Digital Thailand

Danuvasin Charoen*

Abstract

In December 2016, Prime Minister Prayuth Chan-Ocha had led the government for more than two years. Driving the new government's vision was the fact of an economy primarily based on agriculture, manufacturing, and tourism, but 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. Nevertheless, all officials were confident that the planned digital economy policy would contribute immensely to national development, to people's quality of life, and to the country's competitiveness in preparation for the advent of the ASEAN Economic Community (AEC). However, the problems attendant to development of digital economy were numerous, including government tardiness in adopting ICT technologies, limited population access to broadband internet, increasing cybercrime, inefficient payments and logistics infrastructure, controversial issues related to the Computer Crime Act of 2016 (as amended), digital divide, poor education, lack of research and innovation, and lack of public trust in transactions on the Internet – to name a few. Also, the military government's recent announcement of its intention to control the access and flow of information on the Internet through introduction of a revised computer crime act had generated widespread criticism. Although the military government would vanish

* Graduate School of Business Administration at the National Institute of Development Administration (NIDA)
188 Moo 3, Serithai Road, Klong-Chan, Bangkapi, Bangkok 10240, THAILAND.
E-mail: danuvasin@gmail.com

after promised elections, the Prime Minister had made it clear that his government was willing to do anything to ensure the success of the digital economy policy, which was to be his government's major legacy. Thus, he had to determine what steps to take to implement the digital economy policy and devise strategies to deal with obstacles.

In early 2017, the results of the Global Competitiveness Ranking, Global IT Report, and Network Readiness Index report that had just come out were not looking good for Thailand – which, to make the situation worse, had recently been sanctioned by the international community because of the May 2014 military coup. Out of 144 countries, Thailand was ranked 70th in availability of latest technologies, 94th in individuals using Internet, 71th in broadband internet subscription, 70th in capacity for innovation, 70th in patents per million population, 121th in intellectual property protection, 118th in public trust in politicians, 72th in quality of overall infrastructure, and 68th in quality of the education system [1]. Consequently, Thai people had high expectations for Prime Minister Chan-o-Cha's government. He had to prove to both his supporters and opponents that his government was not like former democratically elected governments that, in the final analysis, had done little to bolster the country's standing amidst the nations of the world. The prime minister needed to demonstrate to people that his military government had the resolve to improve Thailand and elevate the country to the next level through the use of digital technologies.

Keywords: Digital Economy, Thailand 4.0, Digital Nation, ICT Competitiveness

ดิจิทัลไทยแลนด์

ดนุวศิน เจริญ*

บทคัดย่อ

ในเดือนธันวาคม พ.ศ. 2559 พล.อ.ประยุทธ์ จันทร์โอชา นายกรัฐมนตรีไทยคนที่ 29 และหัวหน้าคณะรักษาความสงบแห่งชาติ ได้เป็นรัฐบาลเป็นเวลาสองปี นโยบายรัฐบาลของ พล.อ.ประยุทธ์ ต้องการเปลี่ยนแปลงระบบเศรษฐกิจของประเทศจากภาคการเกษตรกรรม การผลิต และการท่องเที่ยว ไปสู่การใช้เทคโนโลยีสมัยใหม่และการพัฒนานวัตกรรม โดยรัฐบาลต้องการนำพาประเทศไทยไปสู่ประเทศที่พัฒนาแล้วโดยอาศัยเทคโนโลยีดิจิทัล อย่างไรก็ตาม นโยบายนี้เต็มไปด้วยอุปสรรคอย่างมากมาย อาทิเช่น ช่องว่างทางดิจิทัลที่ใหญ่ การเติบโตของอาชญากรรมคอมพิวเตอร์ ความไม่พร้อมทางด้านโครงสร้างพื้นฐาน จำนวนและคุณภาพของงานวิจัยที่ไม่เป็นไปตามมาตรฐานสากล รัฐบาล พล.อ.ประยุทธ์ มีความมุ่งมั่นในการเปลี่ยนแปลงจนนำไปสู่การออกนโยบาย Thailand 4.0 เพื่อผลักดันการพัฒนาการใช้เทคโนโลยีดิจิทัลในทุกภาคส่วนของระบบเศรษฐกิจในประเทศไทย ด้วยอำนาจที่มีอยู่เต็มมือ พล.อ.ประยุทธ์ ต้องการสร้าง Thailand 4.0 ให้เป็นมรดกที่มาจากรัฐบาลทหาร คำถามที่ พล.อ.ประยุทธ์ ต้องการคำตอบคือ เวลาจากนี้ไปเหลืออีกไม่นานก็จะมีการเลือกตั้ง รัฐบาลจะผลักดันนโยบายนี้ พร้อมกับขจัดอุปสรรคต่าง ๆ เพื่อให้ประเทศไทยพัฒนาไปสู่ประเทศดิจิทัลอย่างสมบูรณ์แบบได้อย่างไร

คำสำคัญ: เทคโนโลยีดิจิทัล ไทยแลนด์ 4.0 ช่องว่างทางดิจิทัล นโยบายดิจิทัล

* คณะบริหารธุรกิจ สถาบันบัณฑิตพัฒนบริหารศาสตร์
เลขที่ 118 หมู่ 3 ถนนเสรีไทย แขวงคลองจั่น เขตบางกะปิ กรุงเทพมหานคร 10240
อีเมล: danuvasin@gmail.com

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 was 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 2016 as slightly more than 68 million people). Thailand was the second largest economy in ASEAN after Indonesia. It was considered an upper middle country with pro-investment policies and well-developed infrastructure. The country was separated into six regions (North, Northeast, East, South, West, and Central) plus the administrative region comprising the capital, Bangkok (*"Krung Thep"*), which was by far the most significant urban area in the country (see Exhibit 1).

Demographically, the country was comprised of a majority of ethnic Thais, but also had a 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 fell into the 15-64 age group, although a significant portion (nearly 20%) were in the 0-14 age group and slightly more than 9% were in the 65 years and older group. A 50:50 ratio of males to females pertained in each age group. The population growth was 0.566% as of 2011, which represented a decline from the previous year. Culturally, the country had 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 – had exerted the most profound influence on the ethos and mores of Thai society. The country was 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 enjoyed a high level of literacy, with nearly 93% of the population who were 15 years old and over able to read and write. Education was provided mainly by the Thai government through the Ministry of Education and was free through the twelve years of school, but was compulsory only through the first nine years. In 1932, the absolute monarchy that had prevailed for seven centuries

was replaced by 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, Thai people continued 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) was one of 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 was also an active participant in the legislative branch of government. An independent judiciary with a supreme court of final authority comprised the third branch. Since the reformation, Thailand had undergone 19 military coups d'etat and 18 constitutions and charters, reflecting a high degree of political instability. Moreover, throughout the reform period, Thailand had 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 22nd of May 2014, the politics of Thailand were based on the framework of a constitutional monarchy, which the prime minister is the head of government and the king is the head of state. The judiciary, the executive, and the legislative branches were independent from each other. Since the coup on May 22nd 2014, the constitution was revoked and Thailand was under the rule of a military entity called 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 had created an interim government, national legislative assembly, and other government entities tasked with implementing reforms.

Thailand's Economic Structure

According to the World Bank, Thailand had transformed itself from a lower-middle income into an upper-middle income economy as of 2011. Thailand's economy had grown, on average, 7.5 percent annually; and poverty had decreased tremendously from 67 percent in 1986 to 11% in 2014. Nevertheless, poverty and inequality still posed both economic and political challenges. Poverty in Thailand was largely in the rural areas. In 2013, more than 80 percent of Thailand's 7.3 poor people lived in rural areas where there was a lack of modern infrastructure. The wealth distribution was largely unequal compared to other East Asian nations. Significant infrastructure development could be seen in large cities such as Bangkok, Chiang Mai, and Phuket, while the poverty remained in the Northeast, North, and Deep South [2].

Thailand's economy was based largely on manufacturing and tourism. The country was also endowed with rich natural resources such as tin, rubber, natural gas, tungsten, gypsum and lignite. Most of the labor force (43.3%) worked in the agriculture sector; however, manufacturing accounted for 40% of the GDP, compared to only 8.3% from Agriculture (see Exhibit 2). Total exports in 2015 were 212 billion dollars, while total imports in 2015 were 177 billion dollars (see Exhibit 3).

Thailand Path to Development

Thailand had gone through three stages of development. Thailand 1.0 relied on agriculture and natural resource as the primary source of competitive advantage. In Thailand 2.0, the country focused on foreign direct investment policy. Thailand had successfully attracted investment from major global firms in the industries such as electronic and electrical appliance, automotive, and auto parts. Major competitive advantages included cheap and high skill labor, good location, good infrastructure, and good education. In Thailand 3.0, Thailand focused on the investment of heavy industry with advance machinery. Many businesses replaced workers with the use of machine. The minimum wage was increased to 300 baht per day in 2011. Many industries and businesses had adopted global standards

such as ISO in their business processes [3]. However, under Thailand 3.0, the nation faced the "middle-income trap." Thailand had large social and economic disparities which created imbalanced development. In addition, the development focused mainly on large metropolitan areas such as Bangkok, Pattaya, Phuket, and Chiang Mai, while most parts of the country were ignored.

Thailand 4.0

To enhance Thailand's competitiveness through digitization, General Chan-o-cha said 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. Henceforth, the country was to focus on becoming a value-based and innovation-driven economy by shifting from producing commodities to innovative products or services emphasizing the use of digital technologies. Thailand 4.0 was a new economic development model that could potentially upgrade the nation from traditional agricultural and manufacturing to an *innovation-based* society. The policy intended to promote innovation and creativity through the use of technology in various sectors of economy [4]. As earlier stated, Thailand had gone through three economic development models (see explanation above). The new Thailand 4.0 focus called for on upgrading the country through innovation and creativity. General Chan-o-cha targeted 10 industries to be the drivers of digitization. It also created a 20-year national strategic plan consisting of targets and aspirations in six areas – i.e., (1) security, (2) competitiveness enhancement, (3) human resource development, (4) social equality, (5) green growth, and (6) rebalancing and public sector development [4].

Industry 4.0

In mid-2016, the president of Federation of Thai industry established Industry 4.0. Industry 4.0 consisted of two major phases. The first phase (2015-2020) was aimed at upgrading industry from industry 2.0 to 3.0 with the use of advance autonomous machinery to enhance productivity. The second phase (2021-2025) was aimed at achieving product and service differentiation with business models

driven by innovation and creativity. The target industries for "Industry 4.0" included auto parts, electronics, food processing, machinery, agricultural machinery, and embedded technology. Major technologies that could be used to stimulate Industry 4.0 included IoT (Internet of Things), e-Commerce, Fintech, Robotics, Agritech, education technology, and smart factory [5]. These technologies had a potential to not only reduce the cost of labor but also enhance productivity and efficiency in business processes. The heart of Thailand 4.0 was digital technologies, without which the nation would be unable to transition to the next level of development.

ICT in Thailand

Kiatchai Sophastienphong, vice-minister of the finance Ministry, said Thailand had intensive internet usage with 53 million internet users. The country's mobile penetration rate was at 149% of the population. In 2015, there were 84 million mobile subscribers in Thailand. The e-payment market reached 825 trillion bath. According to Yozzo, Thailand-based ICT consulting firm, Thailand had the world's third largest number of Facebook users at 35 million people, 33 million Line users, 4.5 million Twitter users, and 2 million Instagram users [6].

Transformation Power of ICT

Many research studies indicated that ICTs could create economic opportunities and foster political and social inclusion, eventually contributing to shared prosperity. In addition, ICTS could foster entrepreneurship and create new business models such as crowdfunding, Airbnb, and Uber. Furthermore, ICTs also contributed to social benefits by enabling public access to financial services and education. ICT allowed more direct interaction between people and government, thereby providing a new method for citizen participation in policy and decision making processes [7].

Internet Usage in Thailand

Exhibit 4 shows genders, locations, frequency and activities of internet users in Thailand. Exhibit 5 shows the growing numbers of computer, internet and mobile phone users aged 6 years and over between 2010 and 2014. From 62.3 million populations, percentage of mobile phone users ranked first in 2014, 77.2%, followed by computer and internet, 38.2% and 34.9%. However, there were differences as between online users in municipal and non-municipal areas due to access to internet and infrastructure. All municipal areas had twice as many users in computer and internet from 2010 to 2014, approximately 45:39% and mobile phone around 77:65% (see Exhibit 5). The number of online users aged 6 and over had the highest rate in Bangkok, especially among mobile phone users, 89.2% followed by central, north, south and northeast region. For the internet and computer user percentage was about 40% except in Bangkok which almost reached 50% (see Exhibit 6).

Thai population who had internet access preferred to use broadband, including fixed broadband and mobile wireless 3G, rather than narrowband such as analog modem, ISDN, mobile wireless 2G and 2.5G. The ratio between broadband users and narrowband users for the whole kingdom was around 6:42. Nonetheless, the most preferable type of internet used was mobile wireless 3G, for which Bangkok had the highest rate and the Northeast has the lowest rate (see Exhibit 7).

The percentage of users of computers and the internet was highest among aged 6 to 14, 84.9 and 58.2 respectively. However, the potential users were between ages 15 to 24 and 25 to 34 according to online activities (see Exhibit 8). In addition, the Thai population aged 6 to 14 and 15 to 24 used computers or the internet mainly for study, while users aged 25 to 34 and 35 to 49 used them for work. However, the second top activities were different between each age group, largely as a consequence of the types of activities in which users engaged – with those aged 6 to 14 spending money mostly on games, while age groups spent money on other entertainment services (see Exhibit 9).

Except for education learning activities, blog web 2.0, chat, instant message, voice over internet protocol (VOIP), social network, download software and search

for information, were the top 10 activities for population aged 15 to 34 (see Exhibit 10). Moreover, people, on average, spent around $6-12 per month (see Exhibit 11).

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, WeLoveShopping was launched and grew rapidly, ranking among the top three visited online shopping platforms in Thailand. Since 2010, many online shopping platforms were established and competed fiercely. Lazada, an international online platform that had invested in 6 Southeast Asian Countries, started in Thailand in 2012, along with Zalora. As telecommunication began to change from 2G to 3G in 2013, many online shopping platforms were launched and became more competitive than ever. Additionally, the increase in Facebook and Line users created opportunities for online advertising for online shopping platforms. As a result, Lazada became the most visited online shopping platform in 2015.

In 2014, Thai E-commerce doubled from 2013. Since 2014, the growth in e-commerce increased gradually to $63230.79 (see Exhibit 12). Comparing Thai e-commerce with other countries', Thailand had the highest B2C e-commerce among ASEAN countries, in 2014 (11.7), while the top B2C e-commerce countries are developed countries such as the USA, China, Japan and South Korea [8] (see Exhibit 13).

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), of 79.9%. In addition, most e-Commerce in Thailand (66.8%) was small-scale (1-5 persons). Travel, hotel, and resorts were the most popular types of business, followed by fashion accessories and computer and electronic appliances [8] (see Exhibits 15, 16, and 17).

The ETDA survey showed 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 3.65%. It was expected that the estimated value of Thai e-commerce in 2015 would be $63.23-million: B2B of $36.9-million (58.32%), B2C of $14.24-million (22.57%), and B2G of $12.09-million (19.11%) [8] (see Exhibit 18).

Accommodation and food were the highest value because of a 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 was the increase in internet users, especially of social media and in retail and wholesale, which could advance the Thai economy efficiently [8] (see Exhibit 17).

According to statistical data, all types of industry groups had steady growth, except for manufacturing and insurance. Some entrepreneurs still faced internal and external problems. The internal problems included a lack of human resources, which resulted in outsourcing for international specialists and creating a 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 the unstable economy. There were four factors supporting e-commerce growth: 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 [8].

Additionally, Thailand had officially launched new 3G and 4G telecommunication technologies. It was believed that these would help improve the Thai telecom infrastructure, enabling convenience in lifestyles through faster Internet services. The prices of computers and smartphones were declining. Further, the government also supported international investment by offering a 5-year tax holiday for foreign entrepreneurs, thus attracting a lot of overseas investment, which had led to high competition in e-commerce. This, in turn, had 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 [8].

Mobile Space

The Thai mobile market was 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%. High growth in the past had been associated with a combination of low prices, multiple SIM ownership, and aggressive competition. Recently, the growth appeared to be declining. The 8% decline in 2015 was due to 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 was largely dependent on prepaid subscribers. The Thai Telecom market comprised public and private players. Public players included CAT and TOT which owned most of the telecoms infrastructure, which was leased to private operators through BTO (build-transfer-operate) model. The revenue sharing provided private players access to CAT and TOT's network infrastructure and spectrum for an approximately 30% cut of their revenues.

From Concession to License

3G licenses were auctioned by the NBTC in 2012 and were subsequently allocated to the winning bidders, a unit of AIS, DTAC, and True. AIS, DTAC, and True launched their 3G services in May 2013. In addition, True also launched a 4G network service based on LTE (Long Term Evolution) technology, utilizing its 850 MHz and 2.1 GHz frequency, in May 2013, giving it the "first mover advantage" over its rivals. DTAC launched its 4G LTE network service in May 2014, utilizing its 2.1 GHz frequencies. In 2015, the 3G service served 600,000 subscribers. The 1800 MHz and 900 MHz spectrum auctions were carried out in the Q4 of 2015. The auctioning of 2 licenses for 10 MHz each in the 900 MHz band was in total 151.96 billion baht, (the highest price for spectrum in history). The 2 licenses for 15 MHz each in the 1800 MHz band were auctioned for 80.78 billion bath. In total, the government made 232.72 billion baht from both auctions. In addition, the auction saw a new player, Jas Mobile, being licensed for 10 MHz in the 900 MHz. Jas Mobile won a bidding for 75.65 billion bath. Later, the company failed to secure the finance for the first installment of the spectrum fees.

Strategic Framework for a Digital Economy

The Strategic Framework for a digital economy in Thailand has five components

1. Hard Infrastructure

Thailand must develop its digital infrastructure both wired and wireless. The development of the network infrastructure can provide connectivity nationwide, and the network infrastructure must support high-speed broadband communication. In addition, the infrastructure also includes the development of data center and cloud computing services for both public and private organizations to take advantage of. Furthermore, the price of services must be low, and their quality must be guaranteed.

2. Soft Infrastructure

Thailand must develop or modify all related laws and regulations related to the development of its digital economy policy. The soft infrastructure includes standards, laws, and regulations related to e-Transaction, data protection, and cyber security.

3. Service Infrastructure

Thailand must develop e-Government services by connecting governmental information through a single platform. The components include the creation of a central database, a national ID, and the establishment of a public information center. Furthermore, a standard of information must be developed to facilitate connectivity across agencies.

4. Digital Economy Promotion

The government must develop a fully-integrated digital ecosystem connecting enterprises and SMEs. The promotion of a digital economy includes the development of digital industry, capacity building, and the development of innovations.

5. Digital Society

The digital society includes the use of technologies to promote 1) quality of life enhancement, 2) poverty reduction and life-long learning, 3) civic empowerment and participation, 4) media and information literacy, and 5) ethical and societal usage.

Roadmap

In December 2014, the Thai Government amended laws related to digital technologies (see Exhibit 20) to facilitate the development of the digital economy policy. The government also upgraded the Ministry of Information and Communication Technology to the Digital Economic and Social Ministry to better coordinate digital economy policy. Furthermore, the government also planned to apply digital technology to the improvement of small and medium enterprises. The digital services provided by the government include services for everyone, including the elderly who previously had been left behind [9]. *"The economy can expand by 4% if Thailand becomes a digital-based economy and a trading hub for neighboring countries*," declared the Deputy Prime Minister Pridiyathorn Devakula [10].

The government hoped that its Digital Economy policy could jump-start economic growth to 4-5% by providing IT infrastructure that included a national broadband network, a digital gateway, and an integrated data center for both the private and public sectors [11]. In addition, the government planned to implement soft infrastructures such as laws and regulations related to cybersecurity, e-commerce, and paperless public services in order to create confidence on the part of the private sectors to engage in online transaction [11]. The digital economy projects included the creation of a national broadband infrastructure, the auctioning of a spectrum to provide fourth-generation (4G) wireless broadband services, the establishment of a national government data center, and increasing the number of international internet gateway facilities. The government believed that this project could stimulate the development of digital economy policy [11]. *"The effective*

use of information and communications technology (ICT) for economic and social development could result in greater productivity and could move Thailand out of the 'middle-income trap'," General Prayuth said [11].

In addition, Kosol Petchsuwan, one of eight NLA members working on the digital economy, said that Thailand's ICT industry could generate a market capitalisation of 1.2 trillion baht or 10% of the GDP this year. He mentioned that "of the total, 500 billion baht came from telecoms, 400 billion from e-commerce, 100 billion from broadcasting, 100 billion from information technology, 50 billion from digital content and 10 billion from digital marketing." He also pointed out that "Thailand has 200,000 kilometres of fibre-optic lines covering only half the districts in the country, but only 10% are used" [11, 12]. ICT Minister Pornchai Rujiprapa stated that "[u]p to 80% of the population is expected to have an internet connection next year, increasing to 95% in 2016" [11]. In February 2015, the cabinet approved a draft law establishing a digital economy committee. The primary responsibility of the committee was to steer the implementation of digital economy policies. The committee, for which the prime minister served as chairman, was also to create policies and evaluate the performance of governmental units for the transformation to a digital economy [9].

From Digital Economy to Digital Thailand

On February 8th, 2016, Prime Minister General Prayut Chan-o-cha proposed the project "Digital Thailand." The digital development plan would be implemented in four phrases for a period of twenty years. The first step was to build a foundation for Digital Thailand. The second step was to encourage participation of all sectors. The third step was to implement reforms, and the last step was that Thailand would be become one of developed countries in the world [13].

The "Digital Thailand" roadmap comprised six strategies. These strategies aimed to develop efficient digital infrastructure across Thailand. The plan was to use ICT to upgrade the economy by digitizing both public and private sectors. The government had set up 10,000 free Wifi zones. The access to broadband internet was provided in all villages. To boost economy, small and medium-sized

enterprises (SMEs) were encouraged to utilize digital platforms such as e-Commerce and mobile application to do business. For the social affairs, the government had set up electronic health records for medical to share information. In addition, the online learning systems were created to upgrade people's skill and education [13]. See Exhibit 19 for related government agencies related to Digital Thailand.

Smart Cities

Smart Thailand was part of the national ICT framework called "ICT2020", a development blueprint for the country that was to lead and guide all parts of the economy. In addition, the blueprint also nudged the government sector to move forward with ICT development. The objective of the Smart Thailand concept was to raise the country's competitiveness ranking in the world; to empower local stakeholders such as education and business sectors to be ready for competing with other regional countries when the AEC kicked 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 had allocated three million dollars to implement the development of the city of Phuket into a smart city. The investment was to create the digital infrastructure and data center in Phuket [14]. The government partnered with the Korean government to participate in several projects to develop the digital infrastructure. The government planned to implement broadband infrastructure, internet of things (IOT), and surveillance cameras [15]. Chiang Mai, the largest city in the northern part of Thailand, was selected to be the second smart city. Bangkok, the capital city, also invested in a smart city project [16]. Bangkok Metropolitan Administration (BMA) implemented CCTV systems to monitor and reduce crimes. BMA used IBM's Cognos business intelligence software together with global information systems (GIS) mapping and visualization tools for officials could utilize technology to detect crime patterns and take a proper measures to prevent criminal activities [16]. In addition, BMA was planning to implement the common ticket systems for all public transportation. The ticket systems integrated the collaboration of all public transportation [16].

Entering the Age of Internet of Things

According to interviews with government officials, Thai authorities had recognized the importance of the Internet of Things (IoT). Thailand had been hit hard by cyber threats. In 2015, there had been 4371 incidents reported [17]. 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%) [17]. According to the deputy director of ETDA, there had been an increasing incidence of malicious software targeting smart devices such as smartphones, smart homes, and smart cars. The government encouraged manufacturers to comply with international security standards such as NIST and ISO. However, even when manufacturers were found to have not followed the security standards or practices, the government lacked authority to force the companies to comply. When asked about this approach to IoT regulation, the officials responded 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 were responsible for cybersecurity in Thailand included the ETDA, ThaiCERT, the Royal Thai Police Headquarters, the Department of Special Investigation (DSI), and the Central Institute of Forensic Science. Thailand had no regulation for cybersecurity. However, the government was trying to push many bills related to cybersecurity and cybercrime. The acts related to cybersecurity included the Electronic Transactions Acts and Computer Related Crimes Acts. The former aimed to protect the security of electronic transactions, while the latter aimed to defend computer-related crimes. The Electronic Transaction Acts did not have any legal enforcement. The Acts only intended to provide (security) guidelines and recommendations for organizations to conduct electronic transactions. For example, the acts encouraged both public and private organizations to have security and privacy policies, but did not have any power to enforce the organization to do so. As a result, since the Acts was created in 2001, only 128 out of 200 public organizations had a security policy.

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

Regarding computer-related crime, the government was in the process of amending the acts. The Computer Related Crime Acts of 2007 had been used since 2007. The Thai governments had 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, had decided not to invest in Thailand since section 15 indicates that the owners or administrators would be held responsible for any crime, such as posting inappropriate content, conducted on their websites.

Relevant Pending Bills and Recent Acts Related to IT Security

Thailand recognized the importance of Cybersecurity and Cybercrime. Cybersecurity was considered a major component of digital economy policy. The government had passed bills to support the development of national cybersecurity, and in order to facilitate the development of this policy, the Thai Government had approved 10 bills related to information and communication technology, cybersecurity, computer crimes, personal data protection, and telecommunications. These bills were collectively known as the digital economy laws [18, 19] (See Exhibit 20).

Big Data

The amount of data being generated and stored was inconceivably large. Big Data was 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 a better use of business information. Big data enabled business to reduce cost, develop

new product, and make a better decisions [20]. Many businesses in Thailand collected tremendous amount of personal data from customers.

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

Data Center

A data center was a facility that housed computers, telecommunications, and storage systems. It provided backup power supplies, efficient data communication connection, environmental controls, and security systems [21]. In the age of cloud computing, data center is the most critical component connecting all devices, allowing efficiently relay data to users. Data center allows businesses and individuals to rent computer infrastructure and services without having to buy it. Therefore, it allowed cost reduction and better computing services. The creation of data center, both public and private, was necessary for the success of digital economy policy in Thailand. The strategic advantage of being in the center of Southeast Asia and having a good investment climate enabled Thailand to attract global data centers to invest. Global data centers such as TCC Technology, Digital Port Asia, and SuperNap International had invested in data centers in Thailand. Their data centers provided services for both domestic and international customers [22].

The Rise of Thai Start-ups

Thai tech startups were known for innovative solutions in e-commerce, m-commerce, payment, and crowdsourcing. Thailand had an ecosystem to accelerate innovative startups. The government provided accelerator and incubator programs in major cities such as Bangkok, Phuket, and Chiang Mai. These incubator programs provided coworking spaces allowing tech entrepreneurs, investors, developer,

designers, and technology leaders to work in close proximity in order to exchange ideas, thoughts, and innovations. Examples of coworking spaces were Hubba, Launchpad, Pah Creative Space, and the Hive [22]. Startups in Thailand also enjoyed benefits of having access to ASEAN's electronic clusters. They could access OEM, global manufacturers, and prototyping facilities. One of the best examples was Drivebot, a Thai startup that developed a device that could monitor a car's condition. This device allowed real time monitoring of a car through a smartphone application. Another example was a Commerce which is a leading provider of e-commerce total solutions for other startups [22]. The creation of startups trends enabled businesses in Thailand to be more creative and innovative.

Support from Global Companies

Thailand had the potential to be a digital hub of ASEAN due to its strategic location, skillful workforce, and good infrastructure. The country had attracted many global technology firms to support the digital economy policy. These firms – among which were include Intel Corporation, Microsoft, Cisco, and EMC -- could help create the strong foundations for digital development in Thailand. Microsoft established a Microsoft Innovation Center at the headquarters of the National Science and Technology Development Agency. The center partnered with several government agencies to educate a new generation of IT workforce and provided technology support for SME capability development. The center also provided incubation programs for local tech startups [22]. In addition, EMC offered many training courses related to Big Data for Thai universities. Cisco Systems was collaborating with the government to provide internet gateways and broadband initiative [22].

Innovative Workforce

The primary component of digital economy was education systems that could educate and train entrepreneurs, developers, innovators and future technology leaders. Many universities offered cutting edge IT programs. The leading tech universities included Chulalongkorn University, King Mongkut Institute of Technology, and Thammasat university. For the management school, Thailand has three AACSB

accredited business schools including National Institute of Development Administration (NIDA Business School), SASIN Business School, and Chulalongkorn Business School. These institutions educated and trained IT managers and entrepreneurs, and also provided incubation centers.

Access to Markets

Located at the center of Southeast Asia, Thailand provided global companies a gateway to reach AEC market. The ASEAN community consisted of ten countries. The ASEAN Economic Community or AEC came into effect in 2015. The AEC represented 600 million consumers which has a combined GDP of more than two trillion dollars [22]. Thailand provides global companies a gateway to reach AEC market.

Challenges Digital Divide

"Digital Divide" was the term for the gap between those who have access to digital technologies and those who have not. It often lead to other gaps in society such as economic status, education status, social status and job education. Digital Divide was still prominent in Thailand. For example, household PC penetration was 57.2% in Bangkok, but only 25.9% in the north-eastern region. People who live in Bangkok and central area often had access to digital technologies such as computers, notebooks, tablets, smartphones and the Internet, while those located in rural or suburban area often lacked such access.

Despite being a destination for ICT investment, most of Asian countries still laggedg behind the average global adoption of ICT. With exception of Singapore, most of south eastern Asian countries including Thailand lacked 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 were not connected to the Internet, and almost 2 billion people did not have access to mobile phones. Almost five hundred million people lived 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 to not only promote internet connection, but also carry out effective digital strategies to motivate citizens and business as well as government agencies to adopt digital technology [6].

Deepak Mishra, the author of World Development Report 2016: Digital Dividends, said access to the internet is necessary but not sufficient for the digital economy. A country required a strong complement especially regulations that create good business environment in terms of regulations of regulating digital technology, cybercrime acts, digital payment, and e-government [23]. The report implied that digital monopoly and regulatory uncertainty are the critical factors to create low adoption of digital technologies.

The country continued to have a wide disparity of information access, with access for some segments of the ICT sector greater for some than for others. Indeed, this *"digital divide"* was quite large compared to that in other developing countries. For example, only 24 percent of the population had access to the internet. However, on the mobile phones front, the gap between urban and rural areas was considerably smaller – an approximately 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%.

The situation was appreciably less rosy in the area of information technology, where the gap between people who were able to access information technology and people who could not continued to be quite wide. For example, in 2009, with only about 29.3% of the population using the computer and only about 20.1% using the Internet [24], 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 [25]. 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 computer and access to the Internet in a short period of time was difficult, the government had 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 lacked enhancement for effective accessibility to information and communication in remote areas. With only 10% of rural households having computers (despite nearly 100% rural electrification), it was likely that the prices of computers still placed them beyond the pocketbook of most of the farming population who constituted the majority of rural denizens. Further, a lack of education or instruction on how to utilize computers was believed to further contribute to the urban-rural gap in usage of information technology.

A particularly difficult challenge to overcome was the big gap between rich and poor people, especially in urban and rural areas, which had mainly impacted human development in terms of intellectual property, as well as social and economic status. This was 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 – a basic factor for improving the quality of people's lives in the long run.

The Rise of Computer Crimes

There had been an increasing number of computer/internet related crimes in Thailand. In 2016 (through November), there were 3,459 reported computer crime cases (see Exhibit 21). The top computer crime concerned 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 [26].

The Controversial Issues of Computer Crime Acts

On December 16th 2016, the National Legislative Assembly (NLA) passed the draft Computer Crime Act. Thai netizen network and Amnesty International submitted more than 300,000 names of people opposed to the bill claiming that it contradicted the fundamental right of freedom of expression [27]. Computer Crime Acts had been criticized as one of the harshest computer crime acts in the world. The law allowed the authorities to intercept private communication and block any websites that were considered as being "harmful" to national security. The laws also punished anyone who entered false information into computer systems. In addition, any organization that provided access to the network or internet must keep data from ninety days to as long as two years [28]. Arthit Suriyawongkul from Thai Netizen Network, an organization that promoted online freedom, mentioned that the new law could be used to silence citizens' voices. He said *"The bill is very broad and open to interpretation"* [28]. The law would allow authorities greater control of the Internet. The authorities could read private messages and block any website that were considered to be harmful or inappropriate to national security [29]. In contrast, Prime Minister Prayut Chan-o-cha asserted that the law did not violate people's rights, but could be used to prevent illegal online activities and terrorism [30].

Since the amendment of computer crime acts on December 19th 2016, hackers had launched a series of attack against the Thai Government's website. At least six government's websites were brought down on the 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 Defense ministry's website was inaccessible. Responsibility for the attacks was claimed by an activist group called "Civilians against Single Gateway". They demanded that the government scrap the law [29].

FDI (Foreign Direct Investment)

Thailand's competitiveness had for long relied heavily on FDI (foreign Direct Investment). The country had been a successful investment destination for global ICT companies such as Seagate, Sony, Western Digital, IBM, Microsoft, Oracle, Sumsung, HP, and Reuters. For three decades, it had been one of Southeast Asia's top investment destinations due to a good investment climate. Thailand was 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 global manufacturing competitiveness index [31]. The nation had approximately 70 well developed industrial estates and was regarded as one of the world's best industrial regions [31]. In terms of pro-FDI policies, the Board of Investment of Thailand (BOI) offered both tax and non-tax incentives. Tax incentives included exemption or reduction of corporate income tax as well as import duties on machinery and raw materials. For non-tax incentives, firms were allowed to bring in foreign workers, take or remit foreign currency abroad, and even own land.

However, there had in recent years emerged signs that the country was losing its competitive advantages. First, the minimum wage had been increasing, prompting many global manufacturers and other firms to move to lower-wage countries such as Vietnam, Laos, and Mynmar. Second, the growth of FDI had been diminishing from a high of $1,819 million in 2012 to $1,340 million in 2013 and then to a mere $988 million in 2014 (see Exhibit 22).

In addition, many global internet firms such as Microsoft, Facebook, and Google were worried that Thailand's recent crackdown on Internet might persuade global companies to moderate or curtail future investment in Thailand. Thai Internet firms were worried about a case involving Chiranuch Premchaiporn, Thai webmaster of prachathai.com, who was prosecuted for letting inappropriate information on her popular website [32]. Tyrell Haberkorn, a research fellow at Australian National University in Australia who conducted research on internet issues in Southeast Asia marveled that *"It's deeply ironic that a law whose stated aim is to create stable e-commerce environment is achieving completely the*

opposite result," [32]. In addition, the Asia Intent Coalition,a group based in Honk Kong that was founded by Google, Yahoo, eBay, Nokia, and Microsoft averred that *"By 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,"* [32]. This concern might affect global firms' willingess to invest in Thailand.

Corruption

Thailand had a long history of corruption, for corruption was profoundly rooted in Thai culture. Government officials were "entitled" to 10 to 30 percent of governmental project budgets for their services. A norm of giving gifts to high ranking officials was considered appropriate. Bribes were often received by the officials or their relatives who were in a position to grant or deny government projects. In 2013, a Global Corruption Barometer study indicated that 71 percent of Thai people perceived the police to be either corrupt or extremely corrupt, while 68 percent believe that politicians were corrupt [33].

ICT Education/ Research and Development

Research and development activities were necessary components to create competitiveness. However, Thai expenditures for R&D compared to GDP was 0.48% which was relatively low compared to global average at 2.124% [34]. In addition, the Organization for Economic Cooperation and Development (OECD)'s international assessment report had indicated that Thai education system had revealed a worrying decline in test scores among students. Thailand's education ranked 54th, with reduced scores in all subjects compared to Vietnam which ranked 8th. Thailand ranked much lower than other developing countries. It was ranked 54th for math, 57th for reading, and 54th for sciences [35] (see Exhibit 23). Athapol Anunthavorakul of Chulalongkorn University's faculty of education mentioned that the results from the report echoed a large gap between student in well-known schools and students in poor rural areas. He stated that government in the past had focused resources on improving teachers and students in elite schools and ignored schools in rural areas [35]. Prime Minister Chan-Ocha had confidence that the use of digital

technologies such as e-Learning and Massive Open Online Courses (Moocs) could reduce this urban versus rural quality.

Future Direction

The primary objective of Thailand 4.0 was to enable Thailand to become one of the developed countries in 2032. Thailand 4.0 had four major criteria:

i. At least 25% of GDP must come from digital sectors;
ii. Thailand must be within 15 ranks of Global Competitiveness Ranking;
iii. Thailand must be in the top 40 countries ranked by ICT development Index (IDI); and,
iv. Each Thai person has broadband internet access.

Thailand 4.0 focused on 10 targeted industries: 1) Next-Generation Automotive 2) Smart Electronics 3) High-Income Tourism and Medical Tourism 4) Efficient Agriculture and Biotechnology 5) Food Innovation 6) Automation and Robotic 7) Aerospace 8) Bio-energy and Bio-chemicals 9) Digital and 10) Medical and Healthcare [36]. All ten targeted industries need support from digital technologies to upgrade the industries to the next level. Thailand was still facing many problems including poor ICT infrastructure, lack of latest technology, digital divide, issues related to laws and government regulation, diminishing FDI, high corruption, and low level of ICT education as well as research and development. Unlike elected government, Prime Minister Chan-o-Cha had an absolute power to impose any law, regulation, or government budget though section 44 of the interim constitution which allow Prime Minister Chan-o-Cha to issue any order "for the sake of the national reform". The orders were deemed "lawful, constitutional, and final" [37].

Where to From Here?

It was now January 2017. The global competitiveness ranking report would be coming out next month. General Prayuth knew that the success of his government and his future depended on the success of the digital economy and the implementation of the Thailand 4.0 policy. Deep down, he knew that this

would be his major legacy, what people would remember him for long after he had gone. He had to decide what strategies and measures should be taken to ensure its success.

References

Bank, T.W., Overview of Thailand. (2016). The World Bank: Thailand.

Bank, W., World Development Indicators: Science and Technology. (2016). The World Bank.

BOI, Thailand Digital Economy. (2016). Thailand Board of Investment: Bangkok.

BOI, Why Thailand. (2016). Bank of Investment.

Department, T.G.P.R., Moving toward Digital Thailand. (2016). The Governement Public Relation Department.

Forum, W.E., The Global Information Technology Report 2017. (2017). World Economic Forum Geneva.

Governement, R.T., The Cabinet meeting on Tuesday January 6, 2015. (2016). Royal Thai Governement: Bangkok.

Group, T.T.N.S., Thailand: Digital Super Cluster Development Sees Rise Of Smart Cities. 2016.

Hookway, J., Thailand Tightens Web's Leash; Companies Including Google and Microsoft Fear Ending Up in Prosecutors' Sights, Chilling Online Commerce, in Wall Street Journal. (2011). Wall Street Journal New York.

International, T. Thailand. (2016). [cited 2016 Dec 20th]; Available from: http://www.transparency.org/gcb2013/country/?country=thailand.

Leesa-Nguansuk, S., Thailand urged to adopt digital strategies in Bangkok Post. (2016). Bangkok Post: Bangkok.

Maesincee, S. Thailand 4.0. (2017). [cited 2017 Jan 15]; Available from: https://www.facebook.com/drsuvitpage/

Mala, D., Thai education system fails to deliver, in Bangkok Post. (2016). Bangkok Post: Bangkok.

Mishra, D., World Development Report 2016: Digital Dividends. (2016). The World Bank.

Monitor, A.N., Thailand: Authorities to use IT to make bangkok smart city. 2010: Bangkok.

Monitor, A.N., Thailand: Cabinet nods to digital economy promotion committee, in Asia News Monitor. (2015). Thai News Service Group: Bangkok.

Monitor, A.N., Thailand: Deputy prime minister MR pridiyathorn promotes digital economy, in Asia News Monitor. 2014.

Monitor, A.N., Thailand: Government confirms thai movement towards digital economy, in Asia News Monitor. 2014.

Monitor, A.N., Thailand: Government's digital economy policy draws scepticism from industry experts. (2014). Asia News Monitor.

Monitor, A.N., Thailand: Hackers attack thai government's websites., in Asia News Monitor. (2016). Thai News Service Group: Bangkok.

Monitor, A.N., Thailand: NLA gives green light to amended Revenue Code in Asia News Monitor.

Monitor, A.N., Thailand: Thai Lawmakers Approve Tighter Control of Internet, in Asia News Monitor. (2016). Thai News Service Group: Bangkok.

Monitor, A.N., Thailand: Thailand post adopts new innovations in line with thailand 4.0., in Asia News Monitor. (2016). Thai News Service Group: Bangkok.

Monitor, A.N., Thailand: PM says Computer Crime Act helps prevent terrorism in Asia News Monitor. (2016). Thai News Service Group: Bangkok.

PAKAWACHKRILERS, K., Revolution of E-Commerce measurement in Thailand, new initiatives and standards. Value of E-Commerce survey in Thailand 2015. (2015). Electronic Transactions Development Agency (Public Organization): Bangkok.

Plus, L., LAWS ON DIGITAL ECONOMY AND CYBER SECURITY. (2016). Law Plus Ltd.: Bangkok.

Review, T.I., Thailand 4.0 Means Opportunity Thailand. (2017). Thailand Board of Investment.

Sangmahachai, K. Revolution to Industry 4.0. (2017). [cited 2017 January 14]; Available from: www.tgi.or.th/upload/files/Revolution%20to%20Industry%204.pdf

Santipaporn, S. Information and Communication Technology Statistics in Thailand. in International Seminar on Information and Communication Technology Statistics. (2010). Seoul, Republic of Korea.

SAS. What is Big Data. (2016). [cited 2016 26 October]; Available from: http://www.sas.com/en_th/insights/big-data/what-is-big-data.html

Schwab, K., The Global Competitiveness Report 2017. (2017). World Economic Forum

Stats, I.W. Internet Usage in Asia. (2011). [cited 2011 December 25]; Available from: http://www.internetworldstats.com/stats3.htm

ThaiCERT, Cyber Crime Statistics. (2016). Thailand Computer Emergency Response Team: Bangkok.

ThaiCert, Statistics of Computer Crimes in Thailand. 2016, ETDA: Bangkok. (2016). Thai News Service Group: Bangkok.

Tortermasana, K., Phuket set to be Thailand's First smart city. 2016.

Wikipedia. Data Center. (2016). [cited 2016 December 28th]; Available from: https://en.wikipedia.org/wiki/Data_center

Wikipedia. 2014 interim constitution of Thailand. (2017). [cited 2017 January 15th]; Available from: https://en.wikipedia.org/wiki/2014_interim_constitution_of_Thailand.

Exhibit 1: Thailand Map

Exhibit 2: Thailand's Economic Structure

Sector	GDP by Sector (%)	Labor Force by Sector (%)
Agriculture	8.3	43.3
Manufacturing	40.0	13.0
Wholesale and Retail Trade	13.3	15.1
Constructiona and Mining	4.4	4.8
Other Services (include financial sector, education, hotels and restaurants, etc.)	33.2	23.9

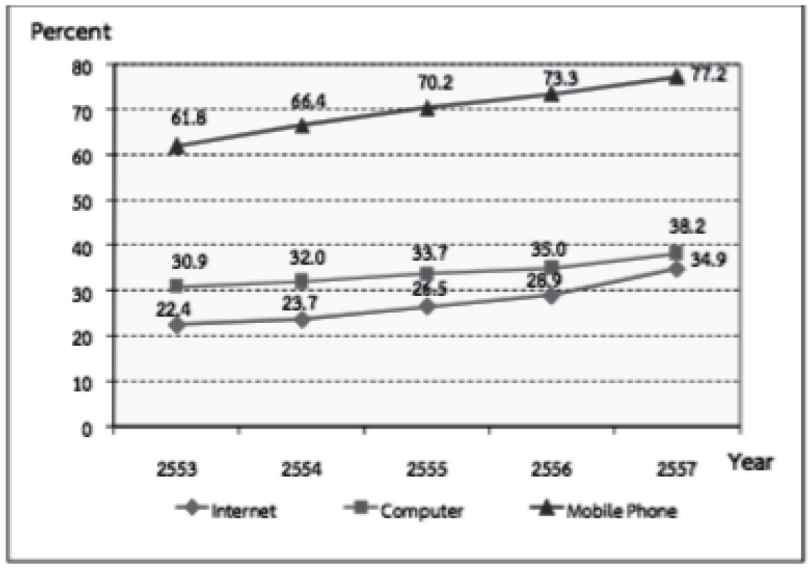
Thailand, B.o. ***Thailand at a Glance.*** **2010 [cited 2011 December 15th]; Available from:** http://www.bot.or.th/English/EconomicConditions/Thai/genecon/Pages/Thailand_Glance.aspx.

Exhibit 3: Thailand Economy Data

	2011	2012	2013	2014	2015
Population (million)	67.6	68.0	68.3	68.7	68.8
GDP per capita (USD)	5,495	5,842	6,166	5,894	5,732
GDP (USD bn)	372	397	421	405	395
Economic Growth (GDP, annual variation in %)	0.8	7.2	2.7	0.8	2.8
Consumption (annual variation in %)	1.8	6.7	1.1	0.6	2.1
Investment (annual variation in %)	4.9	10.7	-1.0	-2.4	4.7
Manufacturing (annual variation in %)	-7.5	10.6	2.4	-5.2	0.3
Retail Sales (annual variation in %)	5.6	19.0	-0.3	-6.0	-1.6
Unemployment Rate	0.4	0.5	0.6	0.6	0.7
Fiscal Balance (% of GDP)	-0.6	-3.7	-2.2	-2.0	-3.0
Public Debt (% of GDP)	38.1	40.2	42.3	42.8	44.4
Money (annual variation in %)	8.6	13.0	3.9	1.3	5.7
Inflation Rate (CPI, annual variation in %, eop)	3.5	3.6	1.7	0.6	-0.9
Inflation Rate (CPI, annual variation in %)	3.8	3.0	2.2	1.9	-0.9
Inflation (PPI, annual variation in %)	5.5	1.0	0.3	0.1	-4.1
Policy Interest Rate (%)	3.25	2.75	2.25	2.00	1.50
Stock Market (annual variation in %)	38.4	12.4	36.0	-13.6	24.1
Exchange Rate (vs USD)	31.64	30.58	32.76	32.92	36.04
Exchange Rate (vs USD, aop)	30.44	31.04	30.68	32.44	34.21
Current Account (% of GDP)	2.4	-0.4	-1.2	3.8	8.0
Current Account Balance (USD bn)	8.9	-1.5	-5.2	15.4	31.6
Trade Balance (USD billion)	17.0	6.7	6.8	24.6	34.6
Exports (USD billion)	220	226	226	225	212
Imports (USD billion)	203	219	219	200	177
Exports (annual variation in %)	15.2	2.7	0.2	-0.5	-6.0
Imports (annual variation in %)	25.8	8.0	0.2	-8.6	-11.7
International Reserves (USD)	175	182	167	157	157
External Debt (% of GDP)	28.1	32.9	33.7	34.8	32.8

Focus Economics, Thailand Economy. 2016 [cited 2016 October 23th]; Available from: http://www.focus-economics.com/countries/thailand

Exhibit 4: Percentage of Population Used Computer, Internet, and Mobile Phone



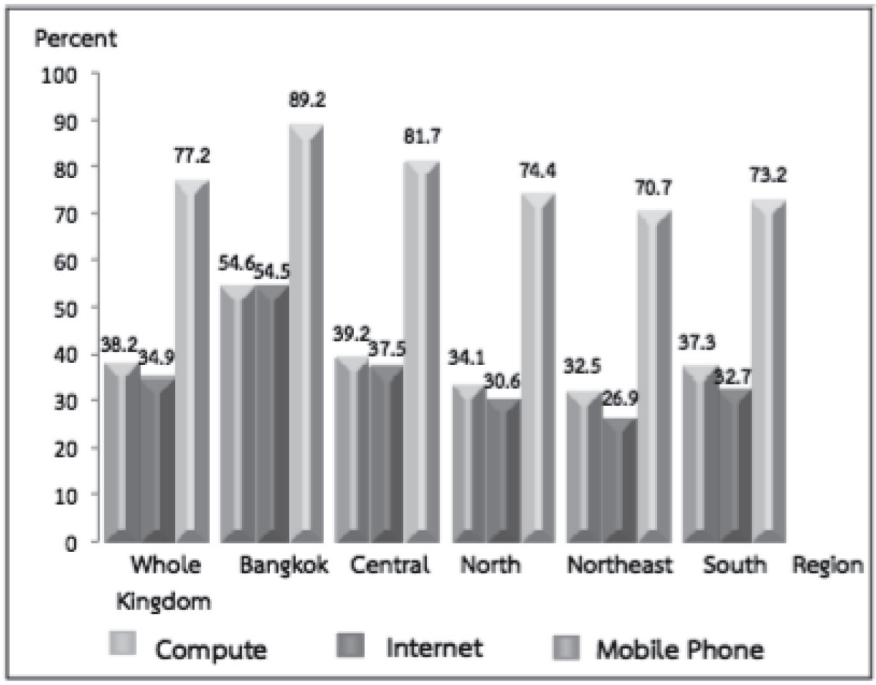
Source: www.nso.go.th

Exhibit 5: Percentage of Population Using Computer, Internet, and Mobile Phone

year	Computer		Internet		Mobile Phone	
	Municipal area	Non-municipal area	Municipal area	Non-municipal area	Municipal area	Non-municipal area
2553	43.3	25.2	35.1	16.5	72.2	57.0
2554	44.3	25.5	36.0	17.2	74.8	62.0
2555	45.4	27.5	37.7	20.5	77.7	66.2
2556	46.3	29.1	39.9	23.2	80.0	69.8
2557	47.8	30.4	44.9	26.9	83.9	71.8

Source: www.nso.go.th

Exhibit 6: Percentage of Population Used Computer, Internet, and Mobile Phone by Region



Source: www.nso.go.th

Exhibit 7: Percentage of Household with Internet Access by Type of Internet Used and Region

Region	Number of Household connected Internet (per thousand)	Type of Internet used				
		Narrowband		Broadband		Unsure
		Analogue modem, ISDN	Mobile wireless 2G, 2.5G (such as GSM, CDMA, GPRS)	Fixed broadband 1/	Mobile wireless 3G (such as WCDMA, EV-DO)	
Whole Kingdom	**100.0**	**3.4**	**8.9**	**45.0**	**40.3**	**2.4**
Bangkok	100.0	3.0	3.4	56.0	35.6	2.0
Central	100.0	3.4	8.5	42.7	42.7	2.7
North	100.0	2.6	9.3	49.4	37.9	0.8
Northeast	100.0	4.1	13.0	37.0	43.4	2.6
South	100.0	3.6	13.4	38.8	40.1	4.1

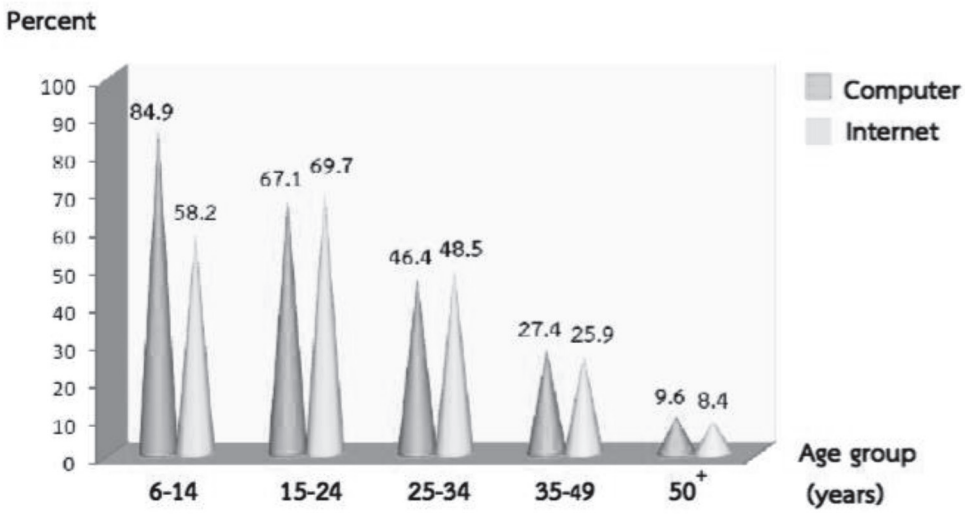
Source: www.nso.go.th

Exhibit 8: Percentage of Population Used Computer/Internet by Activity and Age Group

Activity used computer/Internet[1/]	Age group (Year)					
	Total	6-14	15-24	25-34	35-49	50 years and over
	Computer					
Work	100.0	1.7	12.4	35.3	36.3	14.3
Study	100.0	55.2	41.9	1.8	0.7	0.3
Knowledge (e-book)	100.0	17.1	32.5	19.6	20.3	10.4
Game	100.0	28.0	31.7	19.9	15.6	4.9
Entertainment	100.0	19.3	31.2	21.9	20.2	7.5
Surfing Internet	100.0	19.3	31.8	21.1	20.0	7.9

Source: www.nso.go.th

Exhibit 9: Percentage of Population Used Computer/Internet by Age Group



Source: www.nso.go.th

Exhibit 10: Percentage of Population Used Computer/Internet by Activity and Age Group

Activity used computer/Internet[1/]	Age group (Year)					
	Total	6-14	15-24	25-34	35-49	50 years and over
	Internet					
E- mail	100.0	8.3	32.5	26.2	23.9	9.1
Search for information about products / services	100.0	8.3	30.0	27.3	25.4	9.1
Purchase good or services	100.0	1.6	26.8	32.7	29.7	9.2
Business and offering products / services	100.0	1.7	14.2	36.5	36.1	11.5
Search information about goods / health services	100.0	7.0	27.6	27.3	27.0	11.1
Search government information	100.0	11.4	28.7	23.4	24.9	11.7
Contact / transfer download the document/ transactions with government agencies	100.0	4.7	21.0	28.0	31.8	14.5
Trace news / read or downloaded the newspaper, magazines (e-book)	100.0	10.8	31.5	24.6	23.5	9.6
Games or download, games	100.0	22.8	34.7	22.3	16.0	4.2
Download, movie, listening radio or music	100.0	17.4	33.8	23.5	19.2	6.1
Download software	100.0	9.9	37.8	25.7	20.3	6.3
Blog Web 2.0 / chat / instant message	100.0	11.6	38.4	25.6	18.6	5.8
Social Network (Facebook,Twitter,Hi5 Google Plus etc.)	100.0	13.0	35.0	25.2	20.3	6.6
Education learning activities	100.0	32.1	41.1	12.3	9.7	4.8
Voice over Internet protocol (VOIP)	100.0	7.8	34.6	28.8	21.1	7.7
Internet Banking	100.0	1.7	12.8	36.8	34.7	14.0

Note : [1/]Answer all questions.

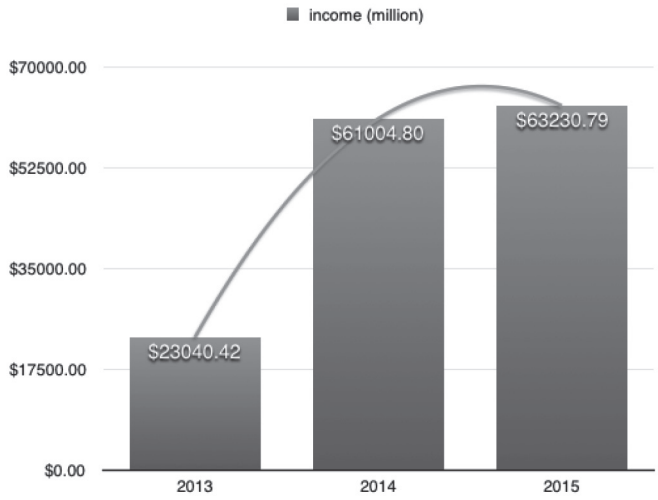
Source: www.nso.go.th

Exhibit 11: Percentage of Population Used Internet by Expense Internet Using per Month and Age Group

Age group (Year)	Total	Expense Internet using per month (Baht)				
		None	Less than 200	200-399	400-599	More than 600
Total	100.0	28.9	19.3	24.9	13.2	13.7
6-14	100.0	62.1	25.3	8.4	1.9	2.3
15-24	100.0	21.3	29.3	30.6	10.9	7.9
25-34	100.0	16.6	13.7	33.4	19.7	16.6
35-49	100.0	21.5	8.3	25.6	19.0	25.6
50 years and	100.0	25.1	6.2	20.2	18.8	29.7

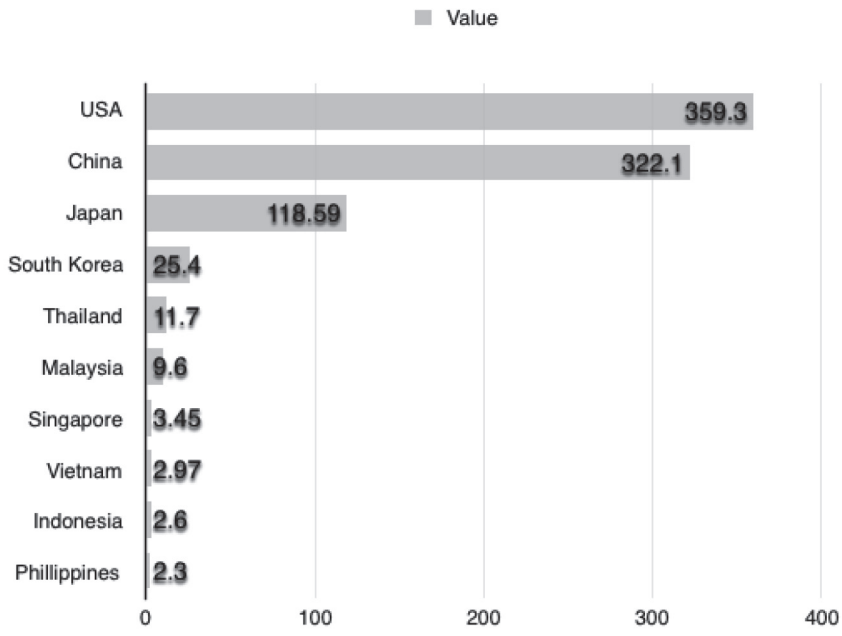
Source: www.nso.go.th

Exhibit 12: Income from Ecommerce



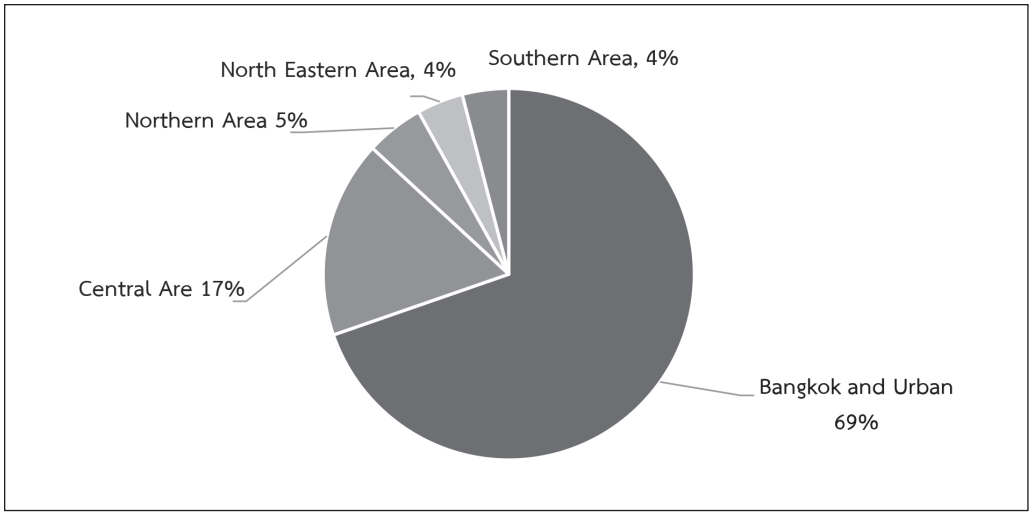
Source: ETDA (2015)

Exhibit 13: Top B2C E-commerce Countries in 2016



Source: Statista

Exhibit 14: Internet Usage in Thailand



Source: ETDA

Exhibit 15: Percentage of E-commerce Business by Types of Entrepreneur in Thailand (Pakawachkrilers, 2015)

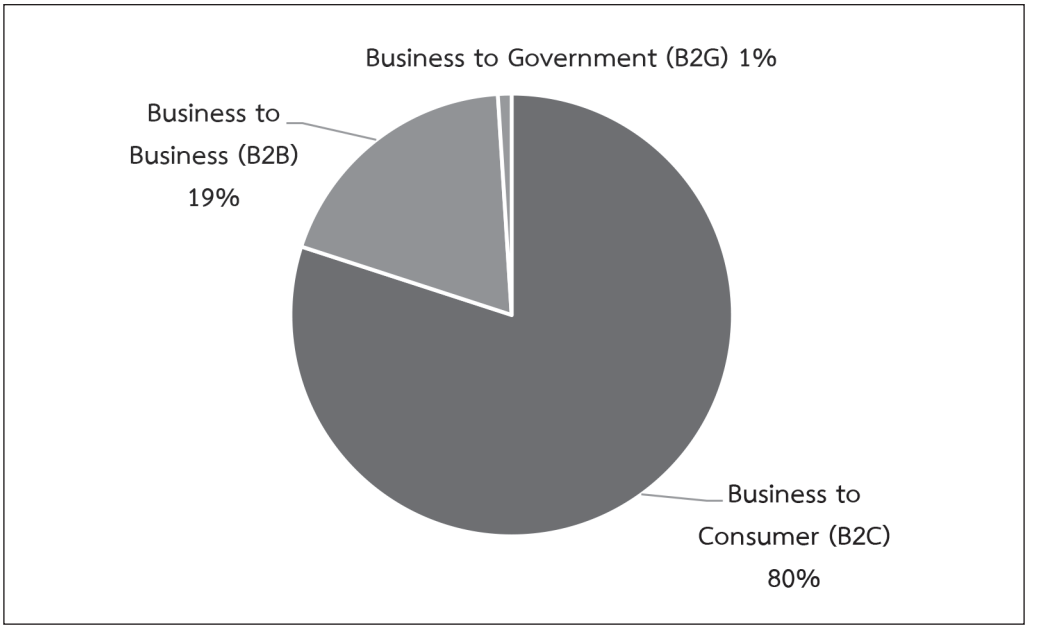


Exhibit 16: Percentage of E-commerce Business by Types of Business in Thailand (Pakawachkrilers, 2015)

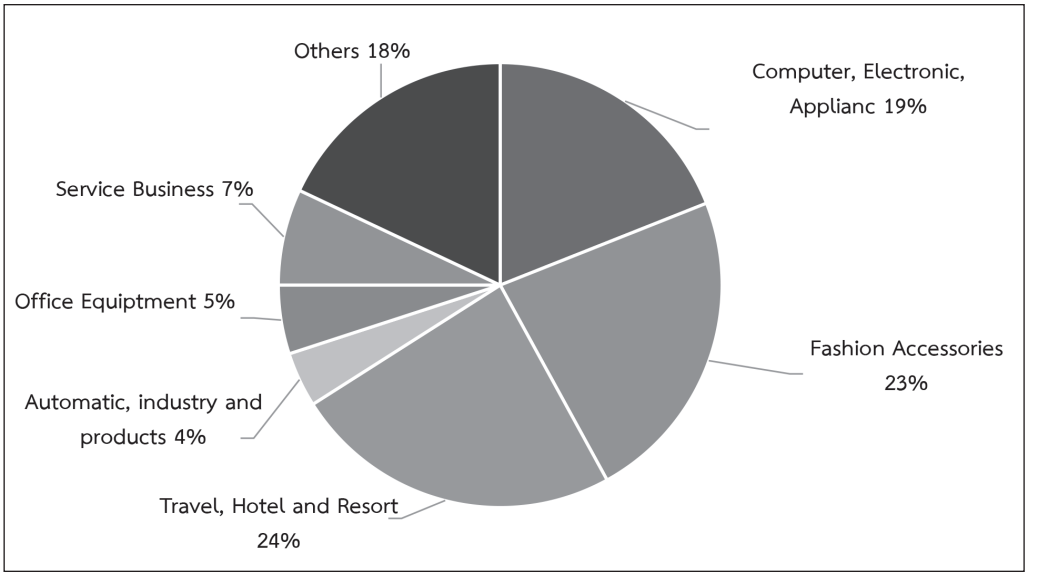


Exhibit 17: Percentage of E-commerce Business by Size of Business in Thailand (Pakawachkrilers, 2015)

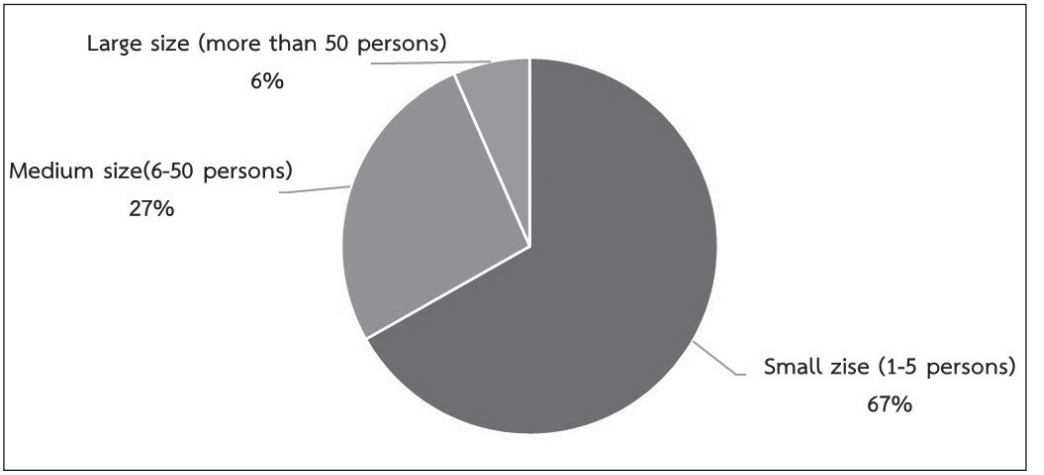


Exhibit 18: Value of Each Type of Thai Entrepreneur (ETDA, 2015)

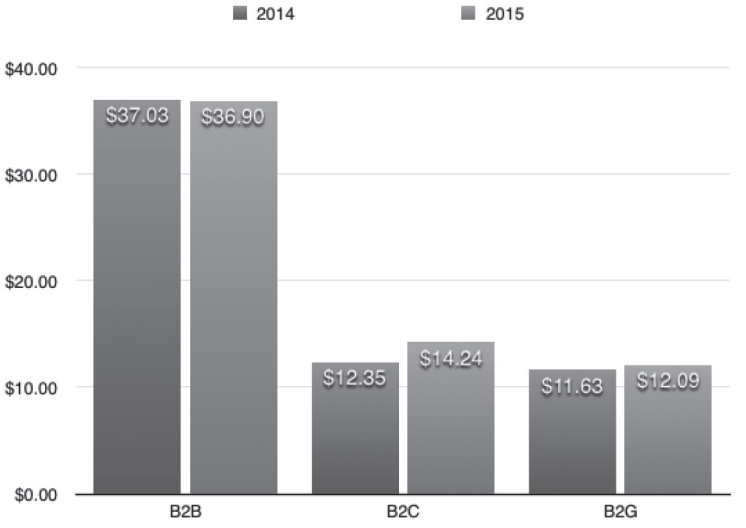


Exhibit 19: Computer Crimes

Types of Threats	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Abusive content	0	0	0	0	0	0	0	0	0	0	0	**0**
Availability	0	0	0	0	0	0	0	0	0	0	0	**0**
Fraud	98	95	66	73	164	125	104	52	57	55	43	**932**
Information gathering	0	0	0	0	0	0	0	0	0	0	0	**0**
Information security	0	0	0	0	0	0	0	0	0	0	2	**2**
Intrusion attempts	35	39	36	62	69	70	59	82	42	35	66	**595**
Intrusions	175	51	122	96	53	44	158	60	95	37	40	**931**
Malicious code	97	123	80	104	168	167	49	14	78	30	89	**999**
Other	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**405**	**308**	**304**	**335**	**454**	**406**	**370**	**208**	**272**	**157**	**240**	**3459**

Source: Thaicert

Exhibit 20: Foreign Direct Investment Classified by Business Sector of Thai Enterprises (millions USD), as of February 25, 2015

FDI by Business Sector (millions of USD)	2014 p	2013 p	2012 p	2011	2010	2009	2008	2007	2006	2005
Agriculture, forestry and fishing	4.63	16.97	3.19	-2.38	5.71	7.30	9.33	2.74	-2.67	12.61
Mining and quarrying	-95.68	-118.65	39.87	220.08	419.23	640.80	-2.11	1,307.24	256.69	-111.00
Manufacturing:	3,797.45	5,006.47	4,599.41	4,007.97	4,622.72	2,412.02	4,891.26	4,495.41	5,160.94	3,500.55
- food products	230.37	101.22	-137.21	355.69	106.49	139.80	136.76	190.79	103.95	75.97
- beverages	113.50	70.34	49.50	-8.94	36.53	54.25	33.72	40.85	48.00	-101.12
- paper and paper products	105.71	78.58	-5.85	266.38	34.92	24.10	389.40	14.08	-42.89	-9.35
- coke and refined petroleum products	76.16	314.48	137.23	200.16	-20.63	181.85	-437.79	1,237.53	364.85	-72.61
- chemicals and chemical products	241.55	272.58	551.73	363.28	872.85	506.66	616.04	-121.58	198.45	499.75
- basic pharmaceutical products and pharmaceutical preparations	89.40	34.60	-14.96	35.24	0.00	0.00	0.00	0.00	0.00	0.00
- rubber and plastics products	268.70	280.19	413.31	414.76	331.91	305.08	389.76	312.80	494.33	467.71
- computer, electronic, optical products, and electrical equipment	987.91	1,340.24	1,818.90	905.46	906.06	325.86	1,643.11	860.94	1,731.41	1,010.69

Exhibit 20: Foreign Direct Investment Classified by Business Sector of Thai Enterprises (millions USD), as of February 25, 2015 (Cont.)

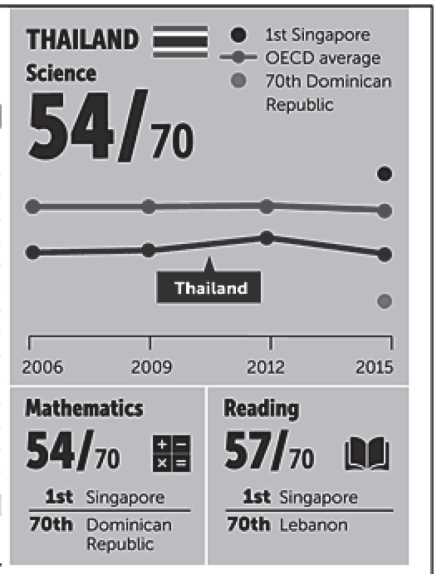
FDI by Business Sector (millions of USD)	2014 p	2013 p	2012 p	2011	2010	2009	2008	2007	2006	2005
- machinery and equipment n.e.c.	306.26	336.39	112.46	581.04	65.03	191.44	118.63	145.39	138.19	87.45
- motor vehicles, trailers and semi-trailers	783.49	1,680.86	1,310.03	512.04	1,398.20	384.35	914.44	1,080.26	1,536.98	1,161.54
- furniture	-0.20	4.51	-4.36	29.68	7.15	-2.86	-0.77	0.06	-4.54	3.53
Electricity, gas, steam and air conditioning supply	-261.93	41.39	-26.59	44.79	-56.08	221.92	200.43	33.20	353.83	-87.71
Construction	73.38	21.37	-170.24	-34.76	27.21	1.43	-34.04	29.96	-93.79	29.56
Wholesale and retail trade; repair of motor vehicles and motorcycles	1,087.89	-2,617.30	453.34	610.59	-58.96	344.86	131.58	-262.52	845.21	260.27
Transportation and storage	49.11	87.05	39.83	222.48	-131.52	118.42	450.25	-43.31	80.53	155.05
Accommodation and food service activities	-23.99	98.53	27.26	-2.81	113.70	46.00	-51.34	166.77	124.97	-29.94
Financial and insurance activities	2,563.37	4,715.84	1,236.24	-2,121.48	2,279.85	274.15	1,765.99	2,815.04	691.65	3,269.45
Real estate activities	1,267.01	1,663.95	1,014.63	1,078.04	984.24	767.96	1,202.53	1,103.16	1,419.06	73.28
Others	3,376.23	3,891.29	3,482.23	-161.45	905.45	18.59	-16.77	1,683.59	623.23	975.96
Total	11,837.47	12,806.90	10,699.17	3,861.08	9,111.55	4,853.45	8,547.09	11,331.29	9,459.64	8,048.08

Source: Bank of Thailand. Retrieved from http://www2.bot.or.th/statistics/ReportPage.aspx?reportID=656&language=eng on March 25, 2015

Exhibit 21: Thai Education System Fails to Deliver

HIGHLIGHTS OF PISA 2015 MEAN SCORES AMONG 70 COUNTRIES AND ECONOMIES

	Countries	Science	Mathematics	Reading
	Average score	**493**	**490**	**493**
1	Singapore	556	564	535
2	Japan	538	532	516
3	Estonia	534	520	519
4	Chinese Taipei	532	542	497
5	Finland	531	511	526
6	Macao (China)	529	544	509
7	Canada	528	516	527
8	Vietnam	525	495	487
9	Hong Kong	523	548	527
10	China	518	531	494
11	South Korea	516	524	517
15	United Kingdom	509	492	498
16	Germany	509	506	509
25	United States	496	470	497
32	Russia	487	494	495
54	**Thailand**	**421**	**415**	**409**
62	Indonesia	403	386	397
70	Dominican Republic	332	328	358



Note: The ranks are adjusted to reflect the whole population of 15-year-old students in each country and economy, according to the OECD

Source: http://www.bangkokpost.com/news/general/1162805/thai-education-system-fails-to-deliver