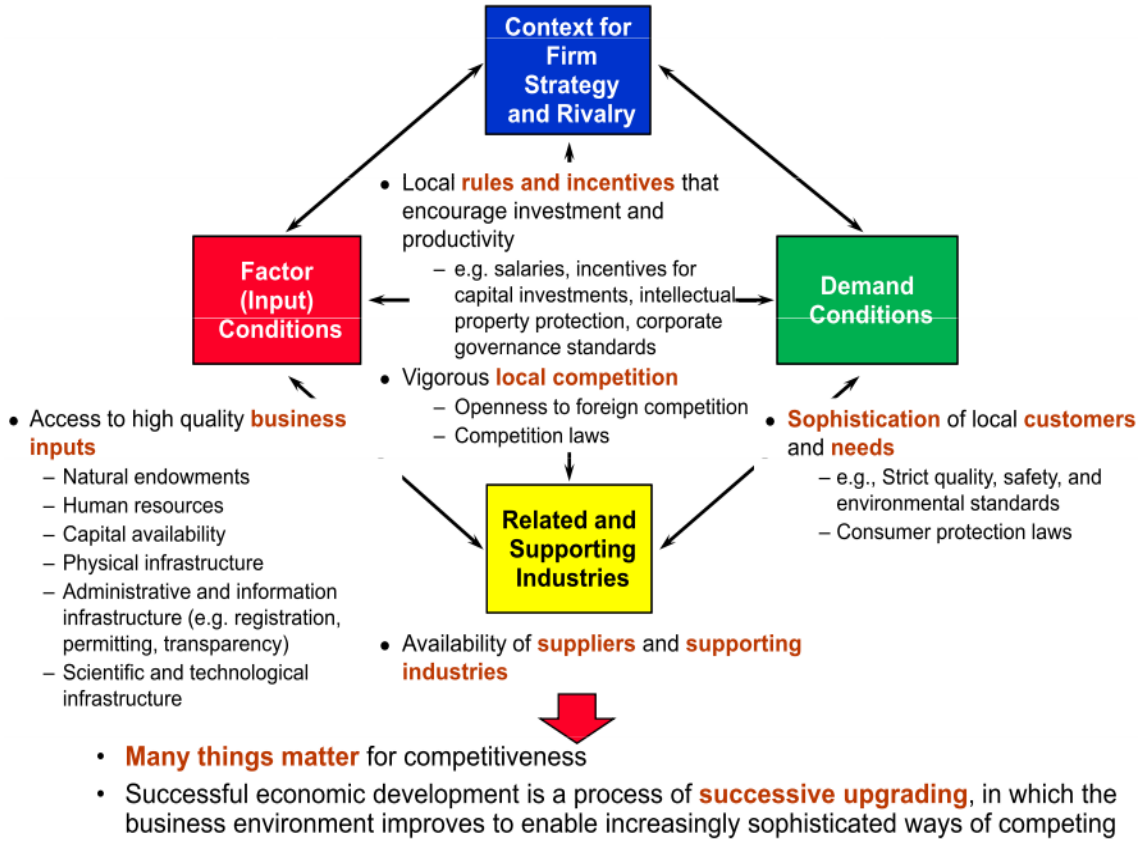
A. *Factor-Driven Economy* — Countries in this category compete based on low-cost inputs. The main objectives to enhance competitiveness are to create political and legal stability, improve human capital, create efficient basic infrastructure, and lower regulatory and other costs of doing business. The countries in this category are under-developed countries.

B. *Investment-Driven Economy* — Countries in this category compete based on creating a good business environment for investment. The main objectives to enhance competitiveness are increasing local rivalry, opening the market, creating advanced infrastructure, and creating cluster formation and activation. The countries in this category are developing countries. Thailand would fall into this category.

C. *Innovation-Driven Economy* — Countries in this category compete based on innovation. The main objectives to enhance competitiveness are creating advanced skills, creating scientific and technological institutions, and upgrading the cluster. The countries in this category are developed countries. These countries normally have world-class companies. Porter notes that a lot of countries in an investment-driven economy cannot upgrade their economies to an innovation driven economy because they cannot develop innovations of their own.

The "Diamond Model"

The Diamond Model is a model developed by Michael Porter in his book, the Competitive Advantage of Nations, in which he published the theory explaining why particular nations and industries become competitive in particular locations (Porter, 1998b).



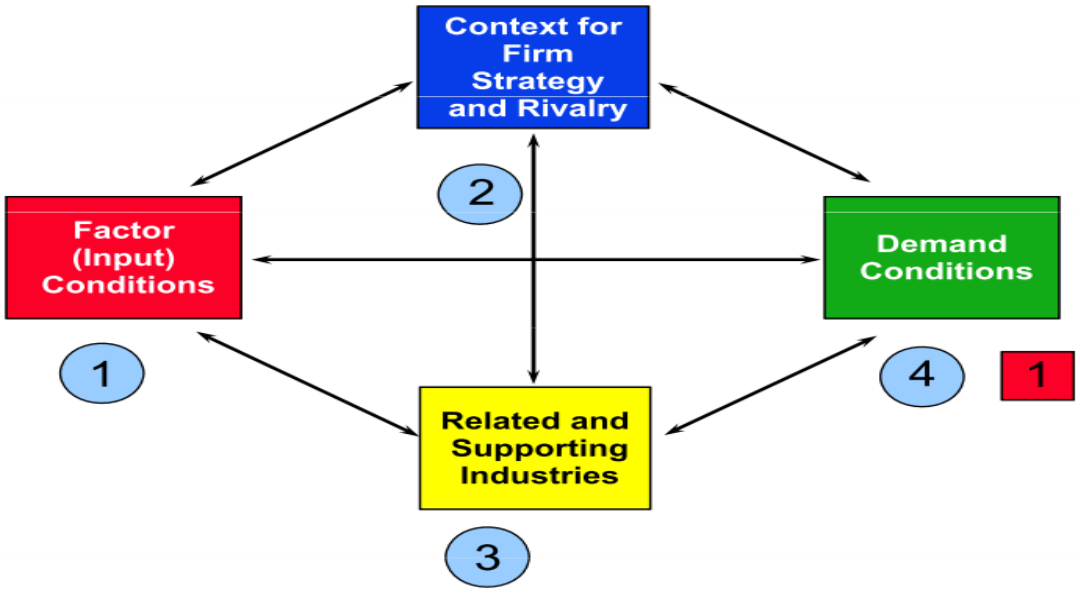
The Diamond Model is used to examine the four factors held to comprise the business environment: (i) Factor Conditions, (ii) Context for Firm Strategy and Rivalry, (iii) Related and Supporting Industries, and (iv) Demand Conditions. The Model is not used to analyze a single firm; rather, it is used to analyze the industry, the cluster, or the nation. Four factors need to be investigated to identify how competitive the industry or nation is.

A. *Factor Conditions* are specialized resources specific for an industry or a nation that are important for its competitiveness. Factor Conditions normally include human resources, capital resources, physical infrastructure, information technology infrastructure, scientific and technological infrastructure, and national resources. Sometimes, a nation does not inherit but instead creates the factor conditions such human skills, science, technology, and innovations. When nations and firms face a disadvantage, such as high land costs, labor shortage, or lack of natural resources, they *must* innovate and upgrade in order to be competitive.

B. *Context for Firm Strategy and Rivalry* includes the business environment in the location. A good context for firm strategy and rivalry includes strong competition among locally-based competitors, openness to trade and investment, free trade agreements, and local context and rules that encourage investment and sustained upgrading (intellectual property protection and anti-corruption laws).

C. *Related and Supporting Industries* provide the access to capable, locally-based suppliers, firms, and institutions in related fields such as energy providers, communication providers, transport services providers, universities, R&D institutions, specialized institutions, institutes for collaboration, etc. The collaboration of these institutions and firms forms a "cluster." A cluster is a group of related companies, public sector entities, and other related institutions with the objective of improving the competitiveness of a group in a specific geographic region.

D. *Demand Conditions* concern the demand for products and services that firms produce in the home market. A strong demand can create pressure to meet high standards, pressure to improve and to innovate, and pressure to respond to tough challenges. In other words firms, industries, and nations can gain a competitive advantage where home demand can provide clear feedback or an earlier picture of customer needs.



For the process of competitiveness development, Porter posits that not all factors are equal, depending on the business environment. In general, if the country, industry, or clusters starts from nothing, he suggests that the first step is to develop Factor Conditions, followed by the Context for Firm Strategy and Rivalry, Related and Supporting Industries, and Demand Conditions. In some circumstances (mostly in a developed economy), Demand Conditions can come first.

Cluster

Porter describes *"clusters"* as "geographical concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (universities, standard agencies, trade associations, etc.) in particular fields that compete but also cooperate." A cluster can create productivity and increase efficiency because organizations and companies in the cluster can share resources and collaborate in the creation of innovations. According to Porter, the cluster enables the following:

- Business Attraction
- Export Promotion
- Market Information and Disclosure
- Education and Workforce Training
- Science and Technology Investments
- Standard Settings

1. Why is ICT important to the country's competitiveness?

Information and Communication Technologies (ICT) can be considered an umbrella which refers to the foundation of a wide range of services (fixed phone, mobile phones, the fax, the Internet), applications (enterprise systems and management information systems), and technologies (hardware, software, service, and telecommunications. ICT affects the way in which people share information. The government, businesses, NGOs, institutions, and individuals have made ICT part of their daily organizational processes. In other words, ICT has become an enabling factor in enhancing the competitiveness in every sector. There is general agreement that ensuring access to information is one of the most significant investments any country can make. ICT can open up access to knowledge, information, and communications, which are important for creating the competitiveness for any nation. .In addition, ICTs have created many new business models such as e-commerce, m-commerce, social medial marketing, Internet advertising, etc. ICT can be used to transform education, healthcare, commerce, politics, and more. Furthermore, the global competitiveness report uses ICT as the main index to measure the country's competitiveness.

Moreover, ICT is a necessary component for any nation to create innovations. ICT can create value for products and services, as well as innovative business models such as e-Commerce and social media. In other words, ICT can be used to upgrade the stage of competitiveness of Thailand from an investment-driven economy to an innovation-driven economy.

3. Objective of this study

The purpose of this study is to analyze the ICT Cluster in Thailand by applying the diamond model.

4. Research Method

This is a descriptive research. The data collection involves document analysis, and the data were collected from secondary sources, such as research databases, news, and related reports.

5. Findings

Current Status of the Thai ICT Industry

The information and communication technology (ICT) business was comprised of four main segments: computer hardware, computer software, computer services, and communication (wired and wireless). Driven by the increasing use of technology in all aspects of society, the industry had been growing rapidly in Thailand as in other countries around the globe, as an ever-expanding diversity of products, lower prices, and wider access to knowledge about how to utilize the various technologies bolstered demand in the public, private, and civil society sectors. In consequence, by 2010, the Thai ICT market, accounting for 11% of GDP, had risen to become one of the largest in the South East Asian region and was projected to grow at a compound annual growth rate of 12% over the 2010-2014 period (NECTEC, 2009c). The total value of Thai domestic spending on IT products and services, which had been in vicinity of US$5.4bn in 2010, was expected to reach US$8.7bn by 2014 (NECTEC, 2009c).

Increased usage of the internet and software application (NSTDA, 2011) had steadily pushed upward the overall market value of the industry, as can be seen in Appendix 2. Total ICT market value increased every year from 2009 to 2011, when it reached a value of $22,621 million, with a solid 11.7% growth from the previous year. By far the largest contributor to the market value was the communication segment, which accounted for 61.7% (or $13,945 million) of the total ICT market. The remaining segments, in declining order of the magnitude of contributions to the overall market value were computer hardware shares (at 14.8%, for a market value of $3,350 million), software shares (at 12.4%, for a market worth of $2,807 million), and services (at 11.1% shares, for a market value of $2,519 million (NECTEC, 2009c; NSTDA, 2011).

However, despite the annual increases in the market value for the entire sector, not every segment of the industry increased on annual basis. For example, as seen in Appendix 3, the communication segment did not increase every year during this time period. Further, the smallest segment, computer services, was doing exceptionally well, with a 25% growth rate since 2009. The market values of the computer hardware and software were also increasing, albeit more moderately.

<u>The Public's "Consumption" of Information and Communications Technology</u>

Underlying the above-cited market values and growth rates of the several industry segments lay distinct behaviors concerning the use of ICT technology. For example, *on the institutional side,* while every business trade and service could increase its efficiency in lowering production costs and creating new markets for products and services, the hospital business in Thailand was the one in which the proportion of employees using computers and the Internet at work was the highest (100% and 90%, respectively), as shown in Appendix 4. The next highest manufacturing, travel agencies, construction, and business trade and services, respectively. However, SMEs had been slow to adopt ICT, despite the fact that research had indicated the positive effect of ICT on firm performance in terms of creating productivity, profitability, market value, and market share. Further, the *size* of the particular establishment impacted the usage of ICT. As shown in Appendix 5, establishments with

fewer than 16 persons used ICT to a slight degree: computer usage - 21.9%; Internet usage - 14.2%; and, websites - 6.2%. By contrast, establishments with 16 persons or more used ICT at a high proportion, e.g., with more than 81.1% of establishments using computers (Santipaporn, 2010).

Among educational institutions, 99.7% of primary educational institutions had computers, while other levels of educational institutions had computers in every institution. Further, the overwhelming major of educational institutions had Internet access. For instance, as can be seen in Appendix 6, Internet access for primary educational institutions, vocational and non-formal education levels, and the higher education institutions was 97.2%, 99.0%, and 100.0%, respectively.

At the level of the *individual person* and *individual households*, *per* Appendix 7, mobile phone popularity had rapidly increased from 28.2% in 2004 to 56.8% in 2009. However, the proportion of the population using computers and the Internet increased only less robustly, going from 21.4% to 29.3% for computers during the 2004-2009 period, and from 11.9% to 20.1% for the Internet. Moreover, the Internet access of households increased very modestly, from 5.7% in 2004 to 9.5% in 2009; and, broadband Internet access increased from 52.8% in 2006 to 55.1, while fixed-line telephone decreased from 23.4% in 2004 to 21.4% in 2009 (Santipaporn, 2010).

The proportion of students per computer at the primary education level in Thailand was 14:1 persons per computer, 8:1 at the vocational level, 11:1 at the higher education level, and 109:1 at the non-formal education level (see Appendix 6). The proportion of teachers per computer at the higher education level was 3 instructors per computer, 5 instructors per computer at the vocational level, 10 instructors per computer at the primary education level, and 12 instructors per computer at the non-formal education level.

Governmental Support Policies and Key Organizational Players

A large measure of the credit for the growth and market performance of the ICT business could be attributed to policies of the Thai government, which having long recognized the critical role of ICT in strengthening the nation's competitiveness and in enhancing the quality of life of its citizens, actively supported and promoted the usage of ICT to strengthen businesses. Although Thailand's main industries had long been the electronic, automobile manufacturing, and agro-business industries (the country was largest rice exporter in Asia), Thailand had entered the ICT field in the early 1980s, with an initial resource basis of Thai professionals who had computer and IT experience from either their involvement with the U. S. military during the Vietnam War era or their exposure during studies at U. S. universities. From that time forward, the Thai government, convinced of the importance of ICT in strengthening the nation's competitiveness and in enhancing quality of the life of its citizens, worked to build and develop a nation-wide IT infrastructure (see Appendix 8).

Indeed, the government believed that ICT was destined to have an increasingly important role to play in the enhancement of economic productivity, as well as in the transformation of Thai society into a knowledge-based society (Santipaporn, 2010). Accordingly, in 2010, the government implemented a framework and policies to support this development and ensure that country was moving forward. The ICT development in Thailand has been guided by the 2010 policy framework, which rested on 3 principles: building human capital, investing in information infrastructure, and promoting a good governance in the ICT industry (NECTEC, 2010).

Several organizations were assigned key roles and responsibilities for the development of ICT. They were the Ministry of Information and Communication Technology (MICT), the Software Industry Promotion Agency (SIPA), The National Broadcasting and Telecommunication Commissions (NBTC), and the National Electronic and Computer Technology Center (NECTEC). The MICT, as the head of ICT development, had the responsibility for developing the second ICT Master Plan (2009-2013),

preparing the 2020 policy framework for the next decade, and coordinating all ICT development according to the ICT Master Plan and the 2010 IT framework (Technology, 2009). The SIPA supported the development of the software industry by promoting and developing software and other digital content entrepreneurs, improving human resource, boosting investments and market opportunities, supporting research activities and training as well as supporting developing tools and measures to protect the intellectual property rights of software. The NBTC's role was that of communication regulator, with concomitant responsibilities to undertake, support, and promote the development of telecommunications technologies through research and development activities. The NECTEC shared responsibility with the MICT for developing the second ICT Master Plan. Collectively, these organizations were charged with ensuring continuing progress in the implementation of the ICT Master Plan.

In conjunction with research and academic institutes, government played a major role in supporting the entire cycle of the ICT industry by setting up policies, constructing innovations, and developing human skills that matched the growth of the ICT market. The country's strategy for becoming a knowledge- and innovation-based society was set forth in the IT 2010 policy framework and in the first Information and Communication Technology Master Plan (2002 – 2006) (NECTEC, 2009b). A strategy was set forth in five areas – specifically, e-Industry, e-Commerce, e-Government, e-Education and e-Society. The second Information and Communication Technology Master Plan (2009-2013) – which represented a continuation of the policies set forth in the IT 2010 framework – also sought to accelerate accomplishment of targets contained in the first plan, as well as fix the drawbacks that caused the first Information and Communication Technology Master Plan to less successful than had been hoped. The strategies and the weaknesses that they were devised to overcome could be described as Appendix 9 (NECTEC, 2009a; Santipaporn, 2010).

Imperatives and Advantages of the Cluster Strategy

Professor Michael Porter of the Harvard Business School, the internationally renowned expert on competitiveness, defined a "cluster" as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities"(Porter, 1998a). Clusters, he argued, are a crucial enabler of competitiveness. That is, Porter posited that modern competition relied largely on productivity, not on access to inputs or the scale of individual firms (Porter, 1998a). The productivity of companies depended on how they compete in a particular location which was strongly affected by the quality of the local business environment. Companies could not compete effectively without a high quality infrastructure and suppliers. They also could not compete without well educated employees and highly skill labor. In addition, companies would not have pressure to create innovations if the operating environment did not have strong rivalry. Companies also could not operate efficiently under political conflicts or instability in the legal system.

In Porter's view, cluster affected competition in three basic ways: 1) cluster increased the productivity of companies in the area 2) cluster drove the direction and pace of innovation and 3) cluster stimulated the formation of new business and collaboration among firms. In sum, by being part of a cluster, "companies [could] operate more productively in sourcing specialized inputs (services, employees, etc.); foster internal innovation, as well as have ready access to innovations and best practices among firms; easily and efficiently coordinate and transact across firms in the cluster; access information, technology, and needed institutions (governmental, standard-setting agencies, think tanks, specialized research, etc.); pursue new business formation (because of the easy availability of skills, suppliers, infrastructure, etc.); and measure and motivate improvement"(Porter, 1998a).

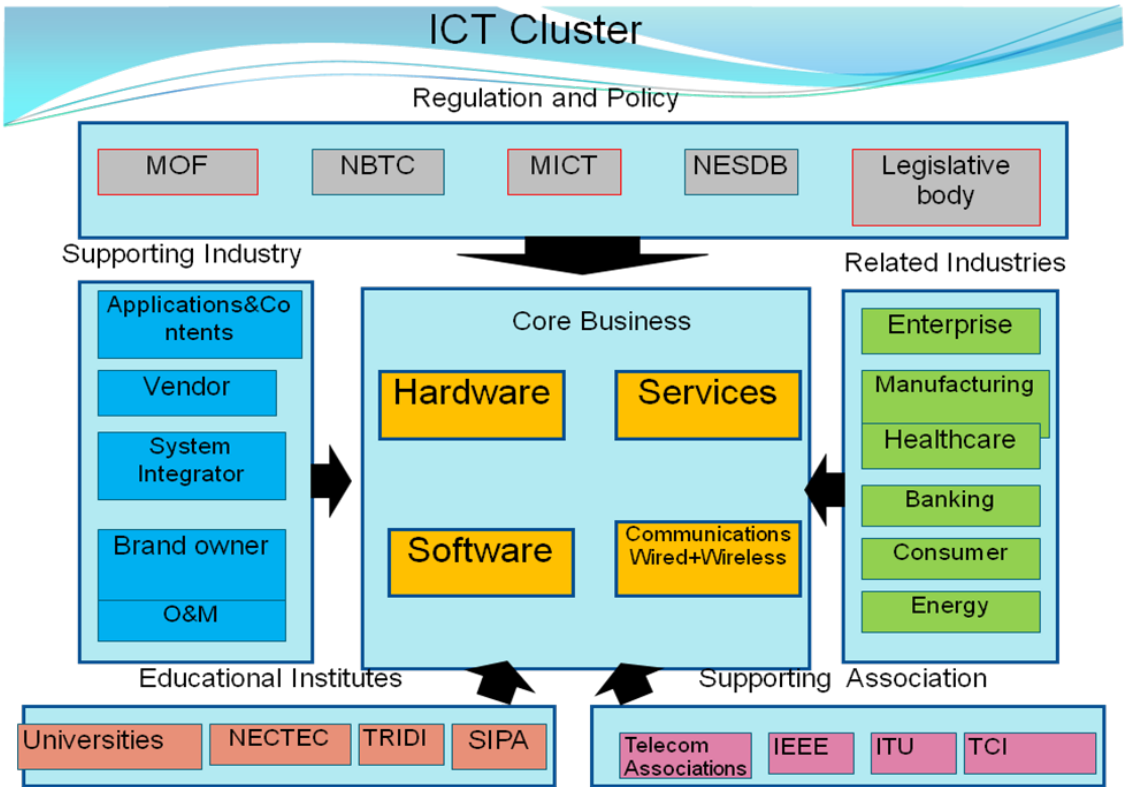
One of example of cluster was the California wine cluster, which included 680 commercial wineries and thousands of independent wine grape growers. In addition, there was a vast complement of

industries supporting both wine making and grape growing. There were also suppliers of grape stock, irrigation, harvesting equipment, and a specialized public relations and advertising firm. The main research institutions were the University of California at Davis which had a world-renowned viticulture and enology program and the Wine Institute. The cluster also had a close collaboration with other California clusters such as ones in agriculture, food and restaurant, and tourism (Porter & Bond, 2008).

One of the most successful Information and Communication Technology clusters in the world was Silicon Valley, the southern part of the San Francisco Bay Area in Northern California, with heavy concentration of high-tech companies. The Silicon Valley IT cluster consisted of thousands of world-class software, hardware, network, Internet, and service companies. There were many research and educational institutions such as Bell Labs, Stanford University and the University of California at Berkeley. There was also strong venture capital support for anyone with a promising business plan who wished to start up a business in the area. The Silicon Valley IT cluster had the highest concentration of high-tech workers of any metropolitan area in the world (Wikipedia, 2011b). The concentration of companies, institutions, and technically skilled people in the cluster enabled companies and startups in Silicon Valley to easily find highly skilled job candidates, as well as collaborate with other firms in the cluster. The success of Silicon Valley IT cluster had a spillover effect on other areas in the United States (e.g., Route 128 - Massachusetts, Austin - Texas, and the Research Triangle - North Carolina, to name just a few), as well as elsewhere in the world (e.g., the digital media city (DMC) in the Sangam-dong district in South Korea) (Wikipedia, 2011a).

The ICT Cluster in Thailand

To gain maximum synergy, as well as maximum impact from the expenditure of resources, the Thai government had also opted to pursue ICT development through the "cluster approach." At its core, this entailed promoting collaboration among several different types of industry sectors (e.g., manufacturing, trading, service, human resources, and the education) pursuant to integrating research into a high-value industry like hard disk drive production and other high value-added products (Intarakumnerd & Lecler, 2010). The Thai ICT Cluster consisted of core businesses, including hardware, software, services, and communications companies, located mostly in Bangkok and the central part of Thailand. These core businesses had a strong relationship with supporting industries, including electronic parts, system integrators, content providers, vendors, and brand owners. Related industries were comprised of enterprise, manufacturing, healthcare, banking, consumer, and energy providers. Educational institutions included universities, the National Electronics and Computer Technology Center (NECTC), the Telecommunications Research and Industrial Development Institute (TRIDI), and the Software Industry Promotion Agency (SIPA). Supporting associations consisted of telecom associations, the e-Commerce Association, the Institute of Electrical and Electronics Engineers (IEEE), the International Telecommunication Union (ITU), and the Telecommunications Consumer Protection Institute (TCI). Finally, regulation and policy organizations included the Ministry of Finance, the National Broadcasting and Telecommunication Commission (NBTC), the Ministry of Information and Communication Technology (MICT), the Office of National Economic and Social Development Board, and various legislative agencies.



Despite these structural arrangements and high expectations, to date, the Thai ICT cluster had not yielded the expected results. There were a number of reasons for this. First, not only did the government not have a clear direction for cluster policy, there was also no other institution that served as the central hub to drive policy or manage the cluster. Second, and largely in consequence of the first issue, the cluster was shallow, with weak collaboration among the member organizations. Indeed, there was more conflict than collaboration, more inter-organizational competition than cooperation. Third, occasional legal battles among institutions in the cluster and with the government agencies, along with the instability of the political and legal systems and government corruption, were also serious and ongoing obstacles to cluster development and success. Fourth, government interference with competition – e.g., through the granting of monopoly concessions, largely in the communication sector – further impeded the normal functioning of the cluster.

On the more positive side of the ledger, the cluster had been successful to date in attracting foreign direct investment (especially in the hardware and communication segments of the industry). However, heavy reliance on cheap and unskilled labor set in motion price-based, as opposed to quality-based, competition among products and services. This was aided by the fact that most consumers were lower-income and had little information about products and services *other than price* on which to base their consumption choices. Further those cluster products and services that were not licensed from abroad tended to be illegally copied, due to the lax enforcement of intellectual property laws.

Hence, to date, it could not be said that the Thai ICT cluster experience had yielded the results that had been anticipated. Indeed, how to invigorate the cluster was one of the main challenges confronting the new prime minister as she embarked on the quest to transform the competitive foundation of the Thai economy.

The analysis of the Thai ICT industry

Factor Conditions

Strengths

Good geographic location—Thailand is located in the heart of Southeast Asia. This area is known as Indochina, which is considered as a strategic location that connects China and India. This area is also considered as a logistic hub. A lot of world-class companies have invested in this area. For example, all top hard disk producers have built their production facilities there, and this has made Thailand the largest exporter of hard disks. In addition, there are numbers of schools and universities offering degrees in computer science, computer engineering, telecommunications, management information systems, software engineering, and ICT related fields in Thailand. Moreover, there are many research and development institutions there, such as the National Electronics and Computer Technology Center (NECTEC), the Telecommunications Research and Industrial Development Institute (TRIDI), and the Software Industry Promotion Agency (SIPPA).

Weaknesses

The telecommunications infrastructure, especially the Internet and fixed-line phones, is poorly distributed. Internet and phone access is available in metropolitan areas; however, people in the rural areas in the some parts of the country cannot access the Internet or phones. This problem results in a digital divide, the gap between people that are able to access information technology and people that cannot use ICT. Furthermore, although Thailand provides cheap labor, there is a lack of highly-skill labor in ICT. As a result, few patents related to ICT have been created in Thailand. Most global companies – seeking to benefit from cheap labor -- have invested only in production, not in research facilities in Thailand.

Firm Strategy, Structure, and Rivalry

Strengths

The ICT market has been growing steadily for the past decade. The ICT market value has accounted for 11% of the GDP. In the hardware market, Thailand is the main exporter of hard disks in the world. Many global companies have invested in production facilities in Thailand. In the software market, there are many government initiatives to support research and development of software, such as the NECTEC and SIPPA. In the service market, Thailand is a destination for software outsourcing due to cheap labor. In the telecommunications sector, the establishment of the National Broadcasting and Telecommunication (NBTC) forces an end to the concession systems. This has led to fair competition among telecom providers. [Note of Clarification: Before the establishment of the NBTC, the Telecommunications sector was dominated by the concession system controlled by TOT and CAT (state owned enterprises). Private companies that wanted to do telecom business need to have concession contracts with either TOT or CAT. Different contracts have different conditions in term of revenue sharing, the size of radio frequency, and the length of time which led to unfair competition. After the establishment of the NBTC, every company competes based on the same rule and regulation. Both TOT and CAT need to transfer the radio frequencies that they owned back to the NBTC to be reallocated. In addition, the government has instituted a policy to attract Foreign Direct Investment (FDI) that has resulted in the investment of many global companies in ICT. Foreign Direct Investment (FDI) is a great contributor to the manufacturing industry, especially regarding hard disk drives, electronics, and computer parts. Finally, the government has created the IT Policy framework and Master Plan (2009-2013), which is fundamental to the development of ICT in Thailand. The Master Plan consists of 6 strategies as follows:

- Create an ICT workforce that can create, develop, and use ICT with awareness and discretion
- Manage ICT with good governance (national ICT governance)

- Develop basic ICT infrastructure
- Use ICT for good governance in the public sector
- Increase the competitiveness of Thailand's ICT industry to add value to the country's economy and to generate income
- Use ICT for sustainable growth

Weaknesses

There are several major weaknesses. First, the competition in the ICT market, especially in hardware and telecommunications, is still based on price. There is a high level of political and economic instability. There have been twelve coups in the last seventy years. In addition, the competition in telecommunications market was neither fair nor free. The government interfered in the competition by using concession systems. Every concession agreement has different conditions and this has led to unfair competition. The competition in the Telecom market is also monopolistic. Only 3 companies, AIS, DTAC, and True, control the majority of the market share. Last but not least, intellectual property protection laws are not properly enforced. Several global companies do not want to invest in Thailand because of the concern about intellectual property infringement.

Related and Supporting Industries

Strengths

A cluster policy has been initiated by the government. The government has a policy of open market access to foreign suppliers of electronic components, machinery, and services.

Weaknesses

The ICT cluster is shallow. Even though the government supports the cluster policy, the collaboration among organizations in the cluster is very weak. Most global companies have invested in production facilities in Thailand in order to export their products rather than transferring knowledge and expertise to the local companies. Furthermore, most sophisticated technologies, innovations, applications, and services must be imported rather than locally sourced.

Demand Conditions

Strengths

The demand for ICT is very strong and has been growing steadily over the past decade. Thailand has the second highest mobile penetration rate in Southeast Asia. The number of mobile numbers has exceeded the size of the population. Broadband Internet and computer users are growing steadily. The price of ICT has been declining. ICT, especially mobile and internet services, has been easily accessible.

Weaknesses

ICT products and services are imitated or licensed from abroad. The competition in the ICT market is still based on price rather than quality. Customers have limited selection of providers in the mobile, fixed phone, and internet market. Consumer complaints regarding ICT services are growing, and quality standards have not been established in the ICT industry. In addition, the adoption of the computer and the Internet has been slow. In 2011, out of 67 million people, there were only 24 million people that could access the Internet. For the number of Internet and computer users, the adoption has been slower than in other neighboring countries such as Malaysia, Singapore, and Vietnam. This slow adoption can be linked with the digital divide and the role of government. The first reason is that the cost of ICT is expensive for most people. Another obstacle is that most Thai people do not see or understand the benefit of ICT; and, for older people, ICT is often viewed as something difficult to understand or that requires a new skill.

6. Implication for Policy

The priority for the government is to create input conditions for the ICT industry. To provide ICT access to people and businesses, the government should create and expand the ICT infrastructure, especially broadband Internet and mobile broadband. The government should also provide ICT education in order to enhance the ICT skill of people. Regarding the context for firm strategy and rivalry, since several world-class ICT companies hesitate to invest in Thailand due to political instability and intellectual property violation, the government should create this stability and enforce intellectual property protection laws. The main reason that Thailand is still among a very few countries that do not have a 3G network is due to political conflicts and legal issues. The government should establish the NBTC as quickly as possible to end the concession systems and to create fair competition. In addition, the government should open the ICT industry to foreign competition in order to absorb innovations from world-class companies. The government should also end the concession systems in the telecommunications industry by issuing licenses with fair competition. For related and supporting industries, the government should create a cluster policy and encourage collaboration among firms and institutions in the cluster. The government should also open ICT market access to foreign suppliers. Regarding the demand conditions, the government should set quality standards for ICT products and services. Especially, the government should set standards to protect ICT consumers. According to the case, it is clear that telecom complaints have been among the top consumer complaints in Thailand. Other standards, such as product/service safety, health, and the environmental should be set and formed into law. The government should also give citizens access to ICT products and services, and it should promote the benefit of ICT for people and businesses.

7. Conclusions

ICT is considered as enablers of competitiveness. ICT is vital for creating new skill and generating growth and technological innovation across the economy. In other words, no country can be competitive without having an efficient ICT infrastructure. Nevertheless, Thailand has fallen behind many developing economies in terms of its ICT infrastructure. This study investigates the various issues related to the ICT cluster in Thailand. The diamond model is used to analyze the competitiveness of the Thai ICT cluster. The results of this study can be used to guide the development of ICT cluster in other developing countries.

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