International Journal of Applied Business and Economic Research

ISSN : 0972-7302

available at http: www.serialsjournals.com

Volume 15 • Number 23 (Part 2) • 2017

Thailand 4.0 from Policy to Implementations

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ABSTRACT

This study investigates how Thailand has created ICT competitiveness through Thailand 4.0 policy. In the past, Thailand was primarily based on agriculture, manufacturing, and tourism, with inefficient government services and poor infrastructure, and a competitiveness ranking that placed Thailand behind other developing countries in many factors that determined a nation's overall ranking. Since 2014, the Thai government has implemented the digital economy and Thailand 4.0 policy to enable ICT to drive national development, business, and people's quality of life. However, the problems attendant to the development of a digital economy were numerous, including government tardiness in adopting ICT technologies, limited population access to broadband Internet, increasing cybercrime, inefficient payments and logistics infrastructure, and lack of public trust in transactions on the Internet. This paper presents how Thailand has implemented its digital economy and Thailand 4.0 together with opportunities and challenges. The findings from this study can be used to guide the country's development using digital technologies in other developing economies.

Keywords: Thailand, ICT in Developing Countries, National Competitiveness.

1. INTRODUCTION

In early2017, the results of the Global Competitiveness Ranking, the Global IT Report, and the Network Readiness Index report had just comeout, and the results were not looking good for Thailand, which made the situation worse because the country had been sanctioned by international communities due to the military coup in May 2014. Out of 144 countries, Thailand was ranked 70th in availability of the latest technologies, 93rd in terms of individuals using the Internet, 90th in government procurement of advanced tech products, 66th in patents per million population, 113th in intellectual property protection, 118th in public trust in politicians, 71st in quality of the overall infrastructure, and 74th in terms of the quality of the education system (Schwab, 2017). The Thai people had high expectations for Prime Minister Chan-ocha's

government; he had to prove to both his supporters and opponents that his government was not like former corrupt democratically-elected governments, and he needed to show the people that his military government had the willingness to improve Thailand and could upgrade the country to the next level with the use of digital technologies.

Overview of Thailand

Located in the strategic centre of the South-East Asian peninsula and bordered by the Gulf of Thailand, Myanmar, Laos, Cambodia, and Malaysia, the Kingdom of Thailand is the world's 50th largest nation in land mass (513,115 square kilometers, or 198,120 sq mi) and the 20th largest country in population (estimated in 2016atslightly more than 68 million people). Thailand is the second largest economy in ASEAN after Indonesia. It is considered an upper middle country with pro-investment policies and well-developed infrastructure. The country is separated into six regions (North, Northeast, East, South, West, and Central) plus the administrative region comprising the capital, Bangkok (*"Krung Thep"*), which is by far the most significant urban area in the country.

Demographically, the country is comprised of a majority of ethnic Thais, but also hasa substantial population of persons of Chinese descent (14%), as well as a scattering of other distinct ethnic groups (e.g., the peoples of the several so-called "Hill Tribes"). Approximately 71% of the population falls into the 15-64 age group, although a significant portion (nearly 20%) are in the 0-14 age group and slightly more than 9% are in the 65 year and older group. A 50:50 ratio of males to females exists in each age group. The population growth was 0.566% as of 2011, which represented a decline from the previous year. Culturally, the country has been shaped by many influences, including the ancient civilizations of India, China, and Cambodia. However, Buddhism—the state religion, as well as the religious preference of nearly 95% of the population—has exerted the most profound influence on the ethos and mores of the Thai society. The country is also alone among its Southeast Asia neighbors in the distinction of never having been a colony at any point in its nearly 1,000-year history.

The country enjoys a high level of literacy, with nearly 93% of the population 15 years old and over able to read and write. Education is provided mainly by the Thai government through the Ministry of Education and is free through the twelve years of school, but is compulsory only through the first nine years. In 1932, the absolute monarchy that had prevailed for seven centuries was replaced by a constitutional monarchy, with a prime minister as the head of government and a hereditary monarch as the head of state. Despite the introduction of the constitutional monarchy system of government, the Thai people continue to respect and revere the King much as they did during the period of absolute monarchy. As reflected in the tri-colored national flag, the king (represented by the blue middle bar) is one of the three symbols of Thailand, together with the nation (represented by the two red outer bars) and religion (represented by the two white bars abutting the blue).

In concert with the traditional structure of parliamentary systems of governance, the Thai executive branch is also an active participant in the legislative branch of government. An independent judiciary with a supreme court of final authority comprises the third branch. Since the reformation, Thailand has undergone 19 military coups d'ét at and 18 constitutions and charters, reflecting a high degree of political instability. Moreover, throughout the reform period, Thailand experienced many political crises, such as Black May

in 1992 and the recent Yellow Shirt and Red Shirt protests, which again demonstrated the pronounced fragility and instability of the Thai polity.

Until the 22nd of May 2014, the politics of Thailand were based on the framework of a constitutional monarchy, which the prime minister as the head of the government and the king as the head of state. The judiciary, the executive, and the legislative branches are independent from each other. After the coup on May 22nd 2014, the constitution was revoked and Thailand came under the rule of a military entity called the National Council for Peace and Order (NCPO). In May 2014, the Pheu Thai Government was overthrown in a bloodless military coup. Since then, the military has created an interim government, a national legislative assembly, and other government entities tasked with implementing reforms.

Thailand's Economic Structure

According to the World Bank, Thailand transformed itself from a lower-middle income into upper-middle income economy after2011, and Thailand's economy has grown on average 7.5 percent annually. Poverty has decreased tremendously, from 67 percent in 1986 to 11% in 2014. Nevertheless, poverty and inequality still create both economic and political challenges. The poverty in Thailand is largely in rural areas. In 2013, more than 80 percent of Thailand's 7.3 poor people lived in rural areas where there is a lack of modern infrastructure. The wealth distribution is largely unequal compared to other East Asian nations. Significant infrastructure development can be seen in large cities such as Bangkok, Chiang Mai, and Phuket, while poverty remains in the Northeast, the North, and the Deep South (T. W. Bank, 2016). Thailand's economy is based largely on manufacturing and tourism. The majority of labor force is in agriculture. The country is also endowed with rich natural resources such as tin, rubber, natural gas, tungsten, gypsum, and lignite. Most of the labor force (43.3%) works in the agriculture sector; however, manufacturing accounts for 40% of the GDP, compared to only 8.3% from agriculture. Total exports in 2015 were212 billion dollars, while total imports in 2015 were177 billion dollars.

Thailand 4.0

In order to enhance Thailand's competitiveness through digitization, General Chan-o-cha stated in his national address on the program "Return Happiness to the People" on 1 July 2016 that the **Thailand 4.0** policy would guide the country's new direction. Thailand 4.0 was a new economic development model that could potentially upgrade the nation from a traditional agricultural- and manufacturing-based one into an innovation-based one. The policy intended to promote innovation and creativity through the use of technology in various sectors of the economy (Monitor, 2016e). Thailand has gone through three economic development models. Thailand 1.0 focused on agricultural development. Thailand 2.0 emphasized industrial development through manufacturing. Thailand 3.0 employed an FDI (foreign direct investment) strategy to attract heavy and high-tech industries, such as electronics and the automotive industry, to upgrade the economy from low-income to middle-income status. Thailand 4.0 focuses on upgrading the country through innovation and creativity. It was intended that Thailand would become a developed country. General Chan-o-cha targeted 10 industries through digitization. Thailand 4.0 created a20-year national strategic plan consisting of six areas. These areas included: (1) security, (2) competitiveness enhancement, (3) human resource development, (4) social equality, (5) green growth, and (6) rebalancing and public sector development (Monitor, 2016e).

Transformation Power of ICT

Much research indicates that ICTs can create economic opportunities and foster political and social inclusion, eventually contributing to shared prosperity. In addition, ICTS can foster entrepreneurship and create new business models such as crowd funding, Airbnb, and Uber. Furthermore, ICTs can also contribute to social benefits by enabling public access to financial services and education. ICT allows more direct interaction between people and the government, and ICT also provides a new method for citizens to participate in policy and decision making processes (Forum, 2017).

Internet Usage in Thailand

With a population of 62.3 million, the percentage of mobile phone users ranked first in 2014, 77.2%, followed by computers and the Internet at 38.2% and 34.9%. However, there are differences in online users in municipal and non-municipal areas due to access to the Internet and infrastructure. All municipal areas had the twice the rate of users of computers and the Internet from 2010 to 2014, approximately 45:39% and mobile phones at around 77: 65%. The number of online usage aged 6 and over has the highest rate in Bangkok, especially mobile phone users at 89.2%, followed by the central, northern, southern, and northeast regions. Regarding Internet and computer usage, the user percentage was at about 40%, except in Bangkok, which almost reached 50%(NSO, 2014).

Thai population that has Internet access prefers to use broadband, including fixed broadband and mobile wireless 3G rather than narrowband: analog modems, ISDN, and mobile wireless 2G and 2.5G. The ratio between broadband users and narrowband users for the whole kingdom is around 6:42. Nonetheless, the most preferable type of Internet used is mobile wireless 3G, where Bangkok has the highest rate and the northeast has the lowest rate (NSO, 2014).

The percentage of users of computers and the Internet is highest among those aged 6 to 14, at 84.9 and 58.2 respectively. However, the potential users are between individuals aged 15 to 24 and 25 to 34 according to online activities. In addition, the Thai population aged 6 to 14 and 15 to 24 use computers or the Internet mainly for study, while those aged 25 to 34 and 35 to 49 use it for work. On the other hand, the second top activities are different between age groups. This could refer to the various expenses for each group; for example, the population aged 6 to 14 spend money on games while the rest may spend money on other entertainment services (NSO, 2014).

Except for education learning activities, such as blog web 2.0, chats, instant messages, voice over Internet protocol (VOIP), social networks, downloaded software and searches for information, which are the top 10 activities, the population aged 15 to 24 and 25 to 34 has the potential to purchase goods or services online at about 29%. Yet, the population aged 25 to 49 has a higher potential to purchase goods or services and business and offering products or services than the rest of the age groups showing approximately 30%. Moreover, these age groups have higher expenses than others. Most of them spend around $6-12 per month (NSO, 2014).

e-Commerce in Thailand

Tarad.com was the first online shopping platform in Thailand. It was founded in 1999 and developed from Thaisecondhand.com. In 2005, We Love Shopping was launched and grew rapidly, ranking among

the top three visited online shopping platforms in Thailand. Since 2010, many online shopping platforms have been established and compete fiercely. Lazada, an international online platform that has invested in 6 Southeast Asian Countries, started in Thailand in 2012, along with Zalora. As telecommunications began to change from 2G to 3G in 2013, many online shopping platforms were launched and have become more competitive than ever. Additionally, the increase in Facebook and Line users has created opportunities for online advertising for online shopping platforms. As a result, Lazada became the most visited online shopping platform in 2015. Since 2014, the growth in e-commerce has increased gradually to $63230.79 (ETDA, 2015).

In 2014 the Thai E-commerce grew twice from 2013. Since 2014, the growth in e-commerce has inclined gradually to $63230.79.Comparing Thai e-commerce with that of other countries, among ASEAN countries, Thailand had the highest B2C e-commerce in 2014 (11.7) while the top B2C e-commerce countries were developed countries, such as the USA, China, Japan, and South Korea (PAKAWACHKRILERS, 2015).

In the domestic market, Thai entrepreneurs with e-commerce transactions of less than $1.5 million mainly targeted Bangkok and other urban areas at 25.24% more than those with e-commerce business of more than $1.5 million, or 43.89%.

From 2007 to 2013, B2C (Business to Consumer) had the highest percentage among the three types of entrepreneurs: B2C, B2B (Business to Business), and B2G (Business to Government) at79.9%. In addition, most e-Commerce in Thailand (66.8%) is small scale (1-5 persons). Travel, hotels, and resorts were the most popular types of business, followed by fashion accessories and computers and electronic appliances (PAKAWACHKRILERS, 2015).

An ETDA survey shows that there were 502,676 e-commerce entrepreneurs between April and October 2015. In 2014, the value of Thai e-commerce was $61,004.802 million, of which B2B was at $37.03-million (60.69 %), B2C at $2.35-million (20.25 %), and B2G at $1.63-million (19.06%). Moreover, the growth of e-commerce in 2015 increased by 3.65%. It was expected that the estimated value of Thai e-commerce in 2015 would be $63.23-million: B2B at$36.9-million (58.32%), B2C at$14.24-million (22.57%), and B2G at$12.09-million (19.11%)(PAKAWACHKRILERS, 2015).

Accommodations and food showed the highest value because of the growing travel industry in Thailand, a rising middle class, the introduction of low-cost airlines, and social media. These had a positive effect on tourism in Thailand. Another positive factor is the increase in Internet users, especially of social media and in retail and wholesale, which could advance the Thai economy efficiently (PAKAWACHKRILERS, 2015).

According to statistical data, all types of industry groups have shown steady growth, except for manufacturing and insurance. Some entrepreneurs still face internal and external problems. The internal problems include a lack of human resources, which results in outsourcing for international specialists and creating high cost in production and transportation. On the other hand, the external problems relate to the business tax model, technological infrastructure, and online security such as online entrance, online policy, and an unstable economy. The government and related organisations must solve these issues through better human resources, transportation, reduced infrastructure costs, or creating One Stop Services (PAKAWACHKRILERS, 2015).

There are four factors supporting e-commerce growth: an increase in e-commerce retail and wholesale industries or online shops, large investments from top domestic and international companies, broad survey groups, and e-commerce data provided by the Tourism Authority of Thailand (TAT) and the Office of Insurance Commission (PAKAWACHKRILERS, 2015).

Additionally, Thailand has officially launched new 3G and 4G telecommunication technologies. This will help improve the Thai telecom infrastructure, enabling convenience in lifestyles through faster Internet services. Thus, the price of computers and smart phones is declining. The government also has supported international investment by offering a 5-year tax holiday for foreign entrepreneurs, thus attracting a lot of overseas investment, which has led to high competition in e-commerce. This has led to the creation of new e-payment methods, such as cash on delivery (COD), in which the customer pays after using the product or service (PAKAWACHKRILERS, 2015).

Mobile Space

The Thai mobile market is one of the largest markets in the Asia Pacific with a total of 83.1 million mobile subscribers and a penetration rate of 122.3%. The high growth in the past has been associated with a combination of low prices, multiple SIM ownership, and aggressive competition. The growth appeared to be declining however in 2015. The 8% decline was due to the result of the compulsory prepaid SIM registration drive that required operators to block unregistered SIM cards from using voice and data services. Like most developing Asian markets, Thailand's mobile market is largely dependent on prepaid subscribers.

Smart Cities

Smart Thailand is part of the national ICT framework called "ICT2020,", a development blueprint for the country that leads and guide all parts of the economy. In addition, the blueprint also guides the government sector to move forward with ICT development. The objective of the Smart Thailand concept is to raise the country's competitiveness ranking in the world, empower local stakeholders such as education and business sectors to be ready for competing with other regional countries when the AEC kicks off in 2015, and to reduce the cost of using ICT for Thai people and help them use ICT to improve their quality of life.

The government has allocated three million dollars to implement the city of Phuket to be a smart city. The investment will create a digital infrastructure and data center in Phuket (Tortermasana, 2016). The government has partnered with the Korean government to participate in several projects to develop digital infrastructure, and the government plans to implement broadband infrastructure, the Internet of things (IOT), and surveillance cameras (Group, 2016). Chiang Mai, the largest city in the northern part of Thailand, was selected to be the second smart city. Bangkok, the capital city of Thailand, has also invested in a smart city project (Monitor, 2010). The Bangkok Metropolitan Administration (BMA) has implemented CCTV systems to monitor and reduce crime, and the BMA has used IBM's Cognos business intelligence software together with global information system (GIS) mapping and visualization tools so that officials can utilize technology to detect crime patterns and take proper measures to prevent criminal activities (Monitor, 2010). In addition, the BMA has planned to implement a common ticket system for all public transportation; this integrated ticket system will integrate the collaboration of all public transportation (Monitor, 2010).

Entering the Age of the Internet of Things

According to interviews with government officials, Thai authorities have recognized the importance of the Internet of Things (IoT). Thailand has been hit hard by cyber threats. In 2015, there were 4371 incidents reported (Thai CERT, 2016a). The most frequent attack in 2016 was a malicious software attack (31.7%). The second and the third were phishing (27.4%) and intrusion attempts (14.4%) (ThaiCERT, 2016a). According to an interview with the deputy director of the ETDA, there has been an increasing incidence of malicious software targeting smart devices such as smartphones, smart homes, and smart cars. The government encourages manufacturers to comply with international security standards such as NIST and ISO. However, the manufacturers have not followed the security standards or practices, and the government does not have any authority to force companies to comply. When asked about the approach to IoT regulations, the officials stated that the industries should come up with "self-regulation" rather than regulations by the government.

The Thai Approach to Sustainable Development and How it is Being Applied to ICTs

The organizations that are responsible for cybersecurity in Thailand include the ETDA, ThaiCERT, the Royal Thai Police Headquarters, the Department of Special Investigation (DSI), and the Central Institute of Forensic Science. Thailand has no regulations for cybersecurity; however, the government is trying to push many bills related to cybersecurity and cybercrime. The acts related to cybersecurity include the Electronic Transactions Acts and Computer Related Crimes Acts. The former aims to protect the security of electronic transactions, while the latter aims to defend again computer-related crimes. The Electronic Transaction Acts does not have any legal enforcement. The Acts only intend to provide (security) guidelines and recommendations for organizations to conduct electronic transactions. For example, the acts encourage both public and private organizations to have security and privacy policy, but they do not have any power to enforce the organization to do so. As a result, since the Acts was created in 2001, 128 out of 200 public organizations had security policy.

For the security of critical infrastructure, the government has prepared the National Cyber Security Acts to deal with the threats against critical infrastructure. The National Cyber Security Committee (NCSC) will be created, which will create a cyber security master plan to address threats against critical infrastructure. Nevertheless, the law has been opposed by many stakeholders since section 35 allows officials to monitor and intercept Internet traffic. Due to political conflict, people are afraid that the government might abuse this law for political advantages.

Regarding computer-related crime, the government is in the process of amending the acts. The Computer Related Crime Acts of 2007 has been used since 2007. The Thai governments have applied the law to shut down or block thousands of websites and to prosecute a number of Internet users. Many global companies, including Facebook and Google, decided not to invest in Thailand since section 15 indicates that the owners or administrators have to be responsible for any crime, such as posting inappropriate content, conducted on their websites.

Big Data

The amount of data being generated and stored is inconceivably large. Big Data is the act of gathering and storing large amounts of data for analysis. There is a potential to gain key insight from data and information

to make better use of business information. Big data enable businesses to reduce costs, develop new products, and make better decisions (SAS, 2016). Many businesses in Thailand have collected tremendous amounts of personal data from customers.

Thailand has no regulations or policy related to Big Data. According to an interview, the government has been trying to push a Personal Data Protection Bill, which will regulate the process of the collection, utilization, and disclosure of personal data. The government encourages the industry to come up with "self-regulation" and to follow privacy standards, such as Fair Information Practice Principles (FIPPs).

Data Center

A data center is a facility that houses computers, telecommunications, and storage systems. It provides backup power supplies, efficient data communication connection, environmental controls, and security systems (Wikipedia, 2016). In the age of cloud computing, a data center is the most critical component connecting all devices and allowing efficient relay of data to users. The data center allows businesses and individuals to rent computer infrastructure and services without buying them. Therefore, it allows for cost reduction and better computing services. The creation of a data center both for the public and for private entitites is necessary for the success of the digital economy policy in Thailand. The strategic location in the center of Southeast Asia and having a good investment climate allow Thailand to attract global data centers for investment. Global data centers such as TCC Technology, Digital Port Asia, and SuperNap International have invested in data centers in Thailand and their data centers provide services for both domestic and international customers (BOI, 2016a).

The Rise of Thai Start-ups

Thai tech startups have been known for innovative solutions in e-commerce, m-commerce, payment, and crowdsourcing. Thailand has an ecosystem to accelerate innovative startups, and the government provides accelerator and incubator programs in major cities such as Bangkok, Phuket, and Chiang Mai. These incubator programs provide co-working spaces that allow tech entrepreneurs, investors, developer, designers, and technology leaders to work in close proximity in order to exchange ideas, thoughts, and innovations. Examples of co-working spaces are Hubba, Launchpad, Pah Creative Space, and the Hive (BOI, 2016a). The startups in Thailand also enjoy the benefits of having access to ASEAN's electronic clusters. They can access OEM, global manufacturers, and prototyping facilities. One of the best examples is Drivebot, a Thai startup that has developed a device that can monitor a car's condition. This device allows real-time monitoring of a car through a smartphone application. Another example is aCommerce, which is a leading provider of e-commerce total solutions for other startups (BOI, 2016a). The creation of startup trends allows businesses in Thailand to be more creative and innovative.

Support from Global Companies

Thailand has a potential to be the digital hub of ASEAN due to its strategic location, its skillful workforce, and good infrastructure, and the country has attracted many global technology firms to support its digital economy policy. These firms can help create strong foundations for digital development in Thailand. These companies include Intel Corporation, Microsoft, Cisco, and EMC. Microsoft has established a Microsoft Innovation Center at the headquarters of the National Science and Technology Development Agency.

The center has partnered with several government agencies to educate a new generation of IT workers and has provided technology support for SME capability development. The center also provides incubation programs for local tech startups (BOI, 2016a). In addition, EMC has offered many training courses related to Big Data for Thai universities. Cisco Systems has collaborated with the government to provide Internet gateways and broadband initiative (BOI, 2016a).

Innovative Workforce

The primary component of a digital economy is its education systems, which can educate and train entrepreneurs, developers, innovators, and future technology leaders. Many universities offer cutting-edge IT programs. The leading tech universities include Chulalongkorn University, King Mongkut Institute of Technology, and Thammasat University. Regarding management schools, Thailand has three AACSB accredited business schools the National Institute of Development Administration (NIDA Business School), the SASIN Business School, and the Chulalongkorn Business School. These institutions educate and train IT managers and entrepreneurs and also provide incubation centers.

Access to Markets

Thailand is located at the center of Southeast Asia. The ASEAN community consists of ten countries. The ASEAN Economic Community or AEC came into effect in 2015 and represents 600 million consumers with a combined GDP of more than two trillion dollars (BOI, 2016a). Thailand provides global companies with a gateway to reach the AEC market.

Related Government Agencies

There are several government bodies related to the implementation of digital Thailand (BOI, 2016a), including the following:

1. Thailand Science Park (TSP) was created in 2002 to promote innovation and encourage research and development activities within technology industries. The agency also provides business space and a full range of services to support technology for businesses.
2. Thailand Software Park is an agency under the National Science and Technology Development Agency (NSTDA). The park was created to engage the participation and collaboration among stakeholders from all industries in Thailand.
3. The National Electronics and Computer Technology Center (NECTEC) is a primary research center under NSTDA. It is responsible for supporting and promoting research in the areas of electronic and computer technologies.
4. The National Software Industry Promotion Agency (SIPA) is an organization aimed at promoting the software industry and supporting knowledge sharing among software companies.
5. The Electronic Transactions Development Agency (ETDA) was founded to develop, promote, and support electronic transactions. ETDA also provides IT infrastructure and policy to facilitate electronic transactions for both government and business organizations.

6. The Electronic Government Agency was created to develop, manage, and provide e-Government infrastructure and services for government applications.
7. The National Broadcasting and Telecommunications Commission (NBTC) is an independent state regulatory body. The major responsibility of NBTC is to allocate radio spectra and to regulate telecommunications and broadcasting industries.
8. The Association of Thai ICT Industry (ATCI) is an association responsible for supporting the use of ICT for business development. ATCI promotes ICT development in the ICT sector.
9. The Ministry of Digital Economy and Society was established in September 2016. This new ministry assumed the responsibility of the Ministry of Information and Communication Technologies. The Ministry is responsible for implementing digital policy to transform Thailand to a digital economy and society.

Challenges

Digital Divide

A digital divide is a gap between those that have access to digital technologies and those that do not. A digital divide often leads to other gaps in society for example in terms of economic status, education status, social status, and job education. A digital divide still largely exists in Thailand. In 2014, household PC penetration was 57.2% in Bangkok, while it was 25.9% in the north-eastern region (NSO, 2014). The people that live in Bangkok and central areas often have access to digital technologies such as computers, notebook, tablets, smartphones and the Internet. However, the people or businesses located in rural or suburban areas often lack this access to digital technologies.

Despite being a destination for ICT investment, most Asian countries are still lagging behind the average global adoption of ICT. With the exception of Singapore, most south eastern Asian countries, including Thailand, lack the ability to climb out of low margin ICT manufacturing into high-margin service sectors, such as innovative software design, mobile application development, and IT services.

Globally, 4 billion people are not connected to the Internet, and almost 2 billion people do not have access to mobile phones. Almost five hundred million people live outside mobile signal areas. According to the world bank report, Thailand was ranked among the twenty countries where at least 48 million people still had no Internet access in 2015. In the report "World Development Report 2016: Digital Dividends," the world bank indicated that Thailand was still in a transition period in terms of technology adoption. The report recommended the country not only promote its Internet connections, but also carry out effective digital strategies to motivate citizens and business as well as government agencies to adopt digital technology (Leesa-Nguansuk, 2016).

Deepak Mishra, the author of the World Development Report 2016: Digital Dividends, has stated that access to the Internet is necessary but not sufficient for the digital economy. The country requires a strong complement, especially regulations, that creates good a business environment such as digital laws, cybercrime acts, digital payment, and e-government (Mishra, 2016). The report implied that digital monopoly and regulatory uncertainty are the critical factors in creating low adoption of digital technologies.

The country continues to have a wide disparity of information access, with access for some segments of the ICT sector greater than for others. Indeed, this *"digital divide"* is quite large compared to that of other developing countries. For example, only 24 percent of the population have access to the Internet. On the mobile phones front, the gap between urban and rural areas is considerably smaller—approximately a 76% usage rate in Bangkok and environs versus a range of between 50% and 62% in the regions, with an overall country rate of nearly 57% (NSO, 2014).

However, the situation is appreciably less rosy in the area of information technology, where the gap between people that are able to access information technology and people that cannot use ICT continues to be quite wide. For example, in 2009, with only about 29.3%of the population using computers and only about 20.1% using the Internet (Santipaporn, 2010), the proportion of people using information technology in Thailand was much lower than that of other developing countries (such as Vietnam, Philippines, Malaysia, and China), particularly with respect to the Internet usage proportion (Stats, 2011). In addition, the disparity of ICT use between the Bangkok metropolitan area and the regional areas was quite high.

Government Efforts to Narrow the Digital Divide

Although helping people at every level and in every region of the country to have a computers and access to the Internet in a short period of time is difficult, the government has tried to fix the disparity of computer and Internet use by conducting projects and creating strategies to support educational units, as well as helping community and district units obtain computers and Internet access. However, they still lack enhancement for effective accessibility to information and communication in remote areas. However, with only 10% of rural households having computers (despite nearly 100% rural electrification), it is likely that the cost of computers still places them beyond the pocketbook of most of the farming population, which constitutes the majority of rural citizens. Further, a lack of education or instruction on how to utilize computers is believed to further contribute to the urban-rural gap in the usage of information technology.

A particularly difficult challenge to overcome is the big gap between rich and poor people, especially in urban and rural areas, which has mainly impacted human development in terms of intellectual property, as well as social and economic status. This is a main challenge for Thailand—to reduce the gaps between the rich and poor, and between the educated and uneducated related to accessibility to information technology, by providing Internet and mobile networks for everyone in all areas in order to disseminate information, news, and education to them at the same level. This would lead to developing the country's sustainably through ICT development, which is an important and basic factor for improving the quality of people's lives in the long run.

The Rise of Computer Crimes

There has been an increasing number of computer/Internet-related crimes in Thailand. In 2016 (until November), there were 3,459 reported computer crime cases. The top computer crime was from the distribution of malicious codes such as viruses, worms, Trojan horses, and spyware. The second highest ranking was fraud, and the third was intrusion, including hacking activities (ThaiCert, 2016b).

The Controversial Issues of Computer Crime Acts

On December 16th 2016, the National Legislative Assembly (NLA) passed a draft of the Computer Crime Act. Thai netitzen networks and Amnesty International submitted more than 300,000 names of people

opposed to the bill claiming that it contradicted the fundamental rights of freedom of expression (Monitor, 2016b). The Computer Crime Acts has been criticized as one of the harshest computer crime acts in the world. The law allows authorities to intercept private communication and block any websites that are considered "harmful" to national security. The laws also publish anyone that enters false information into computer systems. In addition, any organization that provides access to networks or Internet must keep data from ninety days to as long as two years (Monitor, 2016d). Arthit Suriyawongkul from the Thai Netizen Network, an organization that promotes online freedom, stated that the new law could be used to silence citizen's voices: "The bill is very broad and open to interpretation" (Monitor, 2016d). The law would allow authorities greater control of the Internet. Authorities can read private messages and block any website that is considered to be harmful or inappropriate to national security (Monitor, 2016a). However, Prime Minister Prayut Chan-o-cha asserted that the law does not violate people's rights, but it can be used to prevent illegal online activities and terrorism (Monitor, 2016c).

Since the amendment of computer crime acts on December 19th 2016, hackers have launched a series of attacks against the Thai Government's websites. At least six government websites were brought down on amendment day. On December 20th 2016, the government's procurement website was attacked and could not be used for distributing funds for bidding projects. On December 21st, the homepage of the Defense Ministry's website was inaccessible. The attacks were claimed to be the responsibility of an activist group called "Civilians against Single Gateway." They demand that the government scrap the law (Monitor, 2016a).

FDI (Foreign Direct Investment)

Thailand's competitiveness has relied on FDI. Thailand has been a successful investment destination for global ICT companies such as Seagate, Sony, Western Digital, IBM, Microsoft, Oracle, Sumsung, HP, and Reuters. The country has been one of Southeast Asia's top destinations for three decades due to its good investment climate, and Thailand has been ranked 2nd in ease of doing business among emerging economies in East Asia, 11th in the world's most promising emerging economies, and 14th in the global manufacturing competitiveness index (BOI, 2016b). Thailand has approximately 70 well-developed industrial estates regarded as one of the world's best industrial regions (BOI, 2016b). In terms of pro-FDI policies, the Board of Investment of Thailand (BOI) has offered both tax and non-tax incentives. These incentives included exemptions or reductions of corporate income taxes as well as import duties on machinery and raw materials. In terms of non-tax incentives, firms are allowed to bring in foreign workers, take or remit foreign currency abroad, and even own land. However, there have been emerged signs that the country is losing its competitive advantage. First, the minimum wage has been increasing, and many global manufactures and firms are moving to lower-wage countries such as Vietnam, Laos, or Mynmar. Second, the growth of FDI diminished from $1,819 million in 2012 to $1,340 million in 2013 and a mere $988 million in 2014 (BOI, 2016a, 2016b).

In addition, many global Internet firms such as Microsoft, Facebook, and Google are worried that Thailand's recent crackdown on the Internet might reduce opportunities for global companies to invest in Thailand. Thai Internet firms are worried about a case involving Chiranuch Premchaiporn, the Thai webmaster of prachathai.com. She was prosecuted for allowing inappropriate information on her popular website (Hookway, 2011). Tyrell Haberkorn, a research fellow at Australian National University who

conducted research about Internet issues in Southeast Asia stated that "[i]t's deeply ironic that a law whose stated aim is to create stable e-commerce environment is achieving completely the opposite result" (Hookway, 2011). In addition, the Asia Intent Coalition, which a the group based in Honk Kong founded by Google, Yahoo, eBay, Nokia, and Microsoft, stated that "[b]y holding an intermediary liable for the actions of its users, this case could set a dangerous precedent and have a significant long-term impact on Thailand's economy" (Hookway, 2011). This concern might prevent opportunities for global firms to invest in Thailand.

Corruption

Thailand has a long history of corruption and is profoundly rooted in Thai culture. Government officials are entitled to 10 to 30 percent of governmental project budgets for their services. The norm of giving gifts to high-ranking officials is considered appropriate. Bribes are often received by officials or their relatives that are in the position of granting government projects. In 2013, a Global Corruption Barometer study indicated that 71 percent of Thai people perceived the police to be corrupt or extremely corrupt, and 68 percent believed that the politicians were corrupt source http://www.transparency.org/gcb2013/country/?country=thailand.

ICT Education/Research and Development

Research and development activities are necessary components for creating competitiveness. However, expenditures for R&D compared to GDP was 0.48%, which was relatively low compared to the global average at 2.124% (W. Bank, 2016).

2. CONCLUSIONS

This study describes how Thailand has used digital technologies and policy to enhance the country's competitiveness. The study investigates the current status of digital technologies in Thailand and also identifies the challenges and opportunities for technology adoption. The findings from this study can be used to guide the development of digital economy policy in other developing countries. Your conclusion seems too short and weak for the good article earlier.

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