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DIGITALIZATION IMPACT ON GROWTH & HUMAN CAPITAL: INDONESIA BROADBAND PLAN CASE STUDY

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Abstract

Purpose: This paper examines how the Indonesia Broadband Plan initiated by the government as a response to the demands of the SDGs can have the expected impact on Indonesia's economy and human capital as supposed. This project started in 2011 and ended in 2019.

Design/methodology/approach: This research examines the differences in economic growth and human capital development in 33 provinces in Indonesia based on the broadband plan, using data taken from 2011 to 2019.

Findings: Even there is high optimism in the digital penetration project in Indonesia that will bring improvements to the economy and the quality of its people. This study affirmed that the impact of broadband penetration is more obvious to the human capital aspect than in the economy. Although in the results of this study, broadband penetration plays a major role in supporting the development and gives a minor economic impact on Indonesian society. But regarding the economic results, government policy should encourage the participation of domestic products to reap more economic benefits from trade through broadband penetration.

Originality: There is a difference between digital penetration expectations and tangible results when looking at the economic data and HDI presented by the government.

Keywords: digitalization, broadband, growth, human capital, Indonesia broadband plan

Introduction

The pandemic has strengthened the position of information communication technology to become one of the irreplaceable pillars concerning national life. Digitalization greatly encourages positive improvements in the business and social environment, especially in developing countries (Arendt, 2015; Njoh, 2017; Owusu-Agyei et al. 2020). Looking back at 2010, the Broadband

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Commission, United Nation Educational, Scientific and Cultural Organization (UNESCO), and the International Telecommunication Union (ITU) initiated a universal call in which all governments are obliged to increase broadband penetration as one of the goals in accelerating Sustainable Development Goals (SDGs) through communication technology. Broadband is said to be one of the best solutions in overcoming the problems of poverty, health, education, climate change, and demographic change. As many research using communication technology such as growth of fix phone, mobile and internet as a measurement of this penetration (Njoh, 2017; Seperhdoust, 2018)

It is stated in the data of Mckinsey and Company (2009) that the benefits of broadband penetration have helped increase economic growth and create jobs in Europe. It was also affirmed in the World Economic Forum, Broadband Commission, and ITU (2014) that in 2014, broadband technology has successfully provided jobs in China to more than 80 million jobs, of which 70% of jobs are absorbed by the younger generation. It was also emphasized that broadband technology has helped improve people's lives, improve health quality and provide benefits for the distribution of information and knowledge (Broadband Commission Report, 2014). However, Ward and Zheng (2016) argue that communication technology depends on the level of development of society to obtain economic benefits. Another evaluation also states that this infrastructure has more positive benefits in low-income countries than in high-income countries (Dewan and Kramer, 2000).

Observing the condition of Indonesia within the pandemic, since the end of 2019, digital-based communication networks have played a much bigger role in determining the continuation of Indonesia's development. Even before the pandemic, Indonesia's business and the economy has started to shift digitally, seen with the emergence of technology-based applications such as Ruang Guru (education), GoJek, Grab (Transportation), financial technology app, and more online trading sites. In 2013 alone, Indonesia's online trade transaction reached $ 8 billion and the progress has become more notable in the subsequent years. In a survey conducted by the Indonesian Internet Service Providers Association (APJII, 2020) in 2019, it was affirmed that the number of Indonesian internet users had risen to more than 196 million people. This is a huge number both in terms of the potential and challenges that facing the Indonesian government.

In line with the UNESCO agreement, the 6th President of the Republic of Indonesia states presidential regulation number 96/2014 which through the Ministry of National Development Planning (Bappenas) to announced the Indonesia Broadband Plan. This is a project plan on a national scale backed by the central and regional budgets for guaranteeing data connectivity in all regions in Indonesia and is projected for completion in 2019. This project was instated as a step by the government to improve the economy, competitiveness and improve the quality of life of the Indonesian people. There are 5 priority sectors for broadband development that have been marked, namely e-government, e-health, e-education, e-logistics, and e-procurement. The Indonesia Broadband Plan is a project whose development process must involve all parties, including central, regional, and private sectors. Broadband itself is a technology infrastructure based on a communication network, either wired or wireless, that carries a bandwidth speed of up to a calculation of the speed of Gigabytes per second (Bappenas, 2014). This feasible thing

makes the Indonesia Broadband Plan one of the government priority programs to enhance the economy and welfare of the Indonesian people.

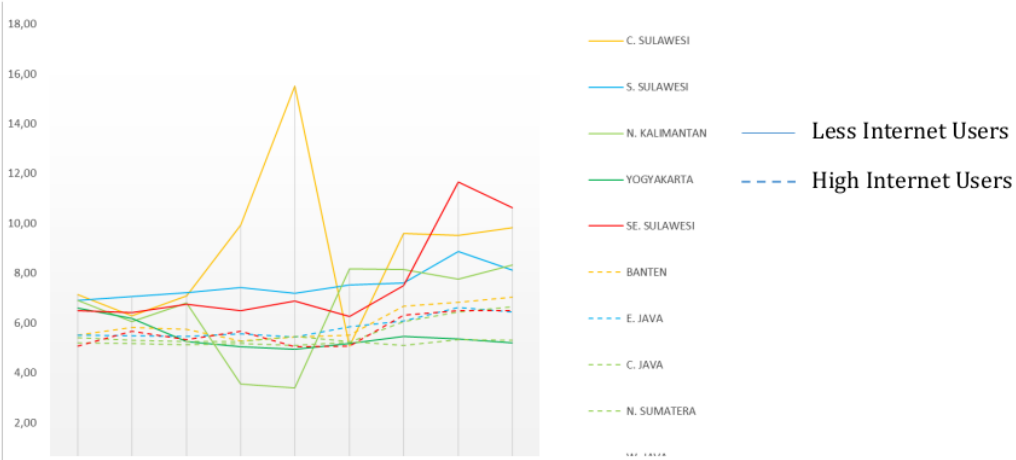

Figure 1: Provincial Growth comparison based on the number of internet users

However, there are contradictory findings between broadband penetration expectations and economic growth in Indonesian Provinces as shown in Figure 1. As displayed, it is revealed that the rank of internet users in Indonesian provinces is not constantly tailgated by their economic growth rank. Such provinces of West Java, Central Java, and East Java are in the top 3 of the provinces with the most internet users in Indonesia. Even so, it is actually below Central Sulawesi province in terms of economic growth. In Figure 1, it can also be noticed that the economic growth of the top 5 internet users in the province is below several other province's growths with fewer internet users. In line with the data gathered, it tells that the majority of provinces in Java, which are acknowledged as the center of the Indonesian government, actually have economic growth under those of provinces outside Java, despite having lower internet users.

Besides the correlation with the economy, it is also known that there is a correlation between information communication technology and human capital as measured by the Human Development Index (HDI) (Atalay, 2014; Njoh, 2017). When looking at the behavior survey of internet technology users in Indonesia by APJII (2016) it is found that the penetration of internet media users in Indonesia is mostly students with a percentage of 89.7% and workers 58.4%, it is widely known that occupation and education interact with the dimensions of HDI. So far in the APJII (2020) survey, internet penetration in Indonesia in 2019 has reached 73.7% of all regions in Indonesia. These results prove the government's efforts to encourage broadband penetration as a step to boost the welfare of the Indonesian people.

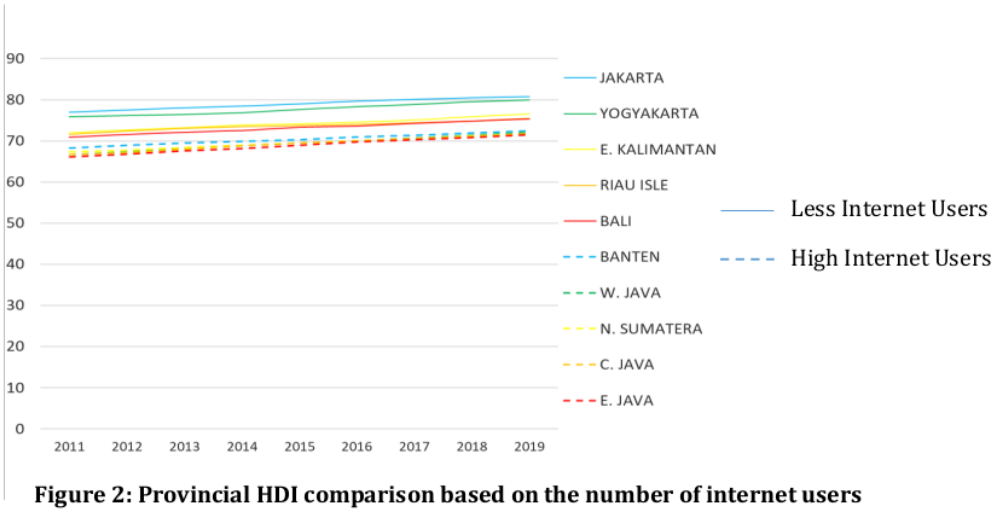

Figure 2: Provincial HDI comparison based on the number of internet users

Nevertheless, as shown in the data presented in Figure 2, it can be observed that it turns out the Province with the largest internet users in Indonesia does not necessarily make the province have the highest HDI achievement. Indeed Jakarta is the province with the most eminent in the HDI achievement, but it is only in the 6th rank of most internet users in Indonesia. As far as the data obtained, West Java with HDI 72 (BPS, 2020) has more than 35 million internet users, with broadband coverage almost 100% (APJII, 2020). Yet, the ranking is far below the top 4 provinces with HDI achievements above 75 (DI Yogyakarta, East Kalimantan, Riau Islands, and Bali) (BPS, 2020) which has a total of internet users of less than 15 million or less than half of the former (APJII, 2020). Here proves that internet penetration effects did not significantly mean that the province has an equivalent HDI score.

This research conducting referring to these conditions that encourage curiosity in seeing the impact of communication technology toward the economy and development of human capital in Indonesia which was initiated by the government through the Indonesia Broadband Plan.

Digitalization and Economic Growth

As the neo-classic theory states separately by Solow and Swan (1956) that predicting in the long run, the growth of every country will achieve the steady-state condition helped by technological progress. This theory emphasizes the contribution of technology that drives productivity as a result of improvement in many sectors by technology. Thus, this theory is strongly backed by many research which proves that infrastructure technology on digital matter indeed intensifies the countries productivity especially given by investment in it (Dewan and Kramer, 2000; Arendt, 2015) and by the ownership of gadgets (Njoh, 2017).

Broadband network which is part of technological developments has a relationship that has been repeatedly discussed in many studies. As many research showing the positive relevance between the relationship communication technology and economic growth (Arendt, 2015; Sepehrdoust,

2018; Myovella et al. 2020). Also, the Broadband Commission (2010) describes the close relationship between the two things, where it is stated that 10% growth of broadband penetration will help boost economic growth by 1.3%. The linkage between technology and economic growth stated by Solow & Swan in Mankiw and Taylor (2014) is presented using the formula:

$$Y = f(K, L, A) \quad \text{.....(1)}$$

Where Y is the output, K is the quantity of physical capital L is the quantity of labor and A reflects the technological variables. Then, the equation used in assessing the impact of digitization on economic growth uses the equation (1) approach, which was then developed through the research model approach used by Sepehrdoust (2018). So that the equation is concluded as follows:

$$Gr_{it} = \beta_0 + \beta_1 MS_{it} + \beta_2 FP_{it} + \beta_3 IH_{it} + e_{it} \quad \text{.....(2)}$$

Gr is defined as GDP per province, β_0 is a constant, $\beta_{1..3}$ is the regression coefficient, *i* refers to the cross-section, *t* refers to time, and *e* is the standard error. Regressors used in these studies include households that have mobile cellular with *MS* notation, *FP* refers to the growth of households that have fixed-phone networks, *IH* is the growth in household internet use in the last 3 months.

Digitalization and Human Capital

The theory about the correlation of digitalization and human capital is begin with the strong relevance of education and human capital as stated by Becker (1993) which explained high rate economic return that given by investment in the level of education. Furthermore of developed theory, Shastry (2012) also explain how education has a deep connection with the information technology which spearheaded by the emergence of many IT companies as a response to globalization. The latest study also links digitalization impact on education (Baumöl and Bockshecker, 2017) especially in the midst of a pandemic (Skulmowski and Rey, 2020). Digitalization in the term of internet access has become basic human right as recognized by United Nations that even include it in SDGs, as individual communication that boosted by the internet has played an important role to drive up human capital value which is now unreplaceable (El Massah and Mohieldin, 2020).

Several studies imply a positive relationship between the use of digital technology and human capital especially on developing countries (Ndinga, 2013; Yakunina and Bychkov, 2015; Njoh, 2017). The study affirms that the effectiveness of technological infrastructure development can help improve the quality of human capital by increasing per capita income and education. Palei (2015) also emphasized that the development of technology has helped increase global competitiveness and increased the productivity of its people and the economy. Human capital looks at the value of "capital" that has been issued by an individual "human" until he/she works (Todaro and Smith, 2011). In assessing human capital standards, several studies (Atalay, 2015; Njoh, 2017) use the results of calculating the Human Development Index (HDI).

UNDP (2015) states that the HDI is a measurement conclusion used to measure human development in the long term. In 2014, Indonesia has made improvements to the HDI calculation by still referring to the UNDP standard which uses the same 3 dimensions (BPS, 2016). The HDI calculation is presented as follows:

$$HDI = \sqrt[3]{HxExI} \quad (3)$$

Where H is the notation of health, E for education, and I for income. The geometric method approach aims to have a direct influence between the weak and strong dimensions to cover each other's weaknesses. The United Nation Development Program (UNDP) also emphasizes that this calculation describes how the performance of a country is related to these 3 dimensions (Todaro and Smith, 2011). Meanwhile, the equation approach used in measuring the impact of technological developments on human capital refers to research from Njoh (2017) using the same regressand with a change in regressor notation *HC* as human capital, which is as follows:

$$HC_{it} = \beta_0 + \beta_1 MS_{it} + \beta_2 FP_{it} + \beta_3 IH_{it} + e_{it} \quad (4)$$

Sample and Data

The data taken is based on the commencement of the 9-year Indonesia Broadband Plan which was initiated in 2011 and ended in 2019 from The Ministry of National Development Planning or National Development Planning Agency (Bappenas, 2014). Data received from 33 of the total 34 provinces in Indonesia excluding North Kalimantan Province which was only officially established in 2013 (BPS, 2020). Then, digital growth uses the approach used by ITU (2010) which links the growth of technology infrastructure penetration as indicated by the growth of mobile cellular, fixed phone, and internet users.

Digital penetration data refers to data on mobile cellular, fixed phone, and internet users presented by BPS (2020) in the form of a percentage. Likewise, economic growth taken from BPS (2020) is presented in the form of rupiah which is then converted into a natural logarithm to simplify calculations and see the characteristics of the value of growth. The calculation method used in this study uses panel data.

Result

The statistical description of the variables can be seen in the summary presented in Table 1. The data shows the inequality of human capital in Indonesia as measured by the HDI. There is a very high gap when looking at the comparison of the HDI of provinces in Indonesia with min (55.01) and max (80.76). Then, if we look at the data on the fixed telephone networks growth, there is also conflicting data, where there is a province that until 2011 the citizens did not have any fixed telephone networks (value 0). It is well known that Indonesia is often faced with geographic challenges, especially when it comes to infrastructure development. Then when compared in terms of equal distribution of ownership of mobile cellular with the smallest percentage (35.12) that are owned by provinces in Indonesia, it can be seen that cellular communication technology is more acceptable and easy for Indonesian people to be owned. For people with geographic

challenges that have communication barriers in regions, surely mobile cellular offered convenience.

Table 1: Descriptive statistic for variables

Variabel	Mean	Std. Dev	Min	Max
Dependent				
Human Capital	68.5888	4.42476	55.0100	80.7600
GDP / Provinces (ln)	18.9079	1.78175	16.5900	31.5500
Independent				
Mobil Subcribe Growth (%)	85.6697	9.93513	35.1200	98.0400
Internet User Growth (%)	43.0154	18.9039	10.4900	93.3300
Fix Phone Growth (%)	3.76539	3.52323	0	26.6900

In the data shown in table 2, there is neither point of correlation between human capital and the value of GDP per province in Indonesia. The strong and significant correlation in Table 2 is seen in the relationship between internet user data and GDP per province (0.776). This is indeed confirmed by a survey from the APJII (2020) that more than 40% of Indonesians are actively used the internet for e-commerce. Table 2 also affirms that people prefer to access the internet with mobile cellular than fixed-telephone, seeing that the correlation number of internet users is higher for mobile cellular subscribers (0.6) compared to fixed-telephone (0.21). Furthermore, based on APJII survey (2016) Indonesian consumers are given more flexibility in using mobile cellular as a communication channel, this technology is more widely used, especially when referring to people who live in isolated and remote areas.

Table 2: Correlation Matrix between variables

Variables	1	2	3	4	5
1. Human Capital	1.000				
2. GDP / Provinces	-	1.000			
3. Mobil Subscribe Growth (%)	0.254***	0.776	1.000		
4. Internet User Growth (%)	0.264***	0.776***	0.60	1.000	
5. Fix Phone Growth (%)	0.241***	0.445	0.214	0.048	1.000

Significant, *0.1, **0.05, ***0.01

The calculation results in table 3 refer to the panel data model that is most suitable for use in computations performed, based on these data the Likelihood test and Hausman test are performed. Looking at the results of calculations with GDP per province as regressed, an estimate is obtained (0.0) regarding the Cross-Section F <0.05, and the Hausman test (0.144) with a Cross-Section Random> 0.05 which refers to choose the random effect as a method to do the calculations. Whereas in the calculation of human capital, the same approach does as well and the suitable estimation model is using the fix-effect refers to the results of Cross-Section F and Random which are 0.0 respectively.

Table 3: Result of Panel Data Calculation

Variables Dependent		GDP / Provinces			Human Capital		
Independent		ols	fix	random*	ols	fix*	Random
Mobil Subcribe Growth (%)	Coef.	0.016	0.006	0.008	0.173	0.088***	0.093
	p-value	0.21	0.58	0.392	0.000	0.00***	0.000
Internet User Growth (%)	Coef.	0.019	0.011	0.014***	0.123	0.071***	0.075
	p-value	0.004	0.009	0.00***	0.000	0.00***	0.000
Fix Phone Growth (%)	Coef.	0.107	-0.027	-0.001	0.422	-0.11***	-0.071
	p-value	0.00	0.419	0.964	0.000	0.00***	0.000
Adjusted R-squared		0.117	0.885	0.127	0.995	0.86	0.949
Prob(F-statistic)		0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
Observation		297	297	297	297	297	297
Cross Section F		-	0.000	-	-	0.000	-
Cross Section Random		-	-	0.144	-	-	0.000

Significant, *0.1, **0.05, ***0.01

Among the data shown in Table 3 explains that all regressors have a simultaneous effect on economic growth (α <0.01). While partially, only internet user as regressors which have a significant effect. Furthermore, mobile cellular subscriber which can be interpreted as a telephone card does not have a significant effect on the Indonesian economy (α> 0.01), the same result was received in fixed telephone networks that do not have a significant effect either. This also indicates that the addition of internet users does not always come from the addition of mobile cellular and fixed-telephone. Looking at the R-square (0.127), which outlines many additional variables that may have more influence on the value of economic growth than the variables presented. No less important, table 3 also explains that there is a positive change in GDP growth per province of 0.01 if there is an increase in internet users by 1%. The value of this relationship, although not as large as the expectations described by the Broadband Commission (2010), is still in line with the relationship of communication technology infrastructure in supporting the economy.

As shown is table 3, the relationship between human capital and all regressors is significant both simultaneously and partially (α <0.01). This means that in general, communication technology has a more significant impact on Indonesia's development compared to its economic growth. Results in Table 3 confirm that mobile subscriber variable and internet growth have a significant positive relationship on growth. Some findings also require a deeper study, that the growth of 1% telephone network has a negative impact (coef.-0.11) on human capital. Based on table 3, a 1% increase in mobile subscribers and internet growth contributed to an increase in the HDI index by 0.88 and 0.71 respectively. It is also known that all regressors contributed a big role in shaping the Indonesian HDI looking at the R-Square number (0.81) compared to other variables which are not presented. Things that are aligned in the findings on a survey conduct by APJII (2016) Indonesian which affirms consumers are given more flexibility in using mobile cellular as a communication channel, this technology is more widely used and helps a lot in disseminating information that is beneficial both educationally and economically, especially when referring to people who live in isolated and remote areas.

Discussion

Although this research acknowledges that the penetration of broadband technology is capable of driving economic growth and human development in Indonesia. But looking at data figure 1, it can be concluded that there are other variables that may more significant for driving economic growth in Indonesian provinces than communication technology (R-Square 0.127). Reflecting on the survey by APJII (2020) which stated about more than 30% of Indonesians using communication technology for economic needs such as selling things, banking, and online shop, even in part time. But there is need a further discussion about how that r-square value is so low. Even so, looking at the data on Indonesia's export-import trade deficit in the recent year (BPS, 2020) there is an implication that broadband penetration makes it easier to access imported goods compared to increasing trade in self-produced goods. However, this result has the linear perspective as the Solow-Swan (1956) model in which technology will create effective labour and increasing the productivity output, given by people tend to trade online and create a product in his spare time thus selling it online. By looking on the figure 1 also also tells the economic benefits obtained by several provinces through internet penetration which most of it already has autonomous authority. This finding is also in line with Elmassah and Mohieldin (2020), which explains how the internet helped several local governments in Asia and Central American countries in the effectiveness of policymaking thus has an impact on economic efficiency. There is also similar finding by Sepehrdoust (2018) as information technology will boost financial development as the online trade becoming more intense between provinces, this activity clearly increase the growth itself. Nevertheless, refers to some provinces with high growth outside the main island, there are findings about the economic growth of several Indonesian provinces still relies on the dependence on natural resources compared to trade (BPS, 2020). It is hoped that the Indonesian government will be able to respond to this wisely.

Indonesian human capital clearly had influenced majorly by digital penetration (R-Square 0.81). Likewise, with the significant correlation between broadband technology and human capital as captured in table 3. To explained situation that occur in figure 2, how provinces with lower broadband penetration can can have high HDI. As HDI itself describes the quality of human capital based on 3 dimensions, namely health, education, and economy. By looking at the APJII survey (2020), the majority of Indonesians use the internet to support the dimensions of education and economy. So things that explain this are the existence of another strong HDI dimension factor in the province besides the dimensions that are strengthened by the presence of broadband penetration. As based on data retrieved from government statistic agency (BPS, 2020), some provinces with high internet penetration are facing a lack of high school participation rate, with less than 70% like as Banten and West Java. On the contrary other provinces with less internet penetration has a high life expectancy like provinces East Kalimantan and Yogyakarta. This result also giving a clear position of how internet penetration can bring social productivity gains by the growth of knowledge as its easiness of access. Becker (1993) theory stated advance in knowledge will be giving positive impact on human capital as this boosts the income through increasing optimization of resource use. This result also affirm previous studies which emphasize the positive influence from the effect of digital technology brought (Shastry, 2012; Baumöl and Bockshecker, 2017*;* Elmassah and Mohieldin, 2020) as well the use of communication technology mostly contributes to socio-economic and educational aspects (Arendt, 2015; Njoh, 2017).

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