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# The Impact of Broadband Access on Unemployment Rate in Indonesia 2016-2019

Roghibah SALSABILA<sup>1</sup>, Siskarossa Ika OKTORA<sup>2</sup>

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## Abstract

**Purpose:** This study aims to determine the effect of broadband access, education level, population numbers, and investment on the unemployment rate in Indonesia. **Research design, data, and methodology:** This study uses panel data from 34 provinces from 2016 to 2019. The analysis uses the fixed-effect model for panel data with the Feasible Generalized Least Square (FGLS) estimation method. **Results:** Broadband access has a negative and significant effect on the unemployment rate. Mean years of school, population, and foreign direct investment also have a negative and significant impact on the unemployment rate. In contrast, the domestic direct investment variable has a positive and significant effect. **Conclusion:** The availability of broadband access in an area allows easier and faster access to information. The ease of access to such information can affect producing goods and services, encouraging innovation and employment growth, and reducing the unemployment rate. This research recommends that the government intensify the Indonesia Broadband Plan policy to accelerate the development and equitable distribution of broadband access in all regions of Indonesia.

**Keywords :** Unemployment Rate, Broadband Access, Panel Data Regression

**JEL Classification Code:** J64, O33, C01

## 1. Introduction

Economic development is a major component in measuring the economic success of a country. Economic development aims to improve living standards by creating more jobs, better education, and greater attention to cultural and human values (Todaro, 2011). One of the problems in economic development in a country is unemployment. The high unemployment rate can have a negative impact on the country's economy. Unemployment can be a major problem

in economic and societal development due to the lack of active participation of the unemployed as consumers of products and services (Sadikova, Faisal, & Resatoglu, 2017).

Unemployment generally occurs because of an imbalance between workers and available jobs (Sukirno, 2004). In addition, another factor that affects unemployment conditions in a country is the development of technology. Technology that develops from time to time affects human life in various aspects, including employment and ways of working. According to Jung and Lim (2020), the

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1 First Author, Department of Applied Statistics, Politeknik Statistika STIS, Indonesia. Email: 211709986@stis.ac.id

2 Second Author and Corresponding Author, Assistant Professor, Department of Applied Statistics, Politeknik Statistika STIS, Indonesia. Email: siskarossa@stis.ac.id

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relationship between technology and labor is an issue that has always been debated during the four industrial revolutions.

Based on McKinsey (2019) report, the use of technology not only has the potential to create jobs but can also replace old jobs and change various professions. The report results show that by 2030, as many as 23 million jobs can be replaced by automation processes, while 27 to 46 million jobs are created, with 10 million of these jobs being new types of work that did not exist before. Therefore, the development of technology in a country must be of concern.

The technology is currently developing and acts as a driver of other technological innovations in Information and Communication Technology (ICT) is the emergence of the internet (Curran, Fenton, & Freedman, 2012). Based on the data obtained from *World Bank (2020)*, the increase in the population in Indonesia from 2000 to 2019 was followed by an increase in the percentage of internet users. Until 2019, internet users in Indonesia amounted to 196.71 million people or 73.7 percent of the total population. The number of internet users has increased by 8.9 percent since 2018 (APJII, 2020).

The high percentage of internet users shows that Indonesia can support the development of internet technology. Based on a report on the We Are Social website, the level of internet usage in Indonesia is higher than in countries with a larger percentage of internet users. The analysis results by McKinsey also estimate that the value of economic activities originating from the digital economy in Indonesia will reach 150 billion USD by 2025 (Das, Gryseels, Sudhir, & Tan, 2016).

In recent years, fast internet access or broadband has been growing in line with the increasing number of increasingly complex internet usage activities. Broadband is internet access that enables faster, more efficient, effective, transparent, and accountable information provision, processing, and distribution. The transmitted information does not lose value and can even create added value for society (Wahab, 2019). For an area to be served by broadband access, it is necessary to develop infrastructure that can provide such access. Since 2010, ITU with UNESCO has launched Broadband Commission to support the development and utilization of broadband in a country. The international policy through the Broadband Commission stipulates that all countries must have a broadband development plan by 2015.

The Indonesian government's step in this regard is establishing Indonesia Broadband Plan (IBP) 2014-2019 as a strategy for accelerating and equitable broadband development in all regions in Indonesia. Broadband services should be affordable for 40 percent of households by setting prices for less than 5 percent of monthly income (Bappenas, 2014).

Due to the importance of broadband development as an ICT infrastructure in a country, several studies have been conducted to determine the effect of broadband access on the economy. Increasing broadband access in an area is believed to positively impact economic growth and labor productivity (J. Jung & López-Bazo, 2020). In addition, increased broadband access enables job creation and a reduction in the unemployment rate in a country. The ease of information flow through the internet makes the job search and the match process more effective. The results of the analysis by McKinsey show that with internet access, online platforms can activate 3 percent of the working-age population who are not working and add as many as one million workers in Indonesia (Das et al., 2016). Research by Autor (2001) and Kuhn and Mansour (2014) shows that broadband access can increase the number and quality of acceptable jobs to job seekers. Kuhn and Mansour (2014), in their research, show that unemployed people who search for jobs online find work 0.25 times faster than those who do not look for work online.

Research by Atasoy (2013) finds that for every increase in broadband access, the percentage of employment will increase. The deployment of broadband access has a greater impact on rural areas and areas with a higher percentage of high-educated employment. Whitacre et al. (2014) finds that high broadband access in an area contributes to the growth of employment in rural areas. Then, research by Jayakar and Park (2013) shows a negative and significant relationship between the deployment of broadband access and the unemployment rate in a region.

Several studies look at the effect of access to broadband on unemployment based on differences in access speed. Bai (2017) shows a positive relationship between normal and fast-speed broadband to the percentage of employment. However, superfast speed broadband has not shown significant results. This is in line with the research conducted by Lobo, Alam, and Whitacre (2020). This study indicates that areas with access to high-speed broadband have a greater influence on the decline in the unemployment rate than regions with low-speed broadband.

Hasbi (2020) has conducted a study on high-speed broadband access on economic growth and unemployment. Using the fixed-effect panel data regression model, the results of this study indicate that areas with 30 Mbps broadband access have a positive and significant impact on the growth of new companies and entrepreneurship. In addition, the high-speed network helps reduce the unemployment rate by 7 to 9 percent. Katz et al. (2010) have conducted a study on the effect of investment in broadband on employment. Using the Input-Output model, the results show that an increase in broadband infrastructure investment to 36 billion Euros will

result in an additional 968,000 jobs. The work generated includes, among others, the construction of infrastructure to meet the set targets and work from the creation of innovations and new businesses.

Indonesia has the potential for the development of internet technology. The development of ICT technology in Indonesia will have a positive impact on the economy, especially on employment. Several studies earlier have been done to determine the effect of the development of ICT on the economy. Still, the research that uses explicitly broadband access variables as an approach to ICT development has never been empirically studied in Indonesia. Therefore, this study aims to describe an overview of the development of broadband access and its impact on Indonesia's unemployment rate.

## 2. Literature Review

### 2.1. Unemployment

Unemployment is a condition in which a person belonging to the labor force wants to get a job but has not obtained it (Sukirno, 2004). Based on the causal factors, the types of unemployment consist of frictional unemployment, cyclical unemployment, structural unemployment, and technological unemployment. According to Statistics Indonesia, unemployment is a population that is not working but is looking for job or does not get a job, or is in the process of preparing a business and has also worked but has not started working.

### 2.2. Broadband

International Telecommunication Union (ITU) defines broadband as a transmission capacity that is faster than Integrated Service Digital Network (ISDN), 1.5 or 2.0 Mbps (Wahab, 2019). According to the OECD (2016), broadband speed is at least 256 kilobytes per second. Types of internet connections with broadband technology consist of fixed broadband and mobile broadband. In the 2014-2019 IBP document, broadband is defined as internet access with guaranteed connectivity that always ensures the connectedness and security of information. It has triple play capability with a minimum speed of 2 Mbps for fixed access and 1 Mbps for mobile access. The impact of broadband technology developments on employment can be classified into four broad categories, namely, job creation, job change, job transfer (outsourcing), and job elimination (OECD, 2014).

First, from the demand side, broadband directly increases employment because human resources and

infrastructure are required to maintain and deploy this technology. From the supply side, the internet job search method can increase the chances of getting a job. The flow of information in the matching process between workers and companies can be used quickly with a wider range due to broadband (Autor, 2001).

Second, broadband can affect jobs through the demand for products in companies that market their products online (Stockinger, 2019). Through e-commerce, the demand for products will be higher than conventional. Companies can also expand their target market geographically. However, the existence of e-commerce can also have a negative impact on companies that have not adapted to online business processes. In this case, competition from online shops can be detrimental to retail stores. In addition, Atasoy (2013) explains that broadband can also provide access to online entertainment options, such as streaming and downloading movies and playing video games, reducing the demand for products in the entertainment industry, such as cinemas.

Third, broadband can affect how companies operate and create a more efficient workforce (Holt & Jamison, 2009). However, this effect will only apply to companies with a workforce skilled in ICT. A skilled workforce may be better equipped to adapt to technological innovations. J. Jung and López-Bazo (2020) found that ICT can further increase the productivity of a skilled workforce through increased access to resources and information. If broadband access is wider, then a computer with a database system can replace routine work.

## 3. Research Methods and Materials

This study examines the impact of broadband access on the unemployment rate in the 34 provinces in Indonesia from 2016 to 2019. The dependent variable used is the unemployment rate, while the independent variable used as an approach to access broadband in the region is the number of broadband subscribers. Broadband subscriber is defined as the fixed broadband subscribers recorded by the providers of telecommunications. Other economic independent variables are school years, population, domestic investment, and foreign investment. The data used are secondary data obtained from Statistics Indonesia, the Ministry of Communication and Information, and the Investment Coordinating Board.

Panel data regression introduced by Gujarati (2009) is used to determine the effect of the independent variable on the dependent variable with a significance level of 5 percent. In general, the specifications of the panel data regression model in this study are as follows:

$$Unemp_{it} = \beta_0 + \beta_1 \ln(BR)_{it} + \beta_2 \ln(MYS)_{it} + \beta_3 \ln(POP)_{it} + \beta_4 \ln(FDI)_{it} + \beta_5 \ln(DDI)_{it} + u_{it} \quad (1)$$

where,

$\beta_0$  : intercept

$\beta_1, \beta_2, \dots, \beta_5$  : slope coefficient of each independent variable

$Unemp_{it}$  : an unemployment rate of  $i$  province in  $t$  period

$BR_{it}$  : number of broadband subscribers of  $i$  province in  $t$  period

$MYS_{it}$  : mean years of school of  $i$  province in  $t$  period

$POP_{it}$  : population of  $i$  province in  $t$  period

$FDI_{it}$  : foreign direct investment of  $i$  province in  $t$  period

$DDI_{it}$  : domestic direct investment of  $i$  province in  $t$  period

$u_{it}$  : error term

$i$  : individual (province)

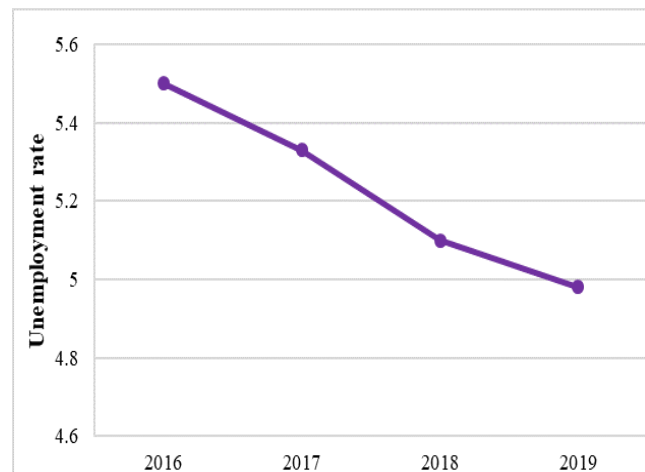
$t$  : period (from 2016-2019)

The procedures that should be done in panel data regression are selection model, variance-covariance error structure matrix test, classical assumption test, and interpretation of regression coefficient. The selection model uses Chow test to choose the model between CEM (Common Effect Model) and FEM (Fixed Effect Model), BP-LM test to select the model between CEM and REM (Random Effect Model), and Hausman test to choose the model between FEM and REM.

If the selected model is CEM or FEM, a variance-covariance error structure matrix test using the LM test is needed. This test is used to test homoscedasticity of error. The  $\lambda_{LM}$  test is used to test the cross-sectional correlation. The classical assumption model should be checked, which are normality, non-autocorrelation, and non-multicollinearity test. In the normality test, if the null hypothesis does not reject, then the error is normally distributed. In a non-autocorrelation test, if the null hypothesis does not reject, there is a non-autocorrelation problem in the model. Non-multicollinearity test uses VIF, wherein if VIF value is less than 10, there is non-multicollinearity between explanatory variables.

## 4. Results and Discussion

Unemployment is a socio-economic problem that has a direct impact on individuals and governments. Not having a job for a large part of the population means a decrease in the standard of living and can lead to serious psychological problems (Sadikova et al., 2017). For the government, high and low unemployment can be used as a measure of the success of economic development. This is because unemployment is able to reflect the level of community welfare from economic development in a country.



**Figure 1:** The unemployment rate in Indonesia 2016 – 2019 (in percent)

Based on Figure 1, during the 2016 to 2019 research period, the unemployment rate in Indonesia showed a downward trend. In 2016, the unemployment rate was recorded at 5.50 percent and continued to decline every year until 2019, reaching 4.98 percent. The decline in the unemployment rate indicates an increase in job creation. This can be seen from the number of job creations that exceeded the 2015-2019 RPJMN target, which reached 11.2 million out of 10 million targeted jobs (Bappenas, 2019). Based on Statistics Indonesia data, the number of workers until 2019 was dominated by informal sector workers with 57.27 percent. Bappenas (2019) also found that increased employment opportunities, especially in the informal sector, are driven by advances in information and communication technology by opening up new job opportunities that did not exist before

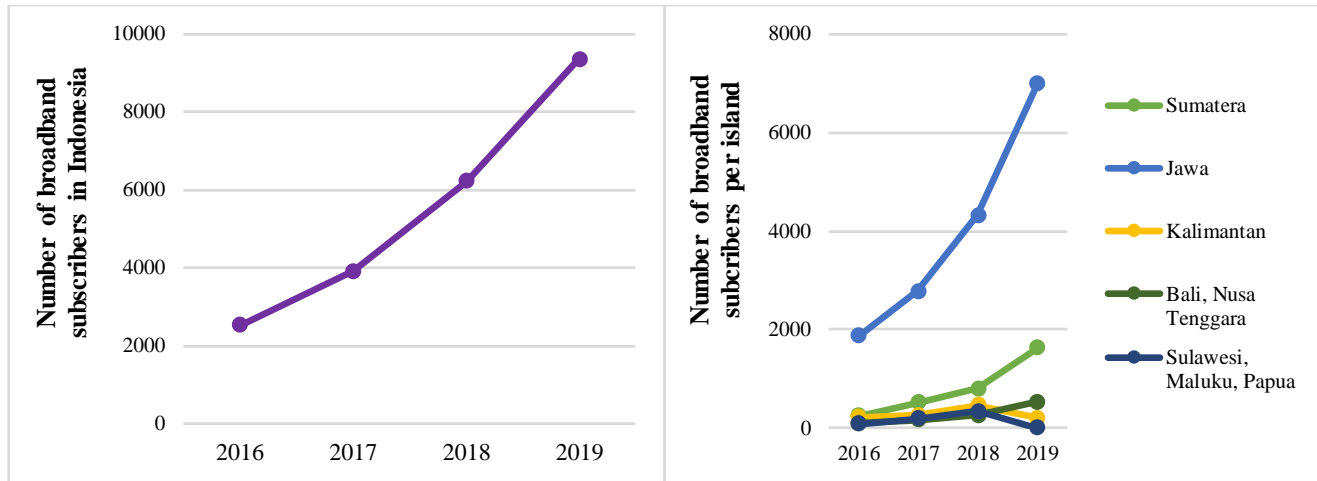


Figure 2: Total number of broadband subscribers in Indonesia and per island 2016 – 2019 (in thousands)

Based on Figure 2, the number of broadband subscribers in Indonesia from 2016 to 2019 showed an increasing trend, even with a rapid increase. In 2016, the number of broadband subscribers was recorded at 2.5 million subscribers and increased every year to reach 9.3 million subscribers in 2019. The increase in broadband subscribers was in line with the increase in internet user penetration in Indonesia. According to data obtained from the Indonesian Internet Service Providers Association, internet user penetration in 2016 was 48.2 percent of the total population and increased to 73.7 percent in 2019. In addition, the increase in the number of broadband subscribers was also supported by the acceleration and expansion of broadband development through IBP 2014-2019.

Although the number of broadband subscribers on each island showed a trend that tends to increase every year, there was a large gap between the number of broadband subscribers on Java Island and the island of Outside Java. Until 2019, the percentage of broadband subscribers on the island of Java has reached 74 percent of the total broadband subscribers in Indonesia, while the other 26 percent were on the outer islands. The large area, the geographical condition of Indonesia as an archipelagic country, and the unequal distribution of the population have been becoming a challenge for the government in distributing broadband development evenly in Indonesia. In addition, the high cost of infrastructure development was also a consideration for telecommunications operators in carrying out development. Telecommunications providers only prioritized commercially viable areas when compared to non-commercial areas in building infrastructure (Kominfo, 2019).

Broadband development in commercial areas is considered more profitable and attracts investors than in non-commercial areas. This condition causes disparities or gaps between regions served by broadband access in

Indonesia. In addition to geographical conditions, the gap in broadband access between regions is also caused by demographic conditions and the region's income (Prieger, 2001; Atasoy, 2013; Reddick, Enriquez, Harris, & Sharma 2020).

From the Chow test results, the p-value is 0.0000, so the null hypothesis is rejected. It means the Fixed Effects Model (FEM) is better than the Common Effect Model (CEM). The Hausman test produces a p-value of 0.0000, and the result is that the null hypothesis is rejected. This can be concluded that the Fixed Effects Model (FEM) is better than the Random Effect Model (REM).

Estimation methods are used to test the structure of the variance-covariance error matrix in the model. The results of the LM test show a statistical test value of 46.7848, so the null hypothesis is rejected. Thus, it can be concluded that the variance-covariance error matrix structure in the model is heteroscedastic. Because the structure of the variance-covariance error matrix is heteroscedastic, it is necessary to continue testing the correlation between individuals in 34 provinces in Indonesia using the test. The test results show a statistical test value of 856, so the null hypothesis is rejected. This shows that there is a correlation between individual provinces generated by the model. Based on the test results, the best model chosen in this panel data regression is the Fixed Effect Model (FEM) with the Feasible Generalized Least Square (FGLS) estimation method.

Based on the selected model and estimation method, the classical assumption test required consists of normality and non-multicollinearity tests. Using the Jarque-Bera test, a p-value of 0.1060 is obtained, so it can be concluded that the error is normally distributed or the assumption of normality is met. Non-multicollinearity assumptions are fulfilled where the results of the examination of non-



multicollinearity assumptions are obtained by VIF <10 for each variable.

**Table 1:** Fixed Effect Model with the Feasible Generalized Least Square

Variable Independent	Coefficient	t-Stat	P-value
C	78.9501	5.6688	0.0000
lnBR	-0.0533	-4.7206	0.0000
lnMYS	-6.7717	-2.5485	0.0124
lnPOP	-7.0446	-2.9864	0.0036
lnFDI	-0.0550	-2.6486	0.0094
lnDDI	0.0940	3.8527	0.0002
R-Squared	0,9945		
Adj. R-Squared	0,9924		

The estimation regression form is:

$$\widehat{Unemp}_{it} = (78.950 + \mu_i) - 0.053 \ln(BR)_{it}^* - 6.772 \ln(MYS)_{it}^* - 7.044 \ln(POP)_{it}^* - 0.055 \ln(FDI)_{it}^* + 0.094 \ln(DDI)_{it}^*$$

\* : significant at  $\alpha = 5\%$

Based on Table 1, the Adjusted R-squared value of 0.9924 shows that the five independent variables can explain 99.24 percent of the variance in the unemployment rate, with the remaining 0.76 percent explained by factors outside the model. Furthermore, the partial test using the t-test indicates that the variable number of broadband subscribers, mean years of school, population, foreign direct investment, and domestic direct investment significantly affect the unemployment rate variable.

The variable number of broadband subscribers has a negative and significant effect on the unemployment rate with a regression coefficient of -0.053. This means that every 1 percent increase in broadband subscribers will reduce the unemployment rate by 0.053 percent. This negative effect follows previous research that showed that increasing broadband access in an area has contributed to a decrease in the unemployment rate in that region (Lobo et al., 2020). Broadband access in an area allows easier and faster access to information. The ease of access to such information can affect the process of producing goods and services, encouraging the growth of innovation and employment, which will reduce the unemployment rate. As a driver of accelerating the flow of information and communication, broadband will reduce the frictional unemployment rate because it can increase job search efficiency (Stockinger, 2019). This is because the job search and match process has become easier, faster, and cheaper (Alam & Mamun, 2017).

Hence, the mean years of school (MYS) variable has a negative and significant effect on the unemployment rate with a regression coefficient of -6.77. This means that every 1 percent increase in the MYS will reduce the unemployment rate by 6.77 percent. This negative effect follows research conducted by Sari and Bangun (2019) and Muslim (2014). The higher the level of education taken, the higher the quality of human resources produced. The high quality of human resources means that the production capacity is increasing, both in work or other situations that make it easier for someone to get a job.

Furthermore, the population variable has a negative and significant effect on the unemployment rate with a regression coefficient of -7.044. This means that every 1 percent increase in the population will reduce the unemployment rate by 7.044 percent. This negative effect is in line with the theory put forward by Emili Durkheim, when the population increases, there will be competition for everyone to improve further their education and skills (Lindiarta, 2014). Thus everyone is competing to get a job and will suppress the high number of unemployed. It can happen if the population of productive age dominates the increase in population. Based on data obtained from BPS, the percentage of the productive age population in Indonesia has reached 67 percent of the total population in 2019, an increase of 40 percent from 2016. This condition is in line with the demographic bonus phenomenon that Indonesia will experience in the 2020-2030 period, where the productive age population will reach 70 percent of the total population of Indonesia (Hayes & Setyonaluri, 2015). Thus, if jobs are available and the quality of employment is adequate, an increase in population forces Indonesia to reduce unemployment.

Meanwhile, the foreign direct investment (FDI) variable has a negative and significant effect on the unemployment rate with a regression coefficient of -0.055. This means that every 1 percent increase in FDI will reduce the unemployment rate by 0.055 percent. This negative effect is in line with the research results by Heliati (2019) and Balcerzak and Zurek (2011). With increasing investment, companies can expand their business by increasing production, which will increase the need for labor and reduce unemployment. In addition, the investment will have a positive effect on increasing the workforce, especially those with high skills.

The domestic direct investment (DDI) variable has a positive and significant effect on the open unemployment rate with a regression coefficient of 0.094. This means that every 1 percent increase in DDI will increase the unemployment rate by 0.094. Research conducted by Hisarcklilar et al. (2012) also shows the same results. The positive effect of investment on unemployment occurs because the investments made, such as in trade,

telecommunications, energy, and finance sectors, are dominated by sectors that do not absorb labor. This means that the investments made are in capital-intensive. According to a publication by Investment Coordinating Board, the transportation, warehouse, and telecommunications sectors have reached the top three sectors with the highest realization value of DDI since 2016 and continue to increase yearly (BKPM, 2020). Until 2018 and 2019, the transportation, warehouse, and telecommunications sectors were the main sector with the highest realized investment value through DDI, while investment through FDI was still dominated by the electricity, gas, and water sectors in that year.

## 5. Conclusions

The unemployment rate in Indonesia from 2016 to 2019 tends to decrease. Broadband access in Indonesia, as seen from the number of broadband subscribers, has increased every year. However, there are still disparities or gaps between the islands of Java and the non-Java. Moreover, the number of broadband subscribers, MYS, population, and FDI negatively and significantly affect the unemployment rate. In a positive direction, the DDI variable affects the unemployment rate varies significantly.

Some suggestions can be made based on the results of these conclusions. First, the government is expected to further intensify the Indonesia Broadband Plan (IBP) program in the context of equitable distribution and expanding broadband access in various regions, especially outside Java, to improve national connectivity. High access to information and communication will open up positive opportunities for workers in job creation and job search. Second, to reduce unemployment, it is necessary to develop human resources through higher education. Furthermore, employment needs to be increased so that there is no surge in unemployment in the increasing productive age population in the future. In addition, FDI and DDI should move into sectors that can absorb more workers.

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