Thailand's Position in the Network Readiness Index (NRI): Analysis and Recommendations

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***Abstract*—Advancements in technology have been an integral part of improving people's quality of life, fostering economic growth, creating equal opportunities for urban and remote population and uplifted an emerging economy to a developed one. Every year, the ICT industries and competitiveness teams at the World Economic Forum cooperate in creating a report to analyze network readiness index (NRI) ranking to evaluate improvement and development of each country. The NRI evaluates the impact of ICT on national competitiveness. It is comprised of three components which are the environment for ICT offered by a given country or community (market, political, regulatory, and infrastructure environment), the readiness of the country's key stakeholders (individuals, businesses, and governments) to use ICT, and the usage of ICT among these stakeholders. The paper aims to evaluate Thailand's Network Readiness Index (NRI) against other ASEAN countries. The paper indicated that there are some challenges regarding the imposition of the NBTC's policies and schemes in the next stage so as to move up the position in other aspects of indicator ranking.**

***Index Terms*—NRI, analysis, ICT, Thailand, ASEAN.**

I. Introduction

The year 2015 is a time where many economies around the world are struggling to ensure sustainable economic growth and to provide equal access to information and ICT resources to bridge the digital divide. Developed economies have yet to reach their full potential and are also faced with challenges such as high unemployment, rising inequality and fiscal challenges. Contrarily, developing economies are facing much more difficult challenges and need to adjust their development models to ensure they catch up with the rest of the world and achieve sustainable economic growth and more equal distribution of resources amongst affluent and underserved populations.

The impact of ICT is much more than productivity gain or increase in GDP. Rather, ICT is a leading transformer of social development, resulting in countries more abled to provide underserved populations with access to basic services, increase in connectivity, enabled them to have information reach and learn job required skills, giving them access to the global online community and most importantly increase their employment opportunities.

Since 2001, the World Economic Forum has published the Global Information Technology Report series in collaboration with Cornell university and INSEAD. This report evaluates the drivers of ICT development in each country, using the Network Readiness Index (NRI). For each of the 143 economies covered, it allows areas of priority to be identified to more fully leverage ICTs for development [1].

The report has highlighted four important developments. First, the ICT development has the potential to transform any national economy, addressing pressing global challenges both developing and developing countries are facing with every single day. Second, ICT development is under way in some parts of the world more than others. In these locations, ubiquitous broadband access (particularly mobile broadband), internet access, policies that allow ease in take up of novel innovative technologies and the accelerating pace of innovation, has the ability to accelerate these economies development faster than ever before. Thirdly, ICT development has yet to reach the largest parts of the world with denser population. Even while ICT has just reached a small part we have seen tremendous development. However, in order to better leverage ICTs for development, a higher level of preparedness and better infrastructure and access are needed. In this context, government leadership and vision are critical. Last and most importantly, digital divide is prominent in many countries, including advanced or development economies. Only segments of a country's population are benefiting from ICT and many are left behind because of age, limited digital literacy, lack of access to resources and living in remote locations.

The NRI is dependent on six components 1) high quality regulation and business environment is critical to fully gain from ICT 2) ICT readiness – this depends on affordability of ICT services, possessing the skills, and having access to ICT infrastructure 3) to ensure full benefit from ICT, it is crucial for a society-wide effort: The government, business sector and population at large have to cooperate 4) ICT is an not end in itself. The impact that ICTs actually have on the economy and society is what ultimately matters; 5) ICT drivers such as the environment, readiness, usage and how populations interact and reinforce each other to form a virtuous cycle; and lastly 6) a well-defined NRI framework can provide a clear guidelines for policymakers, governments and ICT stakeholders to collaborate on creating effective policies to promote ICT development.

II. Network Readiness Index Ranking Report

A. Thailand's Position in the NRI Ranking Remains Steady.

Due to the significance of ICTs to the relative competitiveness of all countries in the world, the World

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Economic Forum (WEF), in partnership with INSEAD - a France's leading institute of business administration - has published the global index assessment results to rank countries in terms of ICT readiness, levels of ICT utilization, and ICT impacts which are collectively called The Global Information Technology Report's Network Readiness Index (NRI). This particular report is regularly published annually and contains various aspects of indicators. According to this, 4 sub-indices comprising 10 composite pillars of total 53 component variables have been created as follows:

1) *Environment sub-index*
   - 1st Pillar: Political and regulatory environment (9 variables)
   - 2nd Pillar: Business and innovation environment (9 variables)
2) *Readiness sub-index*
   - 3rd Pillar: Infrastructure (4 variables)
   - 4th Pillar: Affordability (3 variables)
   - 5th Pillar: Skills (4 variables)
3) *Usage sub-index*
   - 6th Pillar: Individual usage (7 variables)
   - 7th Pillar: Business usage (6 variables)
   - 8th Pillar: Government usage (3 variables)
4) *Impact sub-index*
   - 9th Pillar: Economic impact (4 variables)
   - 10th Pillar: Social impact (4 variables)

The Global Information Technology Report 2014 revealed the survey results indicating that Thailand has retained its 67th position in the NRI ranking among 143 nations worldwide. This is considered the position holding steady from 2013 (Fig. 1).

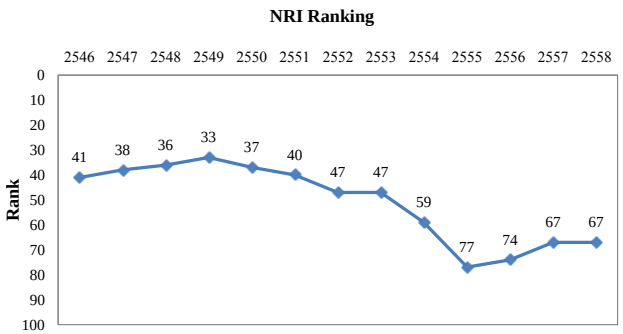

Fig. 1. Thailand's position in the network readiness index [1].

From Fig. 1, it shows that the NRI status of Thailand from 2003 up to the present can be divided into 3 periods. During 2003-2006, Thailand's NRI status had experienced a greater tendency consecutively. However, Thailand's position in the NRI ranking tended to fall down (getting worse) during 2006-2012 which may stem from 2 major factors: the country faced growth deterioration (in deficit) and the country was gradually growing a lot more slowly than other countries, or the growth rate was lower compared with those of other countries, etc. Accordingly, if we take the first factor into consideration, the tendency is unlikely to be valid. This is owing to the fact that a country's level of technology development will not commonly deteriorate under real-life conditions, but there are some possibilities regarding the continual replacement of old by new technologies. As regards the second factor, indicating that Thailand's technology development was in progress but a lot more slowly than other countries, it appears that there might be some barriers that hinder or slow down the development of technology, both from related industries themselves or from other influential external factors. These have affected Thailand to comparatively lag behind global trends or other countries. Therefore, it is necessary that we examine this issue carefully to specify the factor or indicator that encourages Thailand to earn a higher position in the NRT ranking as well as to specify the factor or indicator that pertains to the drop in Thailand's position.

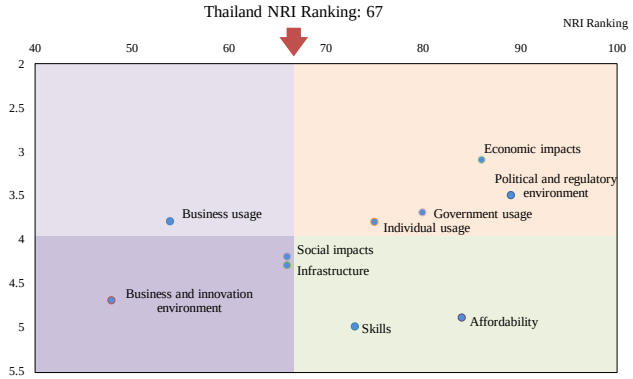

Fig. 2. Analysis of the factors considered Thailand's weaknesses and strengths in relation to its position in the NRI ranking [1].

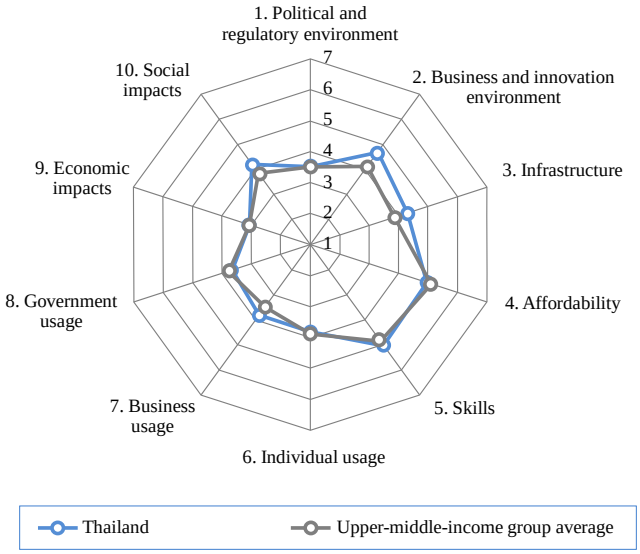

Fig. 3. Thailand's NRI compared with the average of the upper-middle-income group [1].

From Fig. 2, given that the vertical axis represents average annual changes in the ranking: if the average is low, that particular factor will give rise to the drop in the NRI ranking; or if the ranking is high, the competitiveness will decline. On the contrary, if the average is high, that particular factor will give rise to the climb in the NRI ranking; or if the ranking is low, the competitiveness will grow. By the way, given that the horizontal axis represents Thailand's positions in various ranking factors compared with those of other countries: if any factor is low-rank, it means that the country has greater competitiveness than the higher ranked countries. On the contrary, if any factor is high-rank, it means that the country

has lower competitiveness than the lower ranked countries.

If the analysis if focused only on Thailand (Fig. 2 and Fig. 3), the factors related to **the private sector** is considered as belonging to the positive range, where the average and ranking position can contribute to the greater tendency promoting Thailand to earn fair positions in any rankings or improving Thailand's ICT competitiveness as follows:

- **Business and innovation environment (rank 48):** Especially the number of business start-up processes (rank 23), corporate tax rates against company profits (rank 28), venture investment capabilities (rank 44), and so on
- **Business usage (rank 54):** Its strength pertains to the utilization of the Internet in both business-to-business and business-**to**-customers aspects.
- **Infrastructure (rank 66):** Thailand has stood 1st in providing the network coverage for mobile-cellular services. **This** strength consequently results in the utilization of broadband Internet via mobile-cellular networks and the utilization of social networks.

On the other hand, the factors related to the public sector are believed to take part in the decline of Thailand's ICT competitiveness and pose bad effects on its economy. The factors that lead to the declined performance of the public sector are as follows:

- **Political and regulatory environment (rank 89):** Especially the effectiveness of legislation (rank 113), intellectual property protection (rank 103), and ICT-related legislation (rank 98)
- **Government usage (rank 80):** Due to the lack of utilization promotion and inadequate realization of ICT necessities

B. Comparing Thailand's Position in the NRI Ranking with Those of Other ASEAN Countries

Apart from analyzing the country-related factors, data on positions in the NRI ranking is also useful in facilitating the comparison of Thailand's position in relative competitiveness with those of other countries, especially the county at the same level of ICT competitive potential. This can be done through comparing Thailand's NRI with those of other ASEAN countries as the following.

TABLE I: ASEAN COMPARATIVE NETWORK READINESS INDEX: NRI [1]

Country/ Economy	NRI 2015		NRI 2014	
	Score	AEC rank (World rank out of 143)	Score	AEC rank (World rank out of 143)
Singapore	6.0	1 (1)	5.97	1 (2)
Malaysia	4.9	2 (32)	4.83	2 (30)
Brunei Darussalam	-	-	4.34	3 (45)
Thailand	4.0	3 (67)	4.01	5 (67)
Philippines	4.0	4 (76)	3.89	6 (78)
Indonesia	3.9	5 (79)	4.04	4 (64)
Vietnam	3.9	6 (85)	3.84	7 (84)
Lao PRD	3.6	7 (97)	3.34	9 (109)
Cambodia	3.3	8 (108)	3.36	8 (108)
Myanmar	2.5	9 (139)	2.35	10 (146)

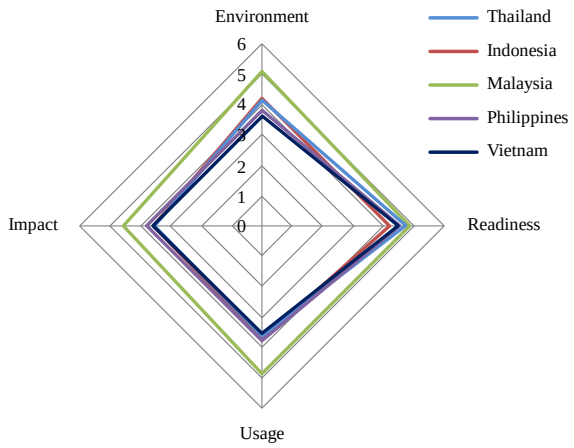

Fig. 4. Comparing the elements in NRI measurement among Thailand, Indonesia, Malaysia, the Philippines, and Vietnam [1].

Being compared with those of other nations in the same region, Thailand's NRI only lags behind Singapore which belongs to the high-income group and Malaysia which belongs to the upper-middle-income group similar to Thailand. However, Malaysia has quite outstanding and higher scores of positive factors influencing ICT usage - both by the public and private sectors - compared with those of the countries at the same level, especially in terms of applications, various environmental aspects, and economic and social impacts. Unlike Thailand, all Malaysian approaches to policy implementation are commonly initiated by the government which plays a primary role in undertaking any activities that enhance ICT readiness and utilization as well as leading other sectors to promote the adoption of related policies.

Considering from its position in the NRI ranking and comparative results with other countries in the same region, Thailand's has held the same position in the NRI ranking as the previous year. If the focus is only given on ASEAN countries, Thailand's position in the ranking will be placed adjacent to those of the Philippines, Indonesia, and Vietnam. However, Thailand still neglects to make improvement as well as minimize the weaknesses, i.e. the management of regulations and control measures, public sector use of ICTs, and economic impacts, especially the encouragement to protect or preserve intellectual properties in relation to law enforcement and innovation creation. On top of that, the public sector should offer supports and simplify complex workflows to facilitate the running of businesses which may result in the trend toward Thailand's higher position in the NRI ranking.

Therefore, if the analysis of the country's competitiveness level is conducted, the direction of competition and development of the country will have to rely on ICT factors. This is due to the objective to boost up the overall country's performance in achieving proficiency and developing innovations, through making investments in multiple dimensions of infrastructure. In order to support and motivate the development of key ICT infrastructures to adequately meet the demand of both the popular and the business sectors, the public sector has to play a pivotal role in propelling and pushing forward the improvement of competitiveness. These can be carried out through utilizing ICTs in the light of research and development spending so as to boost the

performance of human resources in the aspects of knowledge and capacities, readiness for new technology adoption as well as ability enhancement to allow practical use of ICTs for further development.

As regards the overall indicators, Thailand has been ranked 67th out of 143 countries - the same position in 2013. However, its position in the ASEAN ranking has moved up 3 places lagging behind merely Singapore and Malaysia. Regarding the indicators conforming to the NBTS's tasks such as the allocation of ICT resources; spectrum and telephone numbers, the enhancement of service coverage, the regulation of service price rates, and the regulation of competitions to prevent impacts on any lawful rights and services usage, they are considered the factors that supported Thailand to earn higher positions in various rankings. For example, Thailand's position in the number of mobile-broadband Internet users per 100 inhabitants has moved up 90 places: from 132nd position in 2013 up to 42nd position in 2014, also the position concerning the number of mobile-phone users per 100 inhabitants has moved up from 38th position in 2013 to 35th position in 2014. Moreover, according to the report on readiness assessment for mobile-cellular networks, it shows that the particular networks can cover all of the population countrywide. Moreover, Thailand's position in the prepaid mobile-cellular service price ranking is assessed to climb up from 30th position in 2014 to 16th position in 2015, resulting in the greater ability to purchase [1], [2].

Other than various positive factors, there are some challenges regarding the imposition of the NBTC's policies and schemes in the next stage so as to move up the position in other aspects of indicator ranking, for example, the imposition of national broadband development strategies, the enhancement of fiber optic cabling infrastructure expansion along with competitive regulation so that the price rate of fixed-broadband services will decrease resulting in a greater number of users, as well as the imposition of measures to encourage such providers to place the fiber-optic cables underground, etc.

III. Analysis and Recommendations

The study on the digital economy reveal different approaches to related development plans and policies among individual countries based on specific political, economic, social, and domestic industrial factors. The roles of the public sector can range from "active" which means to make direct intervention, "passive" or to rely on the private sector so as to achieve the digital economic growth, and "hybrid" which subjects to the cooperation between the public and private sectors. Regarding the aforementioned roles, Finland, UK, and USA mainly take a passive role but are prone to take a hybrid role at some point, whereas France, Japan, South Korea, and Sweden prefer taking an active role to promote the digital economy policy and seek cooperation from the private sector as well.

It is clear that there is no fixed formula for the economic policy that suits each individual country, but various widespread procedures normally share some common characteristics. In order to fulfill the target, each procedure generally initiates from imposing the digital economy development plan that should made up of clear-stated targets, visions, strategies, operations frameworks, and related projects to fulfill the target. This includes the imposition of related policies and regulations in correspondence with operations frameworks.

1) The overall process

A successful process for developing the digital ecosystem in a country within a short period of time normally begins with drawing up a distinct development plan comprising visions, targets, strategies, and related projects to gain concrete target fulfillment. Then, the examination and evaluation should be carried out systematically to ensure that the development is in the correct direction before an appropriate adjustment is made accordingly. Most of the world's top countries in broadband such as Denmark, Finland, South Korea, and the Netherlands all have already come up with digital economy development plans, for example, Japan has adopted the "eJpan strategy" development plan since 2011 which has gained continual improvement up to this time. Similarly, South Korea has adopted several broadband development plans since 2010 which have been regularly revised in parallel with market changes.

Several governments from all corners of the world have shifted their role from being market dependence and sorely responsible for imposing market incentives, as previously successfully done in international mobile telecommunications. However, just only the competitive incentives may not be adequate for broadband Internet markets. This can be noticed from the study undertaken in USA where the government has promoted broadband telecommunications merely through the market force for almost ten years, up to 2009. During the same period, the position of USA in broadband penetration ranking fell from 2nd place in 1988 to 15th place in 2008, based on the OEDC ranking [3], [4]. Accordingly, the government changed its attitude by officially imposed the national broadband development plan during 2010 instead [5].

Conversely, the South Korean government has played a pivotal role in promoting the rapid growth in broadband markets through practically formulating development plans for this particular activity along with adopting policies and creating a large number of related projects since the late 20th century up to the present day. This brought about the development encouraging South Korea to overcome the economic crisis, transform itself to a high-income country that can attract significantly heavy ICT investments, and finally become one of the world's leading countries in terms of digital technology [6].

2) Creating thriving markets

Though many broadband operators worldwide are private companies, several defects regarding this particular market still exist. For example, the majority of broadband infrastructures have been monopolized by a single typical operator without enabling competitors to gain a fair share of any benefits. This creates barriers to intense competition. Furthermore, the weaknesses in competitive incentives such as complex licensing processes, ineffective spectrum management, and limited access to financial capital pose threat to the trail toward a thriving market as well.

The Thai government should launch strategies such as improving licensing processes, promoting the spectrum management approaches that are more open and facilitate new entry, permitting general operators to use the typical operators' networks at reasonable prices (such as interconnection regulation and local loop unbundling, etc.). Though each country adopts different competitive incentives; facility-based or service-based, they all have the same goal in bringing about a free, fair, and sustainable competitive market.

3) Creating accessible networks and services for everyone

Providing broadband services in remote and hard-to-access areas is considered a major obstacle to the expansion of extensive broadband network coverage, especially the fixed-broadband network that have higher costs than mobile networks. However, when a lot of the public and private sectors began to provide diversified online services, equal access to these services at affordable qualities and prices should be provided for people from all walks of life. Generally, the target of digital economy development plans is composed of network coverage areas, number of users, and quality of services. For example, the target set up under the "Digital Agenda for Europe" framework requires that all Europeans are provided with extensive fundamental broadband Internet services by 2013, all populations are able to have access to broadband of at least 30 Mbps, and that at least half of all households can subscribe to the broadband of higher speeds than 100 Mbps by 2020 [7].

TABLE II: THREE CONCEPTUAL PRINCIPLES OF THE DIGITAL TECHNOLOGY

Accessible	Affordable	Interesting
• Building up an ICT hub in the community • Connecting educational institutions to broadband networks • Making wireless broadband services available in public places, e.g. airports and business areas • Launching projects to thoroughly equip populations with ICT skills	• Adopting taxation measures or supplying target groups with ICT gadgets • Giving financial support regarding ICT gadgets to educational institutions • Giving correct and extensive information in accordance with service providers, prices, and related technologies	• Creating interesting content presented in local languages for a community • Providing information and public services through online media using applications, e-government, and other services like e-health, e-learning, etc. • Creating an appropriate legal framework to promote e-commerce and other applications • Enabling populations to see the advantages of digital technology • Encouraging the use of broadband in business sectors and communities

In order to fulfill the similar goal, the Thai government can use financial incentives promoting operators to expand the networks to remote areas. Alternatively, the government can adopt the method of co-investment between the public and private sectors in combination with the regulations that govern operators to expand their networks to remote areas. Moreover, the government should initiate financial supports to expand the networks to locations where broadband networks are still out of reach so that 99 percent of populations in the country could have fixed-broadband broadband penetration.

4) Putting forward demands

Basically, the digital ecosystem is made up of 4 factors: networks, services, applications, and users. Many countries that experience success in broadband development regularly place emphasis on providing supplies (by expanding networks and services) concurrently with stimulating demands (utilization in business, public, and popular sectors).

A great effort in demand stimulation is very necessary because the expansion of networks and services, especially to remote areas, requires huge capital. Therefore, in order to produce maximum benefits from such investments, local populations should be capable of using technology in producing economic and social impacts. Accordingly, the public sector has to be directly responsible for building the awareness of advantages in digital technology and stimulating demands based on the three conceptual principles of the digital technology: accessible, affordable, and interesting as concluded in the Table II.

IV. CONCLUSION

ICTs is one of the key infrastructures that take part in propelling the country's development in terms of economy, society, education, public health, science, national security as well as bring about social equality. It is clear that there is no fixed formula for the economic policy that suits each individual country, but various widespread procedures normally share some common characteristics. In order to fulfill the target, each procedure generally initiates from imposing the digital economy development plan that should made up of clear-stated targets, visions, strategies, operations frameworks, and related projects to fulfill the target. If policy makers and the telecom regulator implement policies that encourage ICTs investment, competition and innovation, both the ICTs sector and the wider digital economy will expand, creating prosperity, labor improvement and new entrepreneurship. The recommendations in this paper will help the Thai government to gain better Thailand's NRI position and foster the growth of economy and serve the quality of life for the Thai society.

REFERENCES

[1] World Economic Forum, *The Global Information Technology Report* 2015.
[2] World Economic Forum, *The Global Information Technology Report*, 2014.
[3] K. Kelly, *International Broadband Benchmarks, Workshop: International Lessons*. Washington, D.C., USA: FCC.
[4] OECD, *Information Technology Outlook*, 2008.
[5] Federal Communications Commission. (2010). Connecting America: The National Broadband Plan. [Online]. Available: http://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf
[6] OECD, *OECD Internet Economy Outlook*, 2012.
[7] European Commission, *A Digital Agenda for Europe*, Brussels, 2010.

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