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The Influence of Science and Technology, the Length of Education on the Achievement of Indonesia's Human Development Index in 2018-2020

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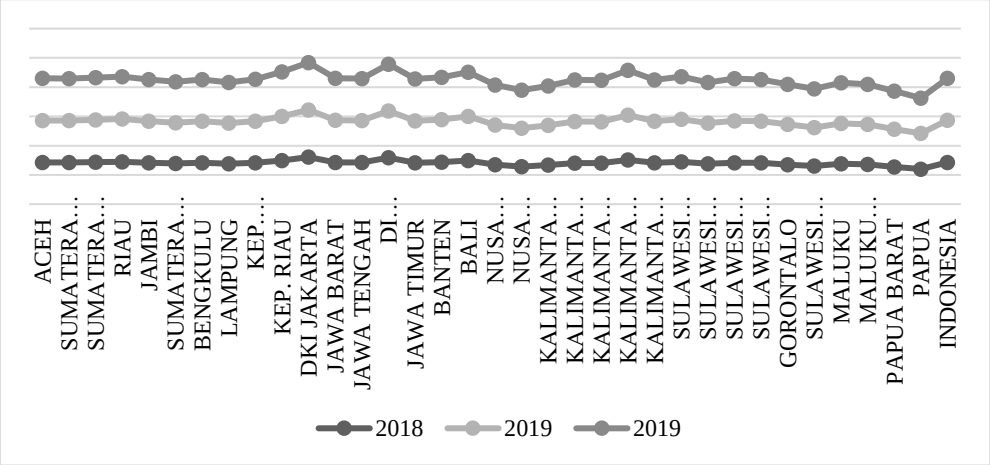
ABSTRACT

The demographic bonus is a phenomenon that will be experienced by Indonesia between 2030 and 2045. This phenomenon can be utilized if Indonesia's human resources have quality education and technological skills. This study focuses on 1) the influence of science and technology and the mean of the school year on HDI Indonesia in 2018-2020; 2) the magnitude of the influence of science and technology and the mean of the school year on HDI Indonesia in 2018-2020. This study uses panel data regression with the FEM model. Based on the results of panel data regression, it is known that science and technology have a positive relationship but do not have a significant effect, while MYS has a positive and significant relationship. Both aspects have positive growth for HDI in the period 2018–2020.

1. INTRODUCTION

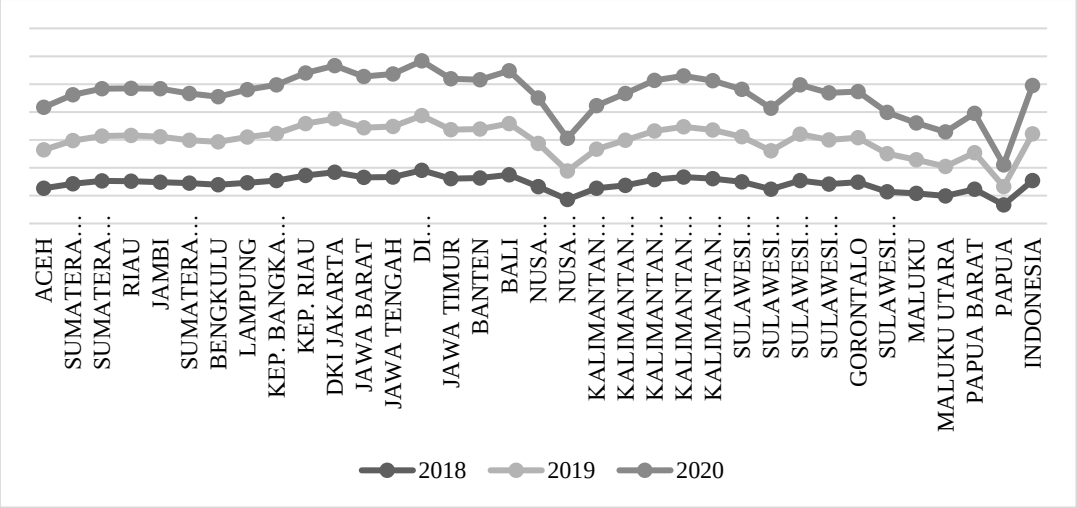
Indonesia Gold 2045 is a phenomenon that Indonesia is even 100 years old and has a dream of Indonesia being superior, being able to compete with other countries, and being able to handle classic issues (Wena, 2020). Indonesia's hope in 2045 is to have qualified human resources (HR) in science and skilled in the use of information and communication technology (IPTEK) (Bappenas, 2019). One of the momentums in Indonesia Emas 2045 is the Demographic Bonus which is the impact of the demographic transition where the productive population is more than the population of unproductive age (Setyaningrum et., al 2020). Indonesia will experience a demographic bonus phenomenon because the population in Indonesia in 2020 has increased by 73 million people from 2019 which was 270 million people (Population, Total – Indonesia | Data, 2022). An increase in the number of people reaching 273 million people can be an opportunity if the population has qualities that can be seen from the Human Development Index (HDI) (David, 2019; Adejumo et al., 2021). The following is data on the development of Indonesia's HDI.



Source: Indonesian Central Statistics Agency.
Figure 1.HDI 34 Provinces of Indonesia 2018-2020

The Human Development Index (HDI) is an indicator that describes human development in an area (Mahya & Widowati, 2021). Human development is an important aspect in seeing human quality both in terms of education and ICT

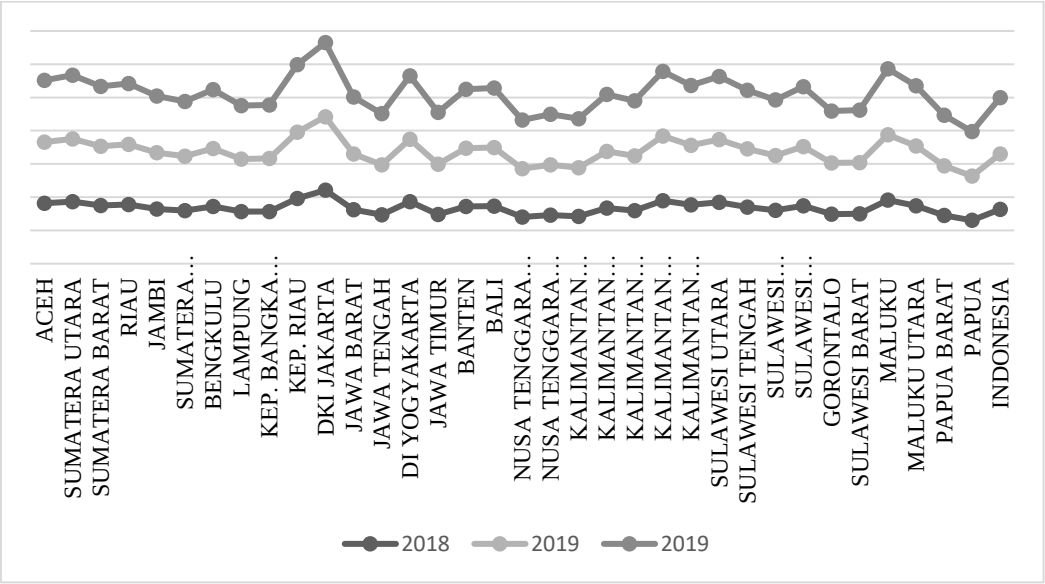
mastery (David, 2019; Adejumo et al., 2021). Indonesia's HDI position compared to countries in the world is ranked 107 out of 189 countries. Indonesia's position in the country*Association of Southeast Asian Nations*(ASEAN) occupies the fifth position out of 10 countries (Duh, RI Human Development Index No. 107 out of 189 Countries!, 2020). The low HDI of Indonesia compared to ASEAN countries cannot be separated from the HDI contribution of 34 Indonesian provinces. In 2020 there are 11 provinces that have HDI values above Indonesia (71.94) including DKI Jakarta (80.77), DI Yogyakarta (79.97), East Kalimantan (76.24) and KEP. Riau (75.59) and 23 provinces have HDI scores below Indonesia. The disparity in HDI achievement at the provincial level occurs because of the inequality of educational infrastructure in every province in Indonesia (Asmawani & Pangidoan, 2021). Education is an important element to see the readiness of human resources in absorbing ICT. Human resources who have skills in the use of science and technology will affect their quality and productivity (Ananda et al., 2019) so that it can be a bridge in utilizing the demographic bonus (Sutikno, 2020; Mutiara & Kusumawarhani, 2020). In addition, the form of quality human resources and accompanied by qualified science and technology capabilities has been proven by South Korea in developing its manufacturing portfolio by occupying the top position in the world class (South Korea Becomes the Country with the Most Innovative Economy, Here's the Recipe, 2021).



Source: Indonesian Central Statistics Agency.

Figure 2. Skills in Using Information and Communication Technology in 34 Provinces of Indonesia in 2018-2020

At the global level, Indonesia's Information and Communication Technology Development Index (IP-TIK) in 2016 was in the 111th position out of 176 countries with a score of 4.43 percent and in 2020 the value increased to 5.59 percent, while South Korea took the first position with the value of IP-TIK has reached 93.7% (BPS, 2021). The value of Indonesian IP-TIK at the global level is in the medium category. This is a contribution from the mastery of science and technology in the provinces in Indonesia. There are four provinces, namely Papua (3.35%), North Maluku (4.7%), West Sulawesi (4.73%), East Nusa Tenggara (4.49%) which occupy the low category with scores between 2.51- 5.00 percent and the remaining 30 provinces are included in the category of moderate IP-TIK scores with values between 5.01-7.50 percent including Java and Bali including DKI Jakarta (7.46%), DI Yogyakarta (7.09%), and Bali (6.57%) (BPS, 2021). This means that the mastery of science and technology in Indonesia as a whole is in the lower middle category. This is because the development of ICT infrastructure in various regions, especially the central and eastern parts of Indonesia, is still lacking. This is one of the causes of the disparity in IP-ICT mastery between regions in Indonesia. Human resources who have skills in the use of science and technology will affect their quality and productivity (Ananda et al., 2019). The demographic bonus can be utilized by Indonesia if human resources have skills in science and technology so that it affects productive human resources (Sutikno, 2020). The growth of science and technology has played an important role in human development in order to face the demographic bonus (Nurarifin & Ridena, 2020). Another factor that determines Indonesia's human development is the Average Length of Schooling (RLS). Average length of school according to*United Nations Educational, Scientific, and Cultural Organization*(UNESCO) is the average number of completed years of education of a country's population aged 25 years and over and does not include years spent repeating individual grades. From the data, Indonesia has an RLS value of 8.48 in 2020 which is higher than in 2019 (8.34). Although Indonesia's RLS is increasing every year, the achievement of RLS is still below the target set by the government, which is 12 years. The following is the development of RLS in Indonesia.



Source: Indonesian Central Statistics Agency.

Figure 3.MYS 34 Provinces of Indonesia 2018-2020

Indonesia has determined that the length of education that must be taken is 12 years. This is a provision in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 19 of 2016 concerning the Smart Indonesia Program. From the data above, Indonesia's RLS has only reached 8.48 years, which means that the average level of final education achieved by the Indonesian people is Junior High School (SMP) level two. The level of education of a country is an indicator in creating quality human capital (Setyowati et al., 2019). When a country has a low RLS, it has an impact on the low productivity of human resources so that they have low competitiveness in economic development (Setyowati et al., 2019). Based on research (Lutz et al., 2019) education is a factor that has a major influence on the demographic bonus in creating human capital. An important investment in utilizing the demographic bonus is to create quality human resources through formal education (Adriani & Yustini, 2021). Furthermore, when viewed from the provincial RLS in 2020, there are 20 provinces that have RLS exceeding Indonesia's figure (8.48) and these provinces are spread across the islands of Sumatra, Java, and Bali. The average length of schooling is a dimension of knowledge in the HDI that is needed to see the quality of a country's education and the absorption of modern technology (Asmawani & Pangidoan, 2021). The low HDI of Indonesia at the world and ASEAN levels as a result of the low RLS and science and technology skills. The length of education and science and technology have an important role in human development to face the demographic bonus. The quality of human resources is formed by formal education and expertise in science and technology. Based on this phenomenon,the author is interested in discussing further about: a) How is the influence of science and technology and RLS on Indonesia's HDI in 2018-2020; b) How big is the influence of science and technology and RLS on Indonesia's HDI in 2018-2020.

2. LITERATURE REVIEW

*Human Development Index*Prior to the existence of HDI, the indicator of development performance was seen from the high and low Gross Domestic Product (GDP) per capita but in reality GDP was not proven as an indicator of community welfare because it turned out that there were several regions that had poverty rates and the level of Gross Regional Domestic Product (GDP) was equally high, it means that the results of regional development cannot be enjoyed by the community, therefore other indicators have been developed to assess the level of welfare enjoyed by the community, namely the HDI (BPS, 2014). HDI has an important function to measure the success of development by improving the quality of human life,

The concept of human development using the HDI can create a comfortable environment for an area so that humans can live a healthy, long and productive life (Pangesti & Susanto, 2018). The HDI concept is a concept in which development is carried out by HR as the emphasis and goes hand in hand with economic growth and development, because human development implies increasing the capacity of the population which over time will increase the opportunity to participate in sustainable development (Mahroji & Nurkhasanah, 2019) . Measurement of human development with HDI already includes physical and non-physical aspects. Physical quality can be seen from people who live long and healthy lives, while the non-physical aspect can be seen from their intellectual abilities, namely knowledge obtained from RLS. With RLS, a more relevant picture will be obtained in seeing the size of the knowledge obtained. In this era of globalization where technology is increasingly sophisticated, education is very necessary to see the readiness of human resources in absorbing knowledge accompanied by qualified science and technology capabilities.

RLS is the number of years taken by the population in formal education (BPS). According to Arofah and Rohiman (2019), the average length of schooling is a component of the HDI which is included in the education index. The average length of schooling is defined as the length of formal education last taken by residents aged 25 years and over (Arofah &

Rohimah, 2019). The average length of schooling is a picture of education in human development where when a person has a high education or years of schooling, they will have a better self-quality (Asmawani & Pangidoan, 2021). In the research of Wardhana et al., 2020 a person's RLS is determined by several factors including 1) The ratio between students and teachers. When there is an increase in the number of students without being accompanied by an increase in the number of teachers, it will cause inequality so that it will add to the burden on teachers which has an impact on decreasing RLS; 2) Income per capita. An increase in per capita income will affect an increase in RLS because households can finance higher education or a longer RLS. The average length of schooling has a positive relationship with HDI because the higher a person is in education, the more visible the quality of humans in acting and behaving means that the quality and human abilities have increased. This is in line with research conducted by Arofah & Rohimah (2019) and Asmawani & Pangidoan (2021), namely RLS has a significant and positive effect on the HDI, so when the RLS increases, the HDI will also increase. However, it is different from the research conducted by Manurung & Hutabarat (2021) that there is a negative relationship between RLS and HDI, so when the RLS increases, it will decrease the HDI in Indonesia.

Science and technology according to research by Al-Mursyid (2019) explains that the increase in science and technology has a positive effect on HDI, meaning that when knowledge of science and technology in Indonesia increases, it will affect the increase in HDI in Indonesia as well. Technology is a scientific method in achieving the comfort of human life, while information is notification or news about a problem, and communication according to the KBBI is the interaction between two or more people (Berita Parapuan Terkini - Kompas.Com) so it can be concluded that ICT is a method that is carried out based on interaction in the communication process. According to BPS, information and communication technology skills can help user effectiveness in computer technology,

According to Irawan's research (2020) the development of science and technology helps accelerate development, and the way of working that initially utilizes human power is replaced by sophisticated machines which have an impact on aspects of efficiency, quality, and quantity of economic development carried out which will result in accelerating the rate of economic growth. The use of ICT for technological skills can be felt by students, such as the interaction between students and teachers, students and students, and increased motivation in participating in learning (Utilization of Information and Communication Technology for Educators - Directorate of Junior High School). Science and technology aims to improve the welfare of the community in building the nation's civilization,

3. METHODOLOGY

3.1. Research Types and Methods

This type of research is a literature survey with a quantitative descriptive method. The literature survey is in the form of data published by other parties and empirical research that has been carried out by previous researchers. (Pratiwi et al., 2021). Quantitative descriptive aims to make a systematic description of the object under study (Indah, 2017). In this study, graphs are used to describe the general condition and are accompanied by supporting data.

3.2. Data Types and Sources

The data used in this research is secondary data. Secondary data is data that has been published by other parties (Suharyadi & SK, 2018:15). The data used are sourced from BPS and the World Bank. The variables used in this study used RLS, science and technology, and HDI data in 34 provinces of Indonesia in 2018-2020.

3.3. Analysis Method

The analytical method used in this research is panel data analysis. Panel data analysis is a combination of time series and cross section data which aims to see the characteristics of each variable in several periods (Gujarati, 2010). This study uses an annual data series for three years (t = 3) with three variables and 34 provinces so that the data used are 102 data.

3.4. Analysis Model

The panel data analysis model used in this study consisted of the dependent variable (HDI) and two independent variables (T and MYS). The panel data equation model is as follows:

$$HDI = 0 + 1T_{i,t} + 2MYS_{i,t}$$

Where:

HDI : Human Development Index
0 :constant
$1T_{i,t}$: Variable Coefficient of Science and Technology in 34 provinces in year t
$2MYS_{i,t}$: RLS Variable Coefficient in 34 provinces in year t

In the analysis of the panel data model, it is necessary to have several tests including the suitability test of the model to be used and the classical assumption test. The suitability test used the Chow test and Hausman test to determine the Commons Effect Model (CEM), Fixed Effect Model (FEM) or Random Effect Model (REM). According to (Fajriyah & Rahayu, 2016) CEM, FEM, and REM are models in panel data regression which are carried out with different estimation methods. CEM is a panel data regression model using the Ordinary Least Square (OLS) method, FEM is performed through the Least Square Dummy Variable (LSDV) estimation method, and REM is performed by assuming the difference in intercepts in the cross section through Generalized Least Square (GLS) estimation (Fajriyah & Rahayu, 2016).

3.4.1. Chow test

Chow test is used to determine the best model between CEM or FEM to be used. The determination of the best model is seen from the probability value in Cross-section F. The hypotheses used are as follows:

H0 : CEM model used

H1 : FEM model used

3.4.2 Hausman test

Hausman test is used to determine the best model between FEM and REM to be used. The determination of the best model is seen from the probability value in the Random Cross-section. The hypothesis used is as follows:

H0 : REM model used

H1 : FEM model used

3.4.3. Classical Assumption Test and Statistical Test

The classical assumption test is used to determine whether the model used has met the BLUE multiple linear assumptions (Suharyadi and SK, 2018: 247). The classical assumption test on the data panel includes the heteroscedasticity test, normality test, and multicollinearity test. In the classical assumption test, the panel model does not apply autocorrelation test because of errors in the cross section and time series units but has a correlation at different times in the same cross section unit (Fajriyah & Rahayu, 2016). Statistical tests were carried out by testing the feasibility of the model using the F test to see whether the model used was feasible or not, the t test to see the significance of each independent variable, and the coefficient of determination to see the magnitude of the influence of the independent variables on the dependent variable.

4. RESULT AND DISCUSSION

4.1 Result

In processing panel data, the author uses the Eviews10 software. The stages in panel data testing are a) Chow test; b) Hausman test. The following are the results of the Chow Test and Hausman Test.

Table 1. Panel Data Model Feasibility Test Results

TEST	PROBABILITY	RESULTS	DECISION
Chow test (CEM : FEM)	0.00 < 0.05	FEM	**FEM**
Hausman test (FEM: REM)	0.00 < 0.05	FEM	

Source: Processed with Eviews10

Based on the results of the model feasibility test using the Chow test, the probability value in Cross-section F is 0.00 and this value is smaller than the alpha value (0.05) so that H0 is rejected. In the Hausman test, the probability value in the Random Cross-section is 0.00 and this value is smaller than the alpha value so that H0 is rejected. If it is concluded then H0 is rejected for both tests so that the best model used in estimating the Indonesian HDI model is the FEM model. After testing the suitability of the panel data model, the next step is for the researcher to test the feasibility of the model by testing classical assumptions and statistical tests. From the model estimation results, the classical assumption test can be seen in Table 2 as follows:

Table 2. Classical Assumption Test Results and Statistical Test

TEST	PROBABILITY VALUE	RESULTS
Normality test	0.905 > 0.05	No problem
Heteroscedastic Test	0.164 > 0.05 0.567 > 0.05 0.188 > 0.05	No problem
Multicollinearity Test	1,000 < 0.8 0.451 < 0.8	No problem
t test	0.000 < 0.05 0.000 < 0.05 0.280 > 0.05	MYS Constants and Variables Have Significant Influence on HDI
F Uji test	0.000 < 0.05	Eligible Model

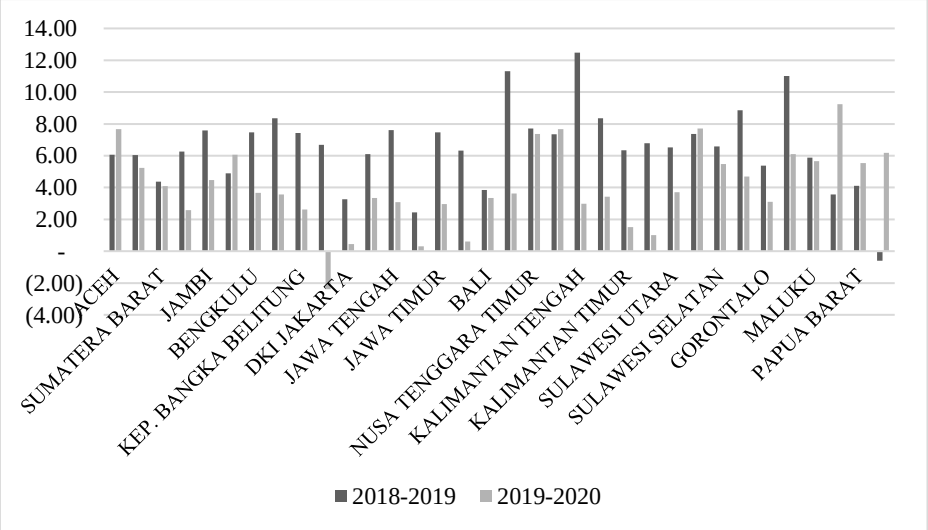
Source: Processed with Eviews10

Based on the results of the classical assumption test in table 2, it can be concluded that the Indonesian HDI panel model is free from heteroscedastic problems, is normal, and there is no multicollinearity problem between the dependent and independent variables. To see how the influence of science and technology and RLS on Indonesian HDI, a t-test and F-test were carried out. From the model estimation results, the t-value for the science and technology variable was 0.000 and the RLS variable was 0.280. After comparing the t-statistical value with the t-table value, it is concluded that H1 is rejected, meaning that the science and technology variable partially has no effect on Indonesia's HDI during the observation period. While the RLS variable H0 is rejected, it means that the RLS variable partially has a significant influence on the HDI. In addition, the estimation model has a probability F value of 0, 000 by comparing alpha of 0.05, it can be concluded that the variables of science and technology and RLS together affect Indonesia's HDI during the observation period. The following is an analysis of the results of the HDI model estimation in Indonesia

HDI = 51.108 + 0.009T + 2,224MYS

4.2 Discussion

Science and technology experienced positive growth during 2018-2020. Provinces with the highest growth in 2018-2020 were in the range of 8 percent – 12 percent and these provinces were Central Kalimantan (12.48), NTB (11.31), and West Sulawesi (11.01). However, there are also several provinces that have experienced a decline in technological skills such as Maluku (-2.40) in 2020 but HDI has increased. Although science and technology experienced positive growth and only 1 province experienced a decline in the percentage of technology skills, this is not in line with the regression results that have been found. Based on the regression results, it is known that science and technology has no significant effect and has a positive influence on Indonesia's HDI in 2018-2020.

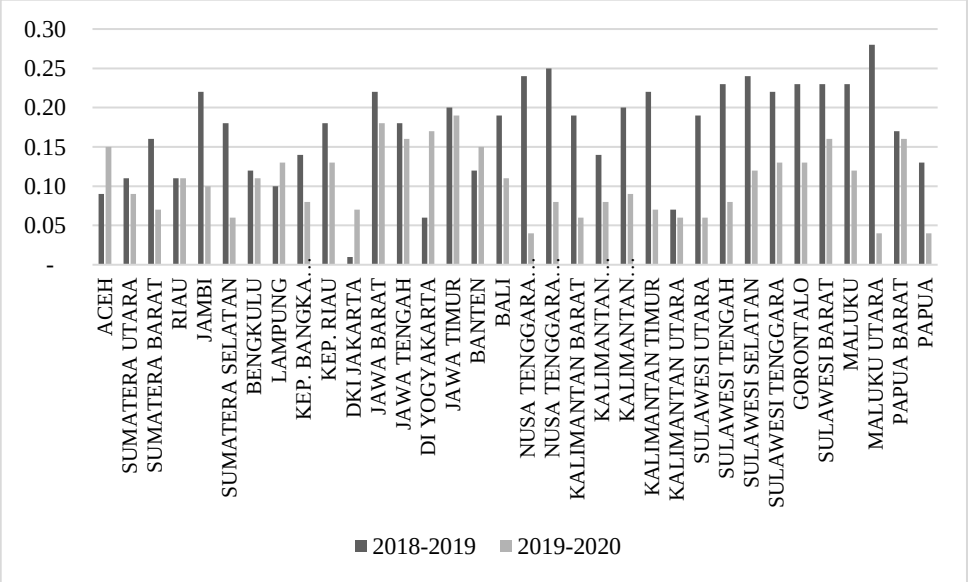


Source: Indonesian Central Statistics Agency. Processed by the Author

Figure 4.. The Growth of Science and Technology in Indonesia in 2018-2020

When viewed logically, science and technology skills have a significant relationship to HDI because with qualified science and technology capabilities the quality of human resources will increase and can meet various needs needed in the industrial era 4.0 (Indah, 2017). However, based on the results of the regression analysis, the science and technology variable has a positive but not significant effect on HDI. This is because the probability of science and technology is 0.28 > 0.05, so it can be concluded that H1 is rejected, which means that the science and technology variable has not been tested significantly on the development of HDI. The results of research that have a positive effect show that when science and technology increases, the HDI will also increase. This science and technology variable which has no significant effect has something to do with several provinces in Indonesia where the value of science and technology has decreased while the HDI has increased, for example in Maluku province in 2019-2020 the value of science and technology decreased by -2.40% to 5.66% while the HDI value increased from 69.45% to 69.49%. This can happen because science and technology skills have a greater influence on individuals, so that it will affect a person's performance or productivity to get a high salary, the high salary makes the purchasing power of the people increase so that welfare and HDI will also increase (Fadrianto 2019). The salary offer for workers in the field of science and technology ranges from 11 million - 27 million depending on their experience, the high offer is due to the imbalance between the lack of human resources who master the field of science and technology and the demand for workers is quite high (Fadrianto 2019). This is different from the conditions in Central Kalimantan where in 2018-2019 the value of science and technology increased significantly by 12.48% while the HDI condition experienced a small increase of 0.49% (BPS, 2020). This significant increase was due to the large percentage of households in Central Kalimantan that have computers, which is 35.44% (BPS, 2020).

However, it is different from the average length of schooling, based on the test results that the average length of schooling (RLS) variable partially affects HDI in Indonesia in 2018-2020. This means that the MYS variable partially affects Indonesia's HDI during the observation period. When the average length of provincial schooling increases by 1 year, it will increase the HDI by 2.24%. This shows that MYS has an elastic relationship to HDI. This is in line with research conducted by Arofah & Rohimah (2019) and Asmawani & Pangidoan (2021), namely MYS has a significant and positive effect on HDI. The regression results are in line with several provinces that have the highest MYS growth and are in line with high HDI levels, namely Bali (0.18%), Bangka Belitung Islands (0.19%), and Jambi (0.17%).



Source: Indonesian Central Statistics Agency. Processed by the Author
Figure 4.. MYS Growth in Indonesia in 2018-2020

When a person has a high level of education, he will show his quality in thinking and acting. Individuals who have a high school level will be channeled to achieve long-term development goals because they have quality human capital (Adejumo et al., 2021). Quality human capital will also support productivity so that with the presence of productive human resources it will be easy to take advantage of the labor market, this is in line with research by Aisyah et al., (2017) that quality human resources will have good performance and good abilities and responsibilities. in carrying out the task. Likewise, according to Ananda et al., (2019) that a person's level of knowledge affects the effectiveness of one's performance.

5. CONCLUSIONS

This study uses a multiple linear regression model to determine the effect of science and technology and RLS on HDI as a preparation for golden Indonesia in 2045. Based on the results of regression analysis that has been carried out, the science and technology variable has a positive but not significant effect on HDI, while the RLS variable has a positive and

significant effect on HDI. The insignificant influence of the science and technology variable is due to the fact that in some areas in Indonesia, such as the Maluku region, science and technology skills are only controlled by individuals who are supported by facilities, therefore in the Maluku provision the HDI value has increased but the science and technology value is low. Unlike the case with the RLS variable which has a positive and significant effect on HDI, the high level of education taken will increase human development.Bali, the Bangka Belitung Islands and Jambi which experienced high growth in their HDI and RLS. Thus, Indonesian science and technology and RLS must continue to be developed and empowered so that at the peak of the demographic bonus in 2045, Indonesian people can enjoy the results, namely economic stability and a more prosperous life for the Indonesian people. In this study, the author will propose several recommendations related to the problem of the influence of science and technology, length of education on the achievement of the Indonesian Human Development Index in 2018-2020. Based on the results of the study, here are some recommendations put forward by the researchers. There are several recommendations put forward by researchers for the development of an area. The results of the research that have been carried out state that a small growth value does not increase public interest in improving education. Based on this, the researcher proposes a recommendation that policy makers can improve education through science and technology and other components of economic growth. Recommendations that need to be considered for further researchers, namely the author can develop research on Science and Technology and the duration of HDI education, further researchers are expected to be able to examine the science of Educational Administration in depth and look for related sources and references, and researchers can conduct comprehensive and accurate research that accountable in the development of science. Based on this, the researcher proposes a recommendation that policy makers can improve education through science and technology and other components of economic growth. Recommendations that need to be considered for further researchers, namely the author can develop research on Science and Technology and the duration of HDI education, further researchers are expected to be able to examine the science of Educational Administration in depth and look for related sources and references, and researchers can conduct comprehensive and accurate research that accountable in the development of science. Based on this, the researcher proposes a recommendation that policy makers can improve education through science and technology and other components of economic growth. Recommendations that need to be considered for further researchers, namely the author can develop research on Science and Technology and the duration of HDI education, further researchers are expected to be able to examine the science of Educational Administration in depth and look for related sources and references, and researchers can conduct comprehensive and accurate research that accountable in the development of science.

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