The Prospect of Indonesian Knowledge-Based Economy: Lessons from Taiwan

Maria Indira Aryani

International Relations Department of UPN "Veteran" Jawa Timur

email: maria_indira.hi@upnjatim.ac.id

ABSTRACT

Economic development is gradually shifting from a resource-based economy to investment-based economy to knowledge-based economy. Knowledge-bases economy is an economic process which concerns the creation, acquisition, dissemination and utilization of knowledge to achieve productivity. In utilizing knowledge, the economy would be more dependent towards information and technology. This paper is trying to see how knowledge-based economy is implemented in Indonesia by analyzing four pillars of education, innovation, information infrastructure and economic and institutional regime. The analysis of these four pillars can be put into SWOT assessment, combined with the assessment of Taiwan's knowledge-based economy is used to see lessons that can be learned from Taiwan and opportunities that can further help Indonesia to achieve economic prosperity and equality. Taiwan as the first economy in Asia to have been successfully implementing the knowledge-based economy is the ideal role model for knowledge-based economy implementation.

Keywords: *Knowledge-based Economy, Indonesia, Taiwan, Four Pillars, SWOT Analysis*

"Our current expectations for what our students should learn in school were set fifty years ago to meet the needs of an economy based on manufacturing and agriculture. We now have an economy based on knowledge and technology" - Bill Gates

Introduction: Knowledge-Based Economy Definition

The quote above was taken from Bill Gates' written testimony before the U.S Senate Committee hearing on March 7, 2007 when he was invited to speak in front of U.S Senate Committee of Health, Education, Labor and Pension. His quote summarizes the fast changing global economic trendthat is often leaving behind those who are not ready to catch up.Bill Gates emphasized on the importance of knowledge and technology as the propeller of economic development in the era of information society. It has been proven that knowledge is often viewed vital for economic success. Wilfred Dolfsma and Luc Soete further stated that knowledge, information and abilities are valuable resources for an economy (Wilfred and Soete 2006). More and more OECD countries acknowledged the role of information, technology and learning as the driving force of economic productivity. This argument was supported by OECD through their report showing the increase of economic dependence towards knowledge and information (OECD; 1996).

Although it is agreed that knowledge and information is valuable for economic development, the relation between knowledge and economy itself in the term knowledge-based economy has always been ambiguous and poorly defined. Wilfred Dolfsma and Luc Soete summarized that the term knowledge-based economy is an elusive term because the role of knowledge and information can always be seen valuable as an economic resources and has always been used to increase economic productivity throughout history, take the industrial revolution for example (Wilfred and Soete 2006). In fact, knowledge and information in traditions that is passed down from generation to generation has always been the main source of the primitive economy's production, distribution and consumption (Lundvall and Johnson 2016). So the term of an economy based on knowledge is actually not a new term, but it has gain its importance in the 1990s when countries tried to integrate knowledge more directly to their economic models. OECD (1996) defined knowledge-based economy as economic model that is directly based on the production, distribution and use of knowledge information.Sajit Chandra Debnath define knowledge-based economy as an economy that generates and utilize knowledge to achieve economic growth.(Debnath and Yokoyama n.d.)Krishna B. Kumar and Desiree Welsum (2013) further specify that knowledge-based economy is an economic process which concerns the creation, acquisition, dissemination and utilization of knowledge.

Knowledge-based economy emphasizes in the importance of information and knowledge as the most valuable source that is being used in the development of the economic process. The value lies in the sense that knowledge and information is an important intangible resources that is prominent to increase the quality of physical capitals, further enabling the increase in economic productivity.The growing importance of knowledge as an economic resources and capital does not necessarily means that manufacturing and agriculture as the older economic modes of production have become obsolete. Economic process of manufacturing and agriculture is further intensified with the use of knowledge and information with the creation of advance manufacturing and agriculture technology. Not just that, the use of knowledge as an economic resource has created inventions that further broaden the knowledge itself, knowledge thus become the input as well as output of economic activities (Lundvall, From the Economics of Knowledge to the Learning Economy 2016). With that being said,knowledge and information are now considered as internal factors of economic production whereas before, only labor, capital, material and energy are regarded as such.

Andrew Wyckoff, OECD's Director for Science, Technology and Industry pointed out that knowledge as an economic resources and capital is far more durable than labor, natural resources or other physical capital (Wyckoff 2013). Investment made for knowledge capital is increasing faster than investment made for physical capital in many OECD countries, especially in the Western countries, and these trends has shown to be parallel with

productivity growth for those economies. As can be seen from Figure 1. below, Western countries has begun investing more on knowledge-based capital than physical capital as shown from the percentage of their 2009 GDP. Investment in knowledge-based capital is investment made in the field of informational and technological advancement as well as knowledge dissemination while investment in physical capital is investment made to increase the quantity of infrastructure such as buildings or machineries. Investment on the knowledge-based capital investment often resulting in the advancement of technology that most of the time would further bolstered the knowledge-based economy trends with the increasing use of internet for personal as well as professional activities (Wyckoff 2013).

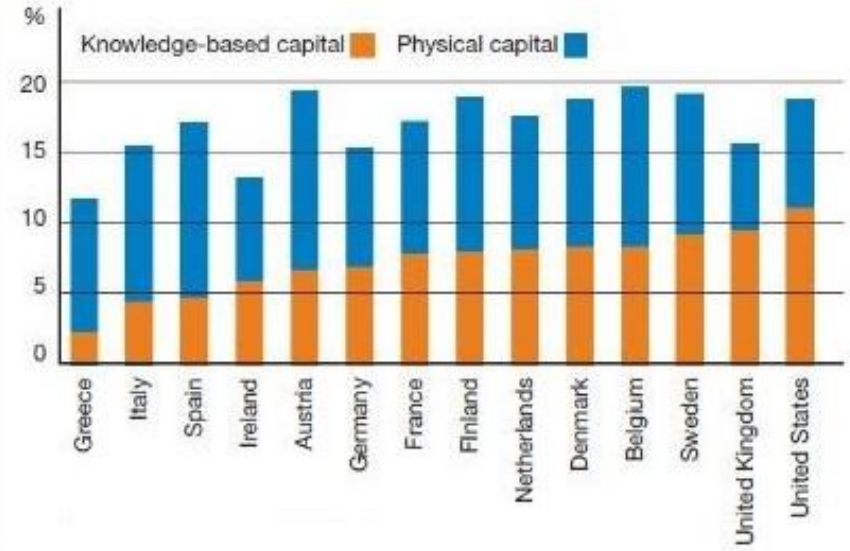

Figure 1. *Business Investment in Knowledge-Based Capital and Physical Capital*
Source: Joint Database on Intangibles for European Policymaking in Wyckoff (2013).

European Summit in 2000 had agreed that a knowledge-based economy has a new strategic goal to enhance employment and economic reform through the shift to a more digitized economy that would create jobs and increase competitiveness (Leydesdorff 2006). It was then explained that over the years, economies grew more dependent towards the role of knowledge as output, leading to an exponential increase of employment in high-technology industries and knowledge-sensitive service sectors. Countries with more investment on knowledge-based capital are seen to be moving their investment towards innovative firms and R&D facilities resulting in an employment growth in the field that has never been expected before.The idea of a knowledge-based economy is not necessarily connected to the use of digital technology. The use of digital technology or internet-based technology is justone part of knowledge-based economy that is important in accelerating the dissemination of the knowledge and information itself.Knowledge-based economy puts the same emphasize on the use and the advancement of science and technology as well as the implication of technological usage in the organizational and institutional forms of economic structure. Again, the shift to the use of ICT and internet does not always characterizes knowledge-based economy although the improvement and the use of ICT has made the knowledge and information dissemination easier and faster. There is also a significant importance that lies in the social aspect of a knowledge-based economy. The dissemination of the knowledge and information is essential in the decision making process in an economic process because a knowledge-based economy comprises of creation, acquisition, dissemination and utilization of the knowledge and information (Kumar and van Welsum 2013).

Knowledge-Based Economy Aspects, Characteristics and Frameworks

To know more about knowledge-based economy, we can examine four different aspects in which knowledge-based economy is affecting. Those aspects are physical capital, human capital, organizational capital and social capital (Kumar and van Welsum 2013).Physical capital is the first aspect of economy that is affected by the dissemination of knowledge and information. With more knowledge and information generated, more advanced technology and innovation aremade through research and development (R&D) processes. These innovations lead to the advancement of technology used in creating the economic infrastructures such as machineries and buildings, enhancing their physical qualities. Technological innovations in the physical capital aspects creates a more efficient and effective economic production. Physical capital improvement leads to human capital improvement. New technologies implemented needs to be accompanied by the improvement of the human capital which later would be the one operating those physical capitals. The improvement of human capital can be achieved through education that would increase the knowledge and quality of labor. The innovative capabilities and skills of the labor, as well as technological innovations in productions,are the primary economic growth generator.

As stated before, the improvement of technologies and innovations are made through R&D processes. The R&D processes allow knowledge to be embedded in firms. Those firms including private and public R&D institutions such as, universities, think tanks and even government.The collective of R&D institutions where knowledge is embedded in a learning is being done is called the organizational capital aspect of knowledge-based economy. Lastly, the social capital aspect of knowledge-based economyreferred to the interaction of the various economic entities, such as individual, firms and government, which will further disseminate knowledge and information among themselves. The organizational aspect along with the social aspect of knowledge-based economy would increase the quality of trust among economic entities that would be beneficial to create a good communication, rules and regulations, even governance for a favorable economic environment. The combination of these four capitals can also be used to create new knowledge and information. These aspects of knowledge-based economy and its combination created distinct characteristics which make it different than resource-based and investment-based economy.

Knowledge-based economy can be identified with many characteristics. OECD characterizes knowledge-based economy with high-technology industries, high-technology investments, and high skilled labor.High-technology industries require high-technology investment and high-skilled labor resulting in the importance of education and R&D institutions. High-technology industry is industry highly dependent on the use of internet and communication technology (ICT) therefore there will be a significant amount put on the investment on the field of ICT including investment of information technology (IT) equipment, communication equipment and software. Knowledge-based economy demanded a balance between the ICT infrastructures and human capacity supervising and using those high-technology infrastructures therefore education, especially tertiary education, is one of the vital element as can be seen from the framework below.

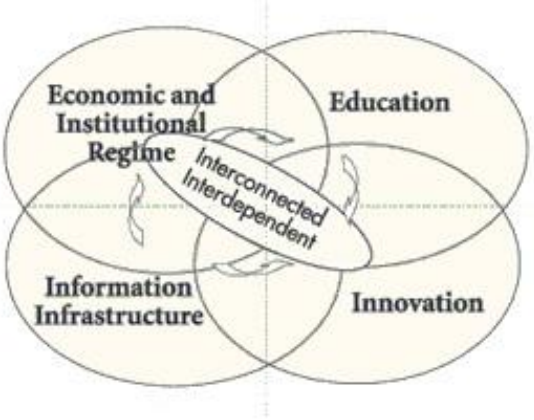

Figure 2. *World Bank's Four Pillars of the Knowledge Based Economy*
Source: As is illustrated by Jorma Routti (Routti 2006)

According to the World Bank, there are four pillars of the knowledge-based economy that is highly interdependent and interconnected (Routti 2006). Not just interdependent and interconnected, long term investment on these four elements have been found to be a key success to the transition towards the knowledge-based economy by modernizing market transaction(Chen and Dahlman 2005). The first pillar is education to increase labor capacity in using information. Indicator for education is the increasing importance of higher education that emphasizes in the adaptation of foreign technologies and environments that will be beneficial for domestic production processes to incorporate new technologies. More educated society usually is more technologically sophisticated thus making education enrollment, especially in the higher education institutions essential. The second pillar is innovation that refers to the network of institutions, rules, and procedures to acquire and utilize knowledge. Indicator for innovation is the growing number of R&D institutions, universities, and think tanks and also patents of scientific product or technical paper. The third pillar is information infrastructure that refers to the ICT infrastructures such as accessibility, reliability and efficiency of telephone, television, radio and their networks (internet). Indicator for this pillar is the increasing use of internet and various digital tools. The last pillar is economic and institutional regime that refers to incentives to economic agents that in time will induce the efficient utilization of knowledge, transparent macroeconomic, market competition and regulatory policies.

Antoni Zwiefka and Malgorzata Nycz (2012) have a slightly different but similar concept of knowledge-based economy as can be seen below. According to them, there are six pillars of knowledge-based economy which are innovation system, education system, communication and information system, business and institutional surrounding, knowledge management in organization and regional aspect. Like the four pillars above, these six pillars influence each other and much of their pillars are the same. One pillar that is different and interesting is the regional aspects pillar. Although this pillar can be put as one of the economic and institutional regime, the regional aspects pillar emphasizes in the importance of regional economic development that could affect country's economic development. ICT advancement can eliminate geographical boundaries and increase competitiveness across borders to make a more efficient market(Chen and Dahlman 2005). Interaction between regional ICT utilization and regional market creates a specific regional economy thus allowing regional specific responses from regional policy makers to make some certain regional identity both in the economy and in the information society (Dunnewijk and Wintjes 2006).

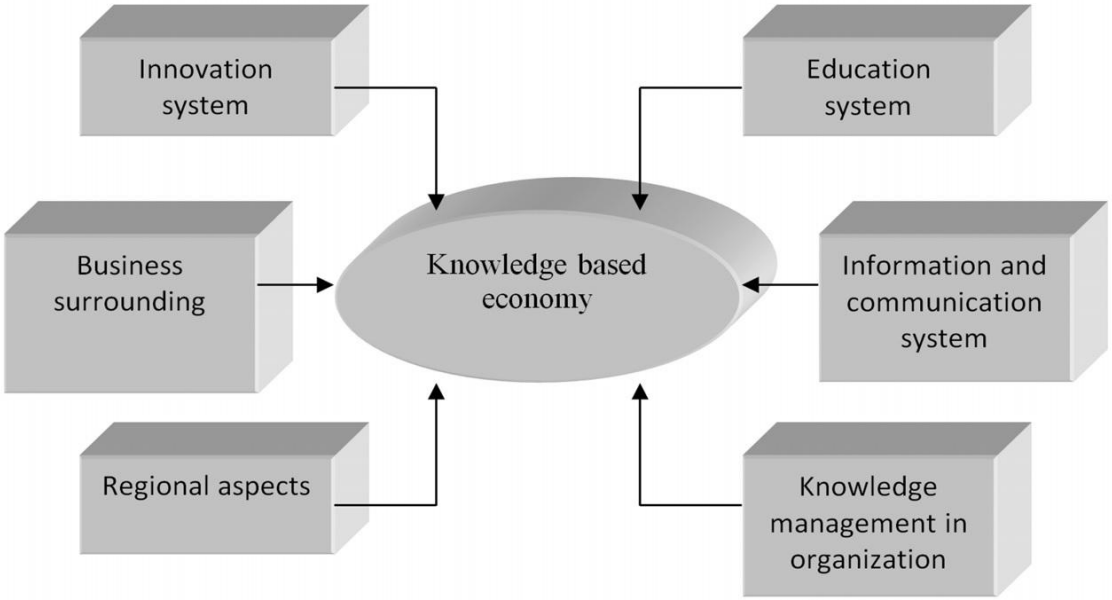

***Figure 3**. Six Pillars of Knowledge-Based Economy*
Source: Malgorzata Nycz, 2002 (Nycz and Zwiefka 2012)

Knowledge-Based Economy of Indonesia

The pillars that have been mentioned above is an excellent tool to assess one country's readiness to fully transfer its economy to a knowledge-based economy. The four pillars of knowledge-based economy according to the World Bank will be used to assess Indonesia's current knowledge-based economy performance. SWOT analysis on education sector, innovation sector, information and infrastructure sector and economic and institutional regime of Indonesia will further clarify challenges and opportunities for Indonesia to fully engage a knowledge-based economy. SWOT analysis is a basic assessment mechanism to analyze overall strategic position of a business, in this paper is Indonesian knowledge-based economy performance, and its environment(Management Study Group n.d.). SWOT analysis evaluates internal factors, that include strengths and weaknesses, and external factors, that include opportunity and threat. Before the SWOT analysis can be performed, it is important to assess Indonesia's knowledge-based economy framework through indicators such as higher education graduate and employment, innovation and R&D institutions, internet penetration and ICT infrastructure, and digitized economic policies.

1. Graduates and Employment

The first pillar to assess Indonesia's knowledge-based economy performance is education. Higher education graduates and their employment will be used to measure the readiness of the education sector in the knowledge-based economy. There has been a serious problem in the higher education and employment system in Indonesia these past six years where there is a high number of tertiary education graduates' unemployment. It is recorded that only 17.5% out of the total of 118.41 million tertiary education graduates could find employment. This number is lower than secondary and primary education graduates that could find employment which are 82% and 60% (Seftiawan 2017). Tertiary education enrolment in Indonesia is only 31.1% out of the total population of 260.6 million, while the graduates in sciences and engineering only amount 21.7% from the total tertiary education graduates.

The major problem of Indonesia's higher education system is that it is often experience a mismatch between what is taught in the classrooms and what is needed in the employment market. As it is stated before, economic development is changing is now knowledge-based,

but the majority of Indonesia's higher education system is not ready for the rapid change of ICT sector dependence. Thus creating a gap between the graduates and the labor market's demand. Knowledge intensive employment in Indonesia is only 9.8% of the total employment because there are skill mismatches between employee and their employment field. Tertiary education graduates seemed to be having a difficult time implementing the acquired knowledge, skills and competences in to a productive knowledge-based, and even, ICT based employment. This situation is making Indonesia fall behind every ASEAN neighboring country, except from Cambodia and Lao PDR, for the implementation of knowledge in productive employment (LaRocque 2015). Most of the higher education curricula in Indonesia lacks the significant amount of knowledge-based skills and practices. There needs to be a reform in Indonesia's higher education system, and this is often come at a high price.

Education system has never been the priority of the government's spending. According to the2016 Indonesia's Government's Expenditure, expenditures on education only amounts of 3.3% of the total GDP of US$ 941 billion(Cornell University, INSEAD and WIPO 2017). This is a very small amount of money to be used to improve the quality of education system. The rapid change of economic trends requires a constant change and improvement from the education system curricula. Government need the help and cooperation from the private sector, as well as from the higher education system itself, to be able to enhance the quality of education. This is what encourage the Triple Helix Model of relations between university, industry (business) and government to further enhance integration of knowledge-based economy into the education system through various R&D mechanisms to create innovations.

2. Innovation and R&D Institutions

In terms of innovation, Indonesia is still quite far behind. Indonesia ranked 87 out of 127 countries in the Global Innovation Index Rankings (Cornell University, INSEAD and WIPO 2017). In the matter of Innovation Input, Indonesia ranked 99 out of 127 but ranked 73 according to Innovation Output. This means that although investment for innovation is less, Indonesia still manage to make the most out of that and maximizes the output, which means that Indonesia's Innovation is quite efficient and is ranked 7th in the lower-middle-income economies group. Indonesia's innovation is more efficient than India and the Philippines. In 2012, R&D funding in Indonesia only amounts for 0.09% of the total GDP that is about 4.72 billion Rupiah (Ferianto 2016). 43% of those funding is government funding with 2.019 billion Rupiah. R&D funding from Higher Education sector amounts for 1.821 billion Rupiah and from Industry is about 880 million Rupiah. Since 2012, Indonesian government through various research institutions in Indonesia such as LIPI and CSIS, has called for a greater role of involvement of the higher education and industries involvement in the R&D mechanisms. The result has been significant that by 2017, university and industry research collaboration amounts for 57% of the total R&D mechanisms made in Indonesia, ranked 30 according to the Global Competitiveness Report (Schwab 2017). The Indonesia's R&D spending by businesses is ranked 24.

Other variables for innovation sector is the quality of scientific research institutions through patents and scientific publications. The quality of scientific research institution in Indonesia is improving and it is now at the 41st position, just below Malaysia and China but above Thailand and the Philippines. In terms of patents and scientific publication, Indonesia is still falling behind with the recorded of only 0.1 patents application per million populations. Patents application in Indonesia only amounts for US$ 0.4 billion out of the total GDP of US$ 941 billion. In the region, patent application in Indonesia is still falling behind Singapore, Malaysia, Thailand and the Philippines. In 2016, there are only recorded of 15 patent applications in Indonesia, while there are 879 fromSingapore, 190 from Malaysia and 155 from Thailand.As for scientific publications, Indonesia ranked 4th in ASEAN with 11.865

publications (Ramadhan 2017) below Malaysia, Singapore, and Thailand. Lack of knowledge resources due to limited information and internet access is the main obstacle in creating innovations and scientific publication. In order to conduct a better research and acquire new knowledge, internet connection is vital and is regarded as the cheapest resource.

3. Internet Penetration and ICT Infrastructure

According to e-Marketer survey, the number of internet user in Indonesia has reach 83.7 million people, putting Indonesia in the 6th position of Top 25 Countries Ranked by Internet Users 2013-2018 (Yusuf 2014). Indonesia came 6th after China (excluding Hongkong), United States, India, Brazil and Japan.There has been a steady increase of internet users in Indonesia since 2005 to 2016 as can be seen from the table below. In 2015, there was no survey of internet penetration conducted by Indonesia Internet Service Provider Association (Asosiasi Penyelenggara Jasa Internet Indonesia/APJII) due to internal reform. A significant increase of internet user occurred in 2016 with 51.7% of Indonesian population recorded as an active internet user. In 2014, internet is mainly used in the trade and service sectors accounted for 31.5% and 26.1% of the total internet utilization. Internet is least used in agriculture sector with only 1% internet utilization(Asosiasi Penyedia Jasa Internet Indonesia 2015).

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2016
Population	206.3	212.7	219.2	225.6	232.1	238.5	242	245.5	248.9	252.4	256.2
User	16	20	20	25	30	42	55	63	71.2	88.1	132.7

***Table 1**. Internet User in Indonesia Compared to Population (in million)*
Source: Collected from various sources of Asosiasi Penyelenggara Jasa Internet Indonesia(Asosiasi Penyedia Jasa Internet Indonesia 2015) and (Asosiasi Penyelenggara Jasa Internet Indonesia 2017)

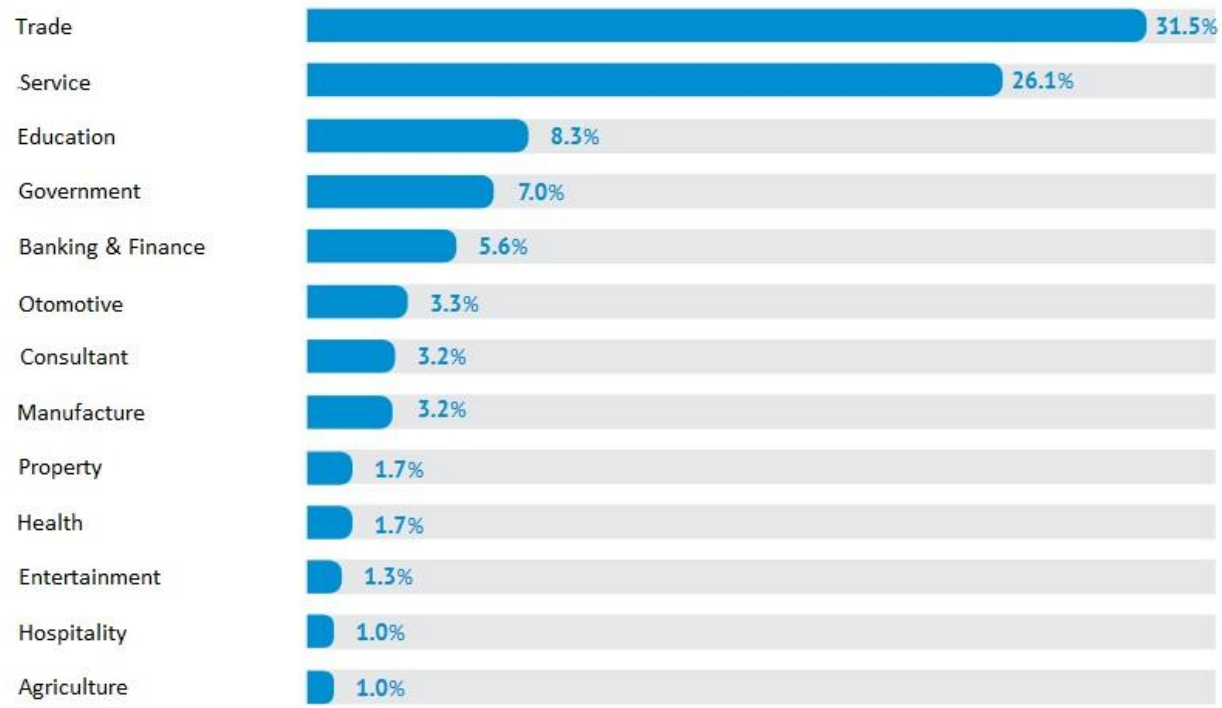

***Figure 4**. Internet Utilization in Indonesia in 2014*
Source: Collected from various sources of Asosiasi Penyelenggara Jasa Internet Indonesia (Asosiasi Penyedia Jasa Internet Indonesia 2015)

The majority of Indonesian population accessing internet is using their mobile gadgets and computers. It was estimated that as high as 85% in 2014 and 47.6% in 2016 of the total internet user in Indonesia is using their mobile gadgets. There is a growing trend in Indonesia to have more than 1 mobile device. In 2016, it is found that 34% of Indonesian internet user is using 2 mobile devices, 12% is using 3 mobile devices, 4.2% is using 4 devices, 4.2% is using 5 devices and 0.2% is using more than 5 devices (Asosiasi Penyelenggara Jasa Internet Indonesia 2017). The use of more than 1 mobile device is caused by the slow connection from the mobile internet provider. Internet user tend to have more than 1 device to accommodate for various mobile internet provider as an option if one provider's connection is too slow. Slow internet connection is the major problem in Indonesia. According to Akamai Technologies report of the State of the Internet, Indonesia's internet connection speed is ranked 77th in the world with average speed of 7.2 Mbps (Akamai Technologies 2017).Indonesia also have an expensive internet cost, ranked 62 from 64 countries included in the research with US$ 28.96 per Mbps (Asosiasi Penyelenggara Jasa Internet Indonesia 2013). The farther is the user from capital, the slower the connection speed and the more expensive the cost is.

Out of those 88.1 million of internet user in 2014, 52% is concentrated in Java, 18.6% in Sumatera, 7.5% in Sulawesi, 5.9% in Nusa Tenggara, Papua and Maluku, while 4.2% is in Kalimantan. It can be seen that there has been a significant disparity of internet users between Java and the other islands in Indonesia.It is not unusual as 58% of Indonesian population live in Java, but this has caused disparity on the development of ICT infrastructure. ICT infrastructure in Java is advanced with more than one options to connect to the internet.More advanced infrastructure such as fiber optics is still very limited in other area other than Java. It is no surprise to find broadband internet connection without indication of cellular access in the eastern area of Indonesia. The limited ICT infrastructure thus only allow 47.1% of the total ICT access in Indonesia.Internet access in Indonesia is dominated by wireless technology, making the connection often time slow. Due to the increasing number of internet user in Indonesia, APJII is adopting newer router technology, Brocade MLXe-16, that will be able to serve traffic up to 7.78Tbps (Asosiasi Penyelenggara Jasa Internet Indonesia 2013). This new technology is being configured in data centers connecting to the IIX to accommodate more users and avoid internet service collapse. This revitalization is the biggest investment ever made by APJII. Investment is needed to advance ICT improvements. High tech imports only amount for 8.5% of the total trade and high tech exports only amount for 3.5% of the total trade. This means that Indonesia's economic development is highly dependent on household consumption and not technological consumption.

4. Start Up and Digitized Economic Policies

There is a growing trend of the ICT utilization in the global economy leading to the trend of digital economy and e-commerce. One sector of the digital economy that received a lot of attention is the Digital StartUp businesses. Digital StartUp is in high demand amongst Indonesian graduates that find difficulties in looking for employment. Digital StartUp is a digital-based business model creation using various mobile device applications. In these past 7 years, more and more young Indonesian are interested in ICT and business model creation as well as ICT and organizational model creation as the future economic model. Digital StartUp is considered beneficial for Indonesia economy because of the high number of mobile device users in Indonesia. It was stated before that the number of more than 1 mobile device users in Indonesia is quite high, the mobile connection user is recorded to be 126% of

the total population, estimated about 326.3 million of mobile devices used in Indonesia. Out of those number, 30% are social media active with the 41% increase of online shopping users. It can be seen that Digital StartUp has a very promising future in Indonesia's economy.

Just like the trend of Digital StartUp that relies heavily on the ICT sector, other digital economic and e-commerce sector is also increasing steadily in Indonesia. As a new sector, government regulations and support is still insufficient. Some would see government regulations as an obstruction, but it can also provide security to parties involved in the process. That is why, on November 10, 2016 Indonesian government launched the Economic Policy Package XIV that specifically regulates electronic-based national trade. There are seven main policies that are aimed to support digital economy's producers and consumers as well protecting them. Those policies include easing and widening funding access, providing tax incentives, protecting consumer, educating human resources, improving e-commerce logistics, developing better communication infrastructure and improving cyber security. Other governmentsupport for the digital economy in in Indonesia is the launch of 1000 Digital StartUp Movement on June 17, 2016. Through this movement, Indonesian government under the Ministry of Communication and Information Technology will facilitate the StartUp Ignition through seminars, Workshop, Hackathon, Bootcamp and Incubation. 1000 Digital StartUp is expected to be established by 2020.

SWOT Analysis, Lessons and Opportunities from Taiwan

In 2014, the Asian Development Bank rated Taiwan as the first Asian countries successful in using knowledge-based industries to achieve economic growth (Taiwan Today; 2014). Taiwan ranked first in ICT infrastructure, ranked second in education and innovation and ranked third in economic incentive. The National Development Council stated that Taiwan have raised investment towards developing intellectual property portfolio that leads to stimulation of the knowledge-based economy (Chen and Huang 2014). There has been an increase of 24.51% in the investment of intellectual property portfolio in Taiwan between 2007 and 2013, amounted to NT$ 701.6 billion in 2013.Knowledge-based economy is believed to be an economic key to prosperity and social transform in Taiwan through equality, inclusion and innovation. As an effort to achieve economic prosperity like Taiwan, and as the respond of the changing economic trend, Indonesia has been initiating a transformation towards a knowledge-based economy. As the most successful economy implementing knowledge-based economy, a lot can be taught by Taiwan. The SWOT matrix below is used to assess Indonesian knowledge-based economy that will then be used to identify with the lessons that can be learned from Taiwan and opportunities for cooperation.

	Opportunities (external, positive)	**Threat** (external, negative)
Strength (internal, positive)	**Strength-Opportunity strategies** Rising number of internet and mobile device users indicates the growing number of internet and technological literacy Growing number of interest in the Digital StartUp sector along with government support	**Strength-Threat strategies** High number of unemployment for tertiary education graduate Low technology-related skill
Weakness (internal, negative)	**Weakness-Opportunity strategies**	**Weakness-Threat strategies**

	Low investment in education, innovation and R&D mechanism leading to a low ICT infrastructure Low enrolment rate in the tertiary education	Taiwan's education in the technology sector is advanced and well managed hence a growing number of Indonesian students pursuing higher education in Taiwan. Cooperation with Taiwan's StartUp enterprises would foster Indonesian Digital StartUp enterprises and create more employment Taiwan's New Southbound Policy would allow more investment for Indonesia in the ICT sectorthrough various frameworks creating a more sophisticated and advanced ICT infrastructure

***Figure 5**. SWOT Analysis of Indonesian knowledge-based economy*

Conclusion

In transforming into a knowledge-based economy, there are several strengths that Indonesia possesses. The growing number of internet users and technological system utilization indicates that Indonesia is steadily changing to a more literacy friendly country. The developing trend of Digital StartUp also shows that the majority of Indonesian population are familiar with ICT as one of the knowledge-based economy pillars. Aside from the strengths, there are also weaknesses. The growing demand of higher technology utilization has not yet been fully accommodated by the government and higher education institution in Indonesia. Low investment in education and high-technology innovation has made the higher education curricula to be outdated. Other than that, the technology that is being developed could not be as sophisticated as in the other area of the region. The result of this weaknesses is a disconcerting threat of a high unemployment rate of higher education graduates because of the low technological skill that is unsuitable in a more high-technological work environment.

To minimize the weaknesses and avoid the threats mentioned before, lies an opportunity for cooperation with Taiwan. Taiwan's education in the technology sector is advanced and has been attracting more Indonesian students pursuing higher education in Taiwan. Pursuing higher education in Taiwan will give more advantage to Indonesian student that would allow them to be employed in a more high-technological working environment. Other than education sector, cooperation with Taiwan's StartUp enterprises would foster Indonesian Digital StartUp enterprises and create more employment. And the last one, investment is a key propeller for a transformation to a knowledge-based economy. Taiwan's New Southbound Policy would allow more investment for Indonesia in the ICT sector through various frameworks creating a more sophisticated and advanced ICT infrastructure. These cooperation are expected to enhance Indonesia's transformation to a knowledge-based economy.

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