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# Factors Influencing the Human Development Index in Indonesia Using Structural Equation Modeling-Partial Least Square

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**Abstract**

HDI is a benchmark for a country in achieving human development in the country. Indonesia is a developing country with a relatively increasing HDI value every year. This shows that the efforts made by Indonesia are going well. However, Indonesia experienced a decrease in HDI value in 2019 towards 2020, due to restrictions on activities caused by the Covid-19 pandemic. In addition, the HDI value in each province in Indonesia is uneven, even from the publication data of the Central Statistics Agency (BPS) shows a significant difference in HDI value between provinces in Indonesia. So that evaluation and improvement are needed to be able to equalize and stabilize HDI in Indonesia. HDI value can be influenced by several factors including economy, education, and health. This study aims to determine the direct effect of economic variables on HDI, the direct effect of education variables on HDI, the direct effect of health variables on HDI, the indirect effect of education variables on HDI through economic variables and health variables. The data used in this study are data on the Human Development Index of economic, education and health variables along with the indicators that measure them, from 34 provinces in Indonesia in 2022. This study applies SEM-PLS to determine the factors that influence the Human Development Index (HDI). The results of this study indicate that economic variables and education variables have a direct influence on the Human Development Index (HDI), while health variables have no direct influence on the Human Development Index (HDI). Then the education variable through the economic variable has an indirect effect on the Human Development Index (HDI), and the education variable through the health variable has no indirect effect on the Human Development Index (HDI).

*Keywords:* SEM-PLS, Human Development Index (HDI), Economy, Education, Health.

## 1. Introduction

Development is a step to make something that does not yet exist into existence or to make things better and improve. Development covers the entire social system, including the political system, economic infrastructure, defense, education, technology, culture, and institutions. Development is carried out consciously by a country for the development of the nation towards modernity or the times (Akbar *et al.* 2022). Development has the aim of being able to strive to eradicate poverty and improve people's welfare through economic channels which are also a form of practicing Pancasila (Rumiati *et al.* 2022). Human development is one form of development that is very important and needs to be improved in a country and government, namely to be able to expand population choices through empowerment efforts that improve the quality, potential and ability of humans so that they can actively participate in the field of development itself. Basically, development is carried out to fulfill human interests and needs so that development is also very important, especially to humans themselves (Ningrum *et al.* 2020). Humans play an important role in development because they have a special meaning, namely as the subject of development and the goal of development itself. Human development does not only focus on the process of increasing income and production but also reducing social and economic inequality and poverty in a country (Ningrum *et al.* 2020).

There are many countries that are able to increase the number of HDI values and economic growth but cannot reduce economic inequality, poverty, and the gap in HDI values at the provincial and district / city levels. In addition, development is also carried out to be able to reduce various kinds of conflicts in a country, namely the emergence of various kinds of diseases and drug and alcohol abuse and violence that are still rampant. A human development is said

to be successful if it has been able to develop basic human potential and reduce poverty levels and enforce wisdom even with relatively low income gains (Apriliana, 2020).

Achievement in development in a region can be done by measuring the Human Development Index (HDI). This is done because humans are an important component to achieve good state development. The Human Development Index (HDI) assessment was introduced by the United Nations Development Programme (UNDP) in 1990 which is included in the United Nations (UN) organization as a benchmark that can be used to assess the welfare of a nation, which is published regularly in the annual Human Development Report (HRD). However, in 2010 UNDP changed the measurement of the Human Development Index (HDI) with a new method, in which UNDP measured three aspects, namely life expectancy at birth (AHH), knowledge rate, namely expected years of schooling (HLS) and average years of schooling (RLS) and GNI per capita (PPP US$) (BPS, 2022)

There are previous studies that have examined the factors that affect the Human Development Index, about analyzing the factors that affect the Human Development Index in Indonesia for the period 2008-2012 using Panel Data Regression (Bhakti and Istiqomah, 2015). This study was conducted to provide a better picture of the factors that can affect the Human Development Index in Indonesia. The results showed that there are several factors among them that have a significant effect on the Human Development Index in Indonesia, such as education, health, and government spending. Then, this study also concluded that economic factors such as GDP did not have a significant influence on the Human Development Index in Indonesia in the 2008-2012 period.

Another study that discusses the influence and mapping of education, health, and UMKN on the Human Development Index in East Java uses Panel Regression and Biplot (Destilunna and Zain, 2015). The results show that factors such as education, health, and government spending have a significant effect on HDI, while economic factors such as GDP have an insignificant impact. The study also shows the importance of economic dimensions to improve HDI and Gender Development Index (GDI). The results of this study can provide a better understanding of the factors that affect HDI in East Java in a given period.

While previous research that discusses Structural Equation Modeling-Partial Least Square (SEM-PLS) is (Ningsi and Agustina, 2018) research which uses SEM-PLS to analyze customer satisfaction with product and service quality. The results of this study indicate that product and service quality have a significant impact on customer satisfaction. These findings can help companies to improve the quality of their products and services to increase customer satisfaction and maintain the existing customer base.

Based on the publication of the Central Bureau of Statistics for 2010-2022, the HDI value is relatively increasing every year. This shows that the efforts made to improve the quality of society in Indonesia are going well. However, in 2019 towards 2020, all values of HDI building indicators in Indonesia experienced a very small increase and even decreased from the previous year, where the HDI value increased by 0.03%, while the adjusted per capita real income decreased drastically from IDR11,299,000 to Rp.11,013,000. In addition, the HDI value in each province in Indonesia is uneven in each province, even from the data shows a significant difference in HDI value between provinces in Indonesia. Thus, evaluation and improvement are needed to equalize and stabilize HDI in Indonesia. Therefore, this research was conducted. This study aims to determine the factors that influence the Human Development Index in Indonesia using Structural Equation Modeling-Partial Least Square (SEM-PLS).

## 2. Material and Methods

### 2.1. Data and Research Variables

The data used in this study is secondary data derived from the publication of the Central Bureau of Statistics (BPS, 2022), where the data is data from 34 provinces in Indonesia. Table 1. shows the use of latent variables and indicator variables (manifest) where the latent variables are HDI variables, economic variables, education variables, and health variables with their indicators.

**Table 1.** Indicator Variables of Each Latent Variable

| Latent Variable's | | Indicator (Manifest) |
|---|---|---|
| Exegon Variable | Economic Variable | Percentage of People Using PLN Electricity in lighting (ECO1) |
| | | Percentage of people having access to proper sanitation (ECO2) |
| | | Percentage of people with adequate housing (ECO3) |
| | Education Variable | Pure Participation Rate (EDU1) |
| | | Gross Enrollment Rate (EDU2) |
| | | School Enrollment Rate (EDU3) |
| | Health Variable | Percentage of married women who give birth assisted by medical personnel (HEA1) |
| | | Percentage of women using family planning (HEA2) |
| | | Percentage of people experiencing health complaints in the |

| Latent Variable's | | Indicator (Manifest) |
|---|---|---|
| | | last month (HEA3) |
| Endogen Variable | HDI Variable | Life Expectancy at Birth (HDI1) |
| | | Average Years of Schooling (HDI2) |
| | | Real Expenditure Per Capita (HDI3) |

## 2.2. Analysis Steps

The analysis in this study uses several steps, which are as follows:

a) Model Specification

SEM begins by specifying the model in the research to be estimated (Jumadil, 2021). Specification of the research model, which is able to represent the problem to be studied is an important part of SEM. According to Byrne and Hair *et al* in Jumadil (2021) said that the analysis will not begin before the researcher can specify a model that shows the relationship between the variables to be analyzed.

b) Model Estimation

According to Jumadil (2021) parameter estimation in SEM-PLS includes three stages including, creating latent variable scores from weight estimates, estimating path coefficients that connect latent variables and estimating measurement model coefficients that connect latent variables with their indicators, and estimating location parameters.

c) Model Evaluation

According to Haryono and Siswoyo (2016) at this stage there are two stages of evaluating the measurement model used in SEM-PLS, namely as follows:

a. Evaluation of the measurement model (outer model)

The first stage in evaluating the model, namely evaluating the measurement model (outer model). In PLS-SEM, this stage is known as the construct validity test, which consists of several stages, namely as follows:

- Convergent validity

Convergent validity measures the amount of correlation between constructs and latent variables. In evaluating convergent validity, it can be seen from the Standardized Loading Factor (SLF) value. The Loading Factor value is said to be valid if the value is $\geq 0.70$ with an AVE value of at least $0.50$ indicating a measure of convergent validity that has good reliability [11]. The Average Variance Extracted (AVE) formula (1)

$$AVE = \frac{\sum \lambda i \, 2}{\sum \lambda i \, 2 + \sum \varepsilon \, i} \quad (1)$$

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$\lambda$ : factor loading,
$\varepsilon$ : error value,
$i$ : number of indicators

- Consistency reliability (Composite Reliability (CR) and Average Variance Extracted (AVE) values)

Composite Reliability is better at measuring internal consistency than Cronbach's Alpha in SEM, because CR does not assume the boot equality of each indicator (Haryono and Siswoyo, 2016). Composite Reliability formula in formula (2)

$$CR = \frac{(\sum \lambda i)2}{(\sum \lambda i)2 + (\sum \varepsilon \, i)} \quad (2)$$

The interpretation of composite reliability (CR) is the same as cronbach's alpha, for composite reliability values must be equal to or more than.

- Discriminant validity

Discriminant validity is evaluated through the cross loading value, then comparing the square root of the AVE with the correlation between constructs or evaluated through the Fornell-Larcker criterion. The discriminant validity measure for the cross loading value is to compare the correlation of the indicator with its variable and other variables, if the correlation between the indicator and its variable is higher than other variables, this indicates that the variable predicts its measurement better. Meanwhile, the root value of AVE must be higher than the correlation between constructs and other constructs.

b. Evaluation of the structural model (inner model)

- Colinearity assessment
  The collinearity test aims to test whether there is collinearity between variables in the model, so the collinearity test at this stage must be carried out. Tolerance level below 5.00 ($VIF < 5.00$) and above 0.20 (VIF $> 0.2$) in the predictor construct as an indication of collinearity (Hair *et al.* 2014).
- Effect size F-Square ($f^2$)
  The R-Square value is used to measure the level of variation in changes in the independent variable on the dependent variable. According to Chin, the $R^2$ criterion consists of three classifications, namely: 0.67 (substantial), 0.33 (moderate) and 0.19 (weak) (Haryono and Siswoyo, 2016).
- Coefficients of determinant (R-Square)
  In addition to evaluating the $R^2$ values of all endogenous constructs, it further evaluates the effect size $f^2$ to evaluate whether the omitted constructs have a substantial impact on the endogenous constructs where $R$ changes when certain exogenous constructs are removed from the model (Hair *et al.* 2014). The effect size $f^2$ can be calculated using the following formula (3).

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}} \quad (3)$$

  According to Cohen in Hair *et al.* (2014), the criteria for assessing $f^2$ are values of 0.02 (small), 0.15 (medium) and 0.35 (large)
- Path coefficient
  After running the PLS- SEM algorithm, results were obtained for the structural model relationships representing the hypothesized relationships among the constructs. The commonly used critical values for the two-tiled test are 1.65 (significance level = 10%), 1.96 (significance level = 5%) and 2.58 (significance level = 1%) (Hair *et al.* 2014).

## 3. Results and Discussion

Based on the results of Convergent Validity obtained for the loading factor value before eliminating the indicator variable where the loading factor $\geq 0.60$ is considered valid (Hair *et al*. 2014), namely as follows:

**Tabel 2.** Loadings Factor before removal of indicators

| Variable | Indicators | Loading Factor |
|---|---|---|
| Economic | ECO1 | 0.970 |
| | ECO2 | 0.968 |
| | ECO3 | 0.589 |
| Education | EDU1 | 0.593 |
| | EDU2 | 0.821 |
| | EDU3 | 0.920 |
| Health | HEA1 | 0.724 |
| | HEA2 | 0.854 |
| | HEA3 | 0.871 |
| HDI | HDI1 | 0.720 |
| | HDI2 | 0.893 |
| | HDI3 | 0.737 |

Based on table 2, it is shown that the average indicator in each variable has a loading factor value greater than 0.60 so that it can be said to be valid. However, there are two indicators that must be removed because they are invalid, namely ECO3 and EDU1. So that the Convergent Validity results after invalid indicators are removed are as follows:

**Tabel 3.** Loadings Factor after removal of indicators

| Variable | Indicators | Loading Factor |
|---|---|---|
| Economic | ECO1 | 0.970 |
| | ECO2 | 0.968 |
| Education | EDU2 | 0.821 |
| | EDU3 | 0.920 |

| | | |
|---|---|---|
| Health | HEA1 | 0.724 |
| | HEA2 | 0.854 |
| | HEA3 | 0.871 |
| HDI | HDI1 | 0.720 |
| | HDI2 | 0.893 |
| | HDI3 | 0.737 |

After removing the indicators, variable reliability testing is then carried out as measured by Composite Reliability (CR) and Average Variance Extracted (AVE). According to Bagozzi and Yi in I. Gazali and Fuad (2017) the cut-off level that can be said to be good enough Composite Reliability is 0.60. Meanwhile, the Average Variance Extracted (AVE) value has good reliability if the AVE value is above 0.50. The following are the output results of Composite Reliability (CR) and Average Variance Extracted (AVE)

**Tabel 4.** Composite Reliability & Average Variance Extracted

| **Variable** | ***Cronbac'h Alpha*** | ***Composite Reliability*** | ***Average Variance Extracted* (AVE)** |
|---|---|---|---|
| Economic | 0.935 | 0.969 | 0.939 |
| Education | 0.687 | 0.829 | 0.620 |
| Health | 0.762 | 0.859 | 0.671 |
| HDI | 0.694 | 0.863 | 0.760 |

Based on table 4, it is obtained that all variables have a composite reliability (CR) value $\geq 0.60$ with an Average Variance Extracted (AVE) value $\geq 0.50$, it can be concluded that the indicators are consistent in measuring the latent variable. Then Discriminant Validity testing is carried out which is obtained by looking at the cross loading value and comparing the root AVE value to the correlation between variables (Rashid, 2010). The cross loading value shows the magnitude of the correlation between the variable and its indicator. Good discriminant validity in a model if the correlation between variables and their indicators is higher than the correlation between variables and other indicators. Table 5 The following are the results of discriminant validity testing.

**Table 5.** Output value of cross loading

| | **Economic** | **Education** | **Health** | **HDI** |
|---|---|---|---|---|
| ECO1 | **0.970** | 0.919 | 0.694 | 0.649 |
| ECO2 | **0.968** | 0.832 | 0.597 | 0.707 |
| EDU2 | 0.582 | **0.821** | 0.530 | 0.387 |
| EDU3 | 0.942 | **0.920** | 0.598 | 0.609 |
| HEA1 | 0.419 | 0.300 | **0.724** | 0.271 |
| HEA2 | 0.646 | 0.637 | **0.854** | 0.230 |
| HEA3 | 0.531 | 0.577 | **0.871** | 0.066 |
| HDI1 | 0.551 | 0.604 | 0.194 | **0.720** |
| HDI2 | 0.495 | 0.346 | -0.083 | **0.893** |
| HDI3 | 0.627 | 0.472 | 0.476 | **0.737** |

Based on table 5 above, it shows that the indicators that measure each variable have a higher correlation than the indicators of other variables, such as economic variables, namely the ECO1 indicator and the ECO2 indicator have a higher correlation than the indicators of other variables. Then the indicators measuring the education variable, namely the EDU2 indicator and the EDU3 indicator, have a higher correlation than the other variable indicators. In addition, indicators measuring health variables, namely the HEA1, HEA2, and HEA3 indicators, have a higher correlation than other variable indicators. Likewise, indicators that measure HDI variables, namely HDI1, HDI2, and HDI3, have a higher correlation than other variable indicators. Thus it can be said that these latent variables have good discriminant validity.

The next stage is to compare the AVE root value to the correlation between variables by looking at the fornell-larcker output results shown in table 6.

**Tabel 6.** Fornell-larcker output value

| | **Economic** | **HDI** | **Health** | **Education** |
|---|---|---|---|---|
| **Economic** | **0.969** | | | |
| **HDI** | 0.699 | **0.787** | | |
| **Health** | 0.667 | 0.219 | **0.819** | |
| **Education** | 0.904 | 0.589 | 0.648 | **0.872** |

Table 6 shows the comparison of AVE with the AVE root, the root AVE value for the economic variable is 0.969, while the maximum correlation of the economy with other variables is 0.904, for the HDI variable is 0.787 with a maximum correlation of other variables of 0.589, for the health variable is 0.819 with a maximum correlation of other variables of 0.648, as well as the education variable of 0.872 greater than the correlation of other variables. So that discriminant validity for economic variables, HDI, health, and education is fulfilled.

The next step is to evaluate the structural model. Where structural model analysis is related to parameter evaluation to determine the effect of one latent variable on other latent variables (Haryono and Wardoyo, 2018). The results of this research model are as shown in the figure 1.

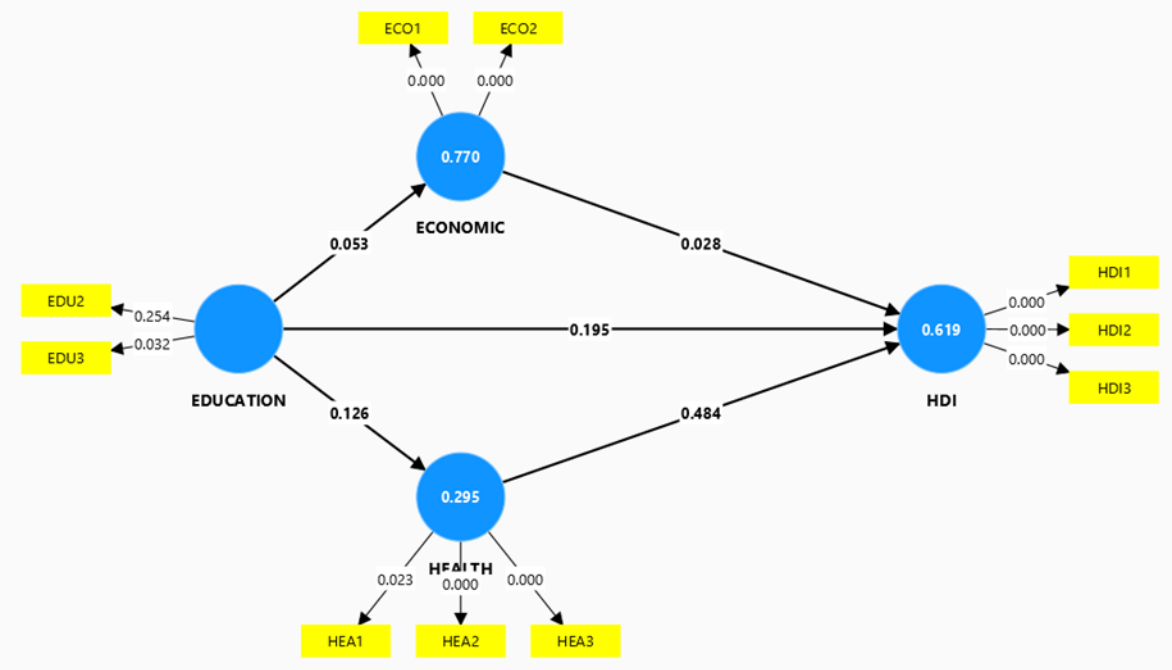


**Figure 1**. Structural Model

After testing the model, colinearity assessment testing is needed to check for multicollinearity between variables by looking at the inner variance inflation factor (VIF) value. Where multicollinearity is checked between endogenous variables and exogenous variables, with the tolerance level being VIF $> 0.20$ to VIF$<5.00$ in the predictor construction is an indication that there is collinearity (Hair *et al.* 2014). The following is table 7 VIF output value.

**Table 7.** Inner VIF output value

| | **HDI** |
|---|---|
| HDI | |
| Economic | 3.677 |
| Health | 1.779 |
| Education | 2.749 |

The results of Table 7 show that all Variance Inflated Factor (VIF) values are greater than 0.2 (VIF > 0.20) and less than 5 (VIF < 500), where the VIF value of the economy on HDI is 3.677, health on HDI is 1.779, education on HDI is 2.749. Thus, from these results it can be concluded that there is no multicollinearity between latent variables.

Furthermore, testing the F-square test is used to determine how much influence the exogenous latent variables have on the endogenous variables. According to Cohen in Hair *et al.* (2014) the criteria for assessing $f^2$are the value of 0.02 (small), 0.15 (medium) and 0.35 (large). The following table is the value of the F-square output results.

**Tabel 8.** F-square output value

| | HDI |
|---|---|
| HDI | |
| Economic | 0.524 |
| Health | 0.257 |
| Education | 0.007 |

Based on the Table 7 shows that the economy has a moderate influence on the structural level of HDI with an F-square value of 0.524. Furthermore, the health variable has an F-square value of 0.257 and the education variable has a small influence on HDI with an f-square value of 0.007.

After testing the F-Square, it is necessary to test the R-square to find out how much influence the endogenous variables are able to explain by the exogenous variables. According to Chin in Haryono and Siswoyo (2016) the $R^2$ criterion consists of three classifications, namely: $R^2$ values of 0.67; 0.33 and 0.19 as high, medium and weak. The following is Table 9 of the R-square output value.

**Table 9.** R-square output value

| | R-square | R-square adjusted |
|---|---|---|
| HDI | 0.602 | 0.562 |

Based on table 9, it shows that the magnitude of the influence of the economy, education and health on HDI is 60.2% while the rest is influenced by variables not examined in this study, where the $R^2$ value is 0.602 which indicates that this influence is a high influence.

The next step is testing the direct effect to find out what variables have a direct influence, which is shown in table 10.

**Table 10.** Testing the direct effect

| Path | Original Sample (O) | T – Statistic | P - Values |
|---|---|---|---|
| Economic → HDI | 1.103 | 2.794 | 0.005 |
| Education → HDI | 0.904 | 6.269 | 0.000 |
| Health → HDI | -0.434 | 1.694 | 0.090 |

Based on the data in Table 8, the direct effect test is that the economic variable and the education variable have a significant direct effect on the HDI variable, with the economic variable having a t-statistic value of 2.794 and a p-value of 0.005, the education variable has a t-statistic value of 6.269 and a p-value of 0.000, which is the most significant influence on the HDI variable. However, the health variable has a t-statistic value of 1.694 and a p-value of 0.090, so this variable has no influence on the HDI variable.

Then the indirect effect test is carried out to determine whether the education variable has an indirect effect through economic variables and health variables. The following is Table 11 of the indirect test.

**Tabel 11**. Testing the indirect effect

| Path | Original Sample (O) | T - Statistic | P - Values |
|---|---|---|---|
| Education → Economic → HDI | 0.997 | 2.487 | 0.013 |
| Education → Economic → HDI | -0.281 | 1.501 | 0.133 |

Based on the data in Table 10, the indirect effect test found that the education variable through the economic variable has an indirect effect on the HDI variable with a t-statistic value of 2.487 and a p-value of 0.013. While the education variable through the health variable with a t-statistic value of 1.501 and a p-value of 0.013, so that the education variable through the health variable does not have a significant indirect effect on the HDI variable.

Furthermore, looking for the total effect, the total effect is the sum of the direct effect and indirect effect. The following Table 12 shows the total effect of the economy, health, and education on the Human Development Index (HDI).

**Tabel 12. Total effect test**

| Path | Original Sample (O) | T-Statistic | P-Values |
|---|---|---|---|
| Economic → HDI | 1.103 | 2.794 | 0.005 |
| Education → HDI | 0.589 | 3.991 | 0.000 |
| Health → HDI | -0.434 | 1.694 | 0.090 |
| Education → Economic | 0.904 | 6.269 | 0.000 |
| Education → Health | 0.648 | 2.302 | 0.021 |

Based on the results of the analysis in Table 12, it is obtained that the economic variable has a significant influence on HDI. Then the education variable has a significant influence on HDI. However, the health variable does not have a significant influence on HDI. Then the education variable has a significant influence on economic and health variables.

## 4. Conclusion

This study shows that economic variables have a significant direct influence on HDI variables. Then the education variable also has a significant direct influence on HDI. So this research is in line with what has been done by (Bhakti and Istiqomah, 2015). However, the health variable does not have a direct effect on HDI where this research is not in line with research conducted by Destilunna and Zain (2015) which states that health has a significant effect on HDI. This is due to the data collection of different indicators so that the results are different. In addition, there is an indirect

effect of education through economic variables on HDI which is significant. Then education through health variables has no indirect effect on HDI. Thus the total effect obtained is that economic variables and education variables have a significant influence on HDI. However, health variables do not have a significant influence on HDI. In addition, the total effect is that the education variable has a significant influence on economic variables and health variables.

Based on this research, the suggestions given in an effort to evaluate and improve the Human Development Index (HDI) in Indonesia are the distribution of electricity (PLN) in lighting in the community needs to be leveled, because there are still many remote areas that still cannot use PLN electricity in lighting, as well as access to proper sanitation for rural communities that need to be improved. Then it is also necessary to pay attention to facilities and access to education in Indonesia, because facilities and access to education affect the education participation rate, both school participation, gross participation, and gross participation, because the better the facilities and access to schools, the better the education participation in Indonesia.

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