

## A MODIFIED HUMAN DEVELOPMENT INDEX, DEMOCRACY AND ECONOMIC GROWTH IN INDONESIA

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### Abstract

**Purpose of the study:** Firstly, to construct a modified human development index by incorporating new dimensions (democracy and employment). Secondly, to measure and compare human development progress in Indonesian provinces. Thirdly, to examine the nexus between human development, economic growth, and democracy during the period 2010-2017.

**Methodology:** Principle Component Analysis (PCA) method is employed to combining components into one index (composite index) which we call MHDI. The panel simultaneous equation model is applied to examine the nexus between human development, economic growth, and democracy.

**Main Findings:** There were significant ranking differences between MHDI and HDI-UNDP in 24 provinces of 33 Indonesian provinces. The most significant ranking differences were found in several provinces, especially Maluku, West Java, Central Java, East Java, and Central Kalimantan. The study found a strong two-way relationship between human development and economic growth as well as between human development and democracy.

**Applications of this study:** This study recommends that human development policies supported by rapid economic growth and democratic stability should be one of the development priorities through government spending and support from private investment (the private sector) which focuses on the development of education and health infrastructure throughout the Indonesian province.

**Novelty/Originality of this study:** This study employs different methods for constructing a human development index by incorporating a new dimension (democracy and employment).

**Keywords:** Human Development, Economic Growth, Democracy, PCA, 2SLS.

### INTRODUCTION

Since first popularized by The United Nations Development Program (UNDP) in 1990. The Human Development Index (HDI) has attracted great attention from policymakers, economists, politicians, and academic circles around the world. This index is widely accepted as one of a development success indicator and designed to help determine strategies for improving human prosperity. However, its contribution and ability to cover up as a sliding concept as human development in its scope have been still highly debated. It has been much criticized, in particular relating its simple weighting of each component, and the high correlation between GDP and other variables of composite index cause these measures to be biased and cannot create an accurate picture of prosperity. Other critics have claimed that the human development Index is too narrow by relying on only a few indicators often derived from the low-quality data (Kovacevic, 2011; McGillivray, 2005).

Efforts to modify and expand the scope of the human development index have been conducted by many researchers. Several studies have proposed to incorporate new dimensions such as democracy, employment opportunities, or other socio-economic variables that are considered to contribute significantly to human development. For instance, [Ranis, et al. \(2006\)](#) proposed 11 important variables of human development index: psychological condition, empowering, political rights, social interaction, social welfare, disparity, work status, leisure time, political safety, economic sustainability, environmental factors. [Silva and Ferreira-Lopes \(2014\)](#) incorporated three fundamental dimensions of HDI with two new dimensions (good governance and environmental condition). [Salas-Bourgoin \(2014\)](#) designed a modified human development by adding new components related to political freedom (democracy) and employment rate. [Migala-Warchol \(2019\)](#) developed the human development index by investigating a large number of new potential variables related to financial and economic condition, science and technology progress, and welfare condition. [Migala-Warchol \(2019\)](#), [Grimm, et.al \(2010\)](#) and [Babiarz et al \(2018\)](#) conducted a recent study with similar objectives to expand the scope of human development by emphasizing several variables that have the potential to enrich human development. Further efforts to improve the general index calculation method emphasize on weighting and combining components into one index ([Babiarz et al., 2018](#); [Mishra & Nathan, 2018](#); [Salas-Bourgoin, 2014](#); [Ayahsrah, 2012](#); [Al-Hilani 2012](#); [Despotis, 2005](#)). Many recent studies of the modification of human development index have applied multivariate analysis such as Principle Component Analysis (PCA) that provide the important findings to support the new extension of human development index ([Săndică et al. 2018](#); [Amaluddin et al., 2018](#); [Mahajan et al., 2012](#); [Lindman and Sellin, 2011](#)).

A great deal of research has been conducted in investigating the relationship between human development, economic growth, and democracy, however, the results of empirical research generally produce diverse conclusions and often

debated. Some researchers find that there is a one-way relationship from human development that has an impact on economic growth or vice versa and other researchers find two-way relationships that influence each other (feedback linkage). [Bandara et al \(2014\)](#) concluded the strong evidence of a two-way relationship between economic growth and human development. Thus, economic growth acceleration positively enhances human development and human development progress becomes one of the economic growth engines. The study of [Suri et.al \(2011\)](#) investigated the linkage of human development and economic growth by employing a panel simultaneous equation model. This study found a two-way relationship or affects each other between economic growth and human development in a simultaneous equation model system. In other words, human development is one of the determinants of economic growth that supports the arguments of the endogenous growth theory.

The debate on economic growth-democracy nexus both in theory and previous research has been caused by differences in methodology, data and patterns of development policies in each country (regions) also often caused by the government regime's policy in responding to political changes and political will to improve development, consequently, the empirical findings have mixed results and lack of consensus. For example, [Rock \(2009\)](#) and [Knutsen \(2011\)](#) found a strong and positive influence of democracy on economic growth. Conversely, the viewpoint of others confirmed that democracy negatively influenced growth ([You, 2011](#); [Rachdi and Saidi, 2015](#)). They concluded that democracy triggers the level of corruption and consequently negatively influence economic performance. [Aisen and Veiga \(2013\)](#) concluded the negative effects of democracy on economic growth. Other studies have not found a significant relationship between democracy and growth. This condition also implies the relationship between human development and democracy which has led to many different empirical findings. The link between economic growth and democracy has a positive impact on human development, but its influence is sensitive to the process of democratization and the level of economic development of a country ([Saha and Zhang, 2017](#)). As regards as democracy-human development nexus, For a long period, most political economists believed that democracy was one of the efficient channels to improve human development, however, this argument has been challenged. [Gerring \(2012\)](#) found evidence that democracy has a weak impact on the improvement of human development.

Human development policies that are supported by the stability of economic growth and democracy in each country will determine the pattern of causality in one direction, two directions, or trade-off relations. Actual data from Central Agency Statistics of Indonesia (BPS) shows that from 2010 to 2014 Indonesia's economy experienced a slowdown from the economic growth of 6.81%, down to 5.02%. However, economic changes began to show improvement in 2017 with a growth of 5.07% higher than the achievement of economic growth in 2016 of 5.02%. In the same period, the progress of human development and democracy showed an increase from year to year. In 2010, Indonesia's human development index reached 66.53 points and then increased to 70.81 points in 2017 while the democracy index increased from 63.17 points in 2010 to 72.11 points in 2017.

There are three primary aims of this study:

1. To construct a modified human development index (MHDI) by incorporating new dimensions (democracy and employment).
2. To measure and compare the human development progress in Indonesian provinces.
3. To examine the nexus between human development, economic growth, and democracy.

## LITERATURE REVIEW

Since the 1930s, the majority of developed and developing countries used national income per capita such as GDP growth as a measure of economic performance and the quality of development. However, in the 1950s-1960s, GDP per capita as an economic development indicator regularly criticized for not presenting a fair view of social well-being. Dissatisfaction with the per capita GDP as the indicator of human welfare has recently led to the search for different indicators of wellbeing. Since the 1970s, the researchers, economists, and policymakers have highlighted and given much more attention to a broad range of social indicators covering health, education, employment, housing, environment, and basic human rights. In 1970, the first attempt to construct an index for comparing the well-being level inter-countries conducted by the United Nations Research Institute for Social Development (UNRISD). This index covered physical needs, cultural needs, and higher needs. Beginning in 1976, the International Labor Organization (ILO) introduced the basic needs approach which covered an adequate level of both consumption and essential services such as health care and primary education ([Stanton, 2007](#)).

In 1979, Moris D. Morris introduced the Physical Quality of Life Index (PQLI) which combined three indicators: life expectancy, infant mortality and basic literacy. The most influential well-being conceptualization was brought by Indian Economist, Amartya Sen. Based on his conceptualization, multidimensional measures were produced by combining various kinds of social indicators. Amartya Sen focused on a society's capability, rather than GDP. This "capability approach" makes two normative claims: 1) development means increasing people's freedom (i.e., self-determination) and 2) freedom should be understood in terms of capability ([Stanton, 2007](#)). In the late 1980s, the broader emphasis of economists on the use of development indicators that included social indicators. In 1990, Amartya Sen has first countered the idea of transforming Human Development into a numeric but after persuasion from Pakistani economist

Mahbub Ul Haq, they continue to develop an index that captures human development performance. The Human Development Index is currently used by almost all countries of the world. This index was first popularized and published by The United Nations Development Program (UNDP) in 1990. The Human Development Index (HDI) has attracted great attention from policymakers, economists, politicians, and academic circles around the world. The Human Development Index (HDI) is a summary measure of achievement in key dimensions of human development: to live healthy and creative life, access to knowledge, and a decent standard of living. The HDI is the geometric average of the three dimensions. The index measures from 0-1 with 1 being the maximum development. The health aspects of human development are measured by life expectancy. The education aspect of HDI is measured by the mean years of schooling for residents of a country and the expected years of schooling. The aspect of economic known as the standard of living is measured by GNI per capita based on purchasing power parity (PPP) (Kovacevic, 2010).

Nevertheless, the human development index has been much criticized, in particular relating its simple weighting of each component, and the high correlation between GDP and other variables of composite index cause these measures to be biased and cannot create an accurate picture of prosperity. Other critics have claimed that the human development index is too narrow by relying on only a few indicators often derived from low-quality data (Kovacevic, 2010; McGillivray, 2005).

## HYPOTHESIS DEVELOPMENT

In the development economics literature, human capital accumulation (education and health) is one of the growth-engine as explained by the Solow growth model and endogenous growth theory (Todaro and Smith, 2015). Education is one of the components of the human development index. There is, the evidence strongly suggests that there is a bidirectional relationship between education and economic growth. Education may stimulate economic growth through several channels and human capital is an important direct contributor to the creation of a new idea and technological progress (Van Den Berg, 2012). Concerning with the previous studies, to examine the influence of human development on economic growth. Most previous studies have highlighted the influence of each component of human development on economic growth such as education and health. There is, the evidence strongly suggests that there is a bidirectional relationship between education and economic growth (Sala-i-Martin et al. (2004) concluded that the most robust factor affecting economic performance, especially in developing countries is primary education. A positive connection between education expenditure and economic growth was also reported by Baladacci et al. (2008). Similar results were revealed by Lawal and Whab (2011) for Nigeria and by Tsamadias and Prontzas (2012) for Greece. Hanushek and Kimko (2000) concluded that high school enrolment has a positive impact on income per capita growth leading to productivity acceleration. Reza and Valeecha (2012) found a long-run relationship between education and economic growth. The health factor of human development is also found to have an impact on economic growth. Weil (2007) have reported that health factor is one of the essential determinants of income growth in different countries.

The empirical finding also shows the link between economic growth and human development through two directions or two-way relationships. Bandara et al (2014) concluded the strong evidence of a two-way relationship between economic growth and human development. Thus, economic growth acceleration positively enhances human development and human development progress becomes one of the economic growth engines. The study of Suri et.al (2011) investigated the linkage of human development and economic growth by employing a panel simultaneous equation model. This study found a two-way relationship or affects each other between economic growth and human development in a simultaneous equation model system. In other words, human development is one of the determinants of economic growth that supports the arguments of proponents of the endogenous growth theory. Ranis et al. (2000), confirmed that the extension of capacity and freedom leads to increased economic performance, and human development would have a significant effect on development. Similarly, Ghost (2006) found that India displays a two-way causality between EG and HD, indicating possibilities of vicious cycles. Suri et al. (2011) confirmed that there was a strong relationship between economic growth and human development with human development being more important to sustain growth.

In terms of growth-democracy nexus, democracy-human development nexus, as well as human development-growth nexus, has been carried out by several researchers. However, their findings tend to vary. Klomp and Haan (2013) concluded that human capital is positively influenced by democracy while political (rezim) instability is negatively related to basic human capital. Annaka and Higashijima (2017) confirmed that democratization has a long-run effect on reducing infant mortality as a proxy of human development. For example, Rock (2009) and Knutsen (2013) found a strong and positive influence of democracy on economic growth. Conversely, the viewpoint of others confirmed that democracy negatively impacts on growth (You, 2011; Rachdi and Saidi, 2015). They argued that democracy triggers the level of corruption and consequently negatively influences economic performance. Aisen and Veiga (2013) argued that the negative effects of democracy on economic performance as well. Other studies have not found a significant relationship between democracy and growth. This condition also implies the relationship between human development and democracy which has led to many different empirical findings. The link between economic performance and democracy is positively related to human development, but its influence is determined by the process of democratization and economic development level of a country (Saha and Zhang, 2017).

Based on the relationship between human development, democracy, and economic growth. The hypotheses of these relations are:

H1: There is a significant difference rank between modified human development and HDI-UNDP.

H2: There is a long-run feedback causal relationship between human development and economic growth.

H3: There is a long-run feedback causal relationship between the human development index and democracy.

H4: There is a long-run feedback causal relationship between democracy and economic growth.

H5: Economic growth, education infrastructure, health infrastructure, political freedom positively affects human development while income distribution inequality, and dropout rate negatively affect human development.

H6: Human development, democracy, and labor productivity positively affect economic growth while population growth negatively affects economic growth.

## METHODOLOGY

### Data and Variables

This study employs panel data of the selected socio-economic indicators of 33 provinces in Indonesia over the period 2010 to 2017. All data were collected from the Central Bureau of Statistics of Indonesia (BPS), The Ministry of Education and Culture as well as the Indonesian Ministry of Health. Data management and analysis were performed using SPSS 16.0 and EViews 8.0. Based on the purposes of the research, data, and analysis in this study are divided into two categories. The First data group for a Modified Human Development Index (MHDI) that consist of Means years of schooling (MYS), Expected Years of Schooling (EYS), Adjusted Per Capita Expenditure (AEP), Life Expectancy at Birth (LEP), Democracy Index (DI) and Employment Rate (EYR). Democracy index and employment rate incorporate as new dimensions in Modified Human Development (MHDI) to generate a broader perspective of HDI, proposed by previous studies ([Salas-Bourgoin, 2014](#); [Ranis et.al, 2006](#)). The Second data group was used to analyze the relationships between human development and economic growth by employing panel data simultaneous equation model.

### Principal Component Analysis (PCA)

The first step of the analysis method is to construct a modified human development by incorporating two new dimensions (democracy and employment rate) for measuring the human development progress of 33 provinces in Indonesia. Principal Component Analysis (PCA) method is employed for combining components into one index (composite index), which we call MHDI. In recent studies, PCA consider as one of the best methods to generate a single index ([Amaluddin et al 2018](#); [Mahajan et al., 2012](#)).

PCA is a method of statistic that utilizes a transformation process to reduce a large number of observations (dataset) that might correlate to smaller uncorrelated variables. This technique is widely used in many fields for dimensional reduction. The study applies the PC method to incorporate the 6th selected components of human development into a single index. The jth factor Fj can be expressed as:

$$FJ = WJ_1X_1 + WJ_2X_2 + WJ_3X_3 + ..... + WJ_pX_p \quad (1)$$

Where: Fj is the estimation of the jth factor, Wj is the weighted factor score coefficient and P is the number of variables.

The percentage of variance as weights on the factor score coefficients. Non-standardized MHDI was obtained by summing the multiplication of the variance proportions of each selected component ( $vc/V$ ) with a principal component score (factor score) (PC) of each province. The formula of Non-standardized MHDI as follows ([Krishnan, 2010](#); [Mahajan et, al, 2012](#)):

$$NMHDI_i = \sum (\frac{vc_k}{V}).(PC_{ik}) \quad (2)$$

Where  $NMHDI_i$  is the non-standardized value of the modified human development index of i province.  $Vc_k$  is the percentage of variance in the  $k^{th}$  principal component.  $V$  is the total percentage of variance in selected principal components.  $PC_{ik}$  is  $k^{th}$  principle component score (factor score) in the province of i. The non-standardized value of the index can produce a positive or negative numeric, consequently, it is difficult for interpretation. One of the solutions for this computation is standardizing the calculation result of equation (2), thus, a Modified Human Development Index (MHDI) can be obtained. The result of the standardized value can be range from 0 to 100 using the following equation :

$$MHDI(i) = \frac{(Value(i) - Min V)}{(Max V - Min V)} \times 100 \quad (3)$$

A similar method was adopted from previous studies ([Krishnan, 2010](#); [Amaluddin, 2018](#)).



## Panel Simultaneous Equation Model

The third aim of this study is to investigate the relationship between human development, economic performance, and democracy in Indonesian Provinces by using the panel data simultaneous equation model. In a system of simultaneous equations, structural equations are derived from theories and previous empirical research. Human development is a function of economic growth ([Arisman, 2018](#); [Asmita et al., 2017](#); [Sangaji, 2016](#); [Ranis et.al, 2004](#)), lag of economic growth ([Bandara, 2014](#)), education and health infrastructure ([Trunajaya 2015](#)), dropout rate, income inequality ([Alvan, 2007](#)) and political freedom ([Klomp and Haan, 2013](#)).

$$HD = f(EG, EI, HI, DO, GR) \quad (4)$$

In equation (5), economic growth is a function of human development ([Sala-i-Martin et al., 2004](#); [Reza and Valeecha, 2012](#); [Lawal and Whab, 2011](#)), private investment ([Sahoo et.al, 2010](#); [Makuyana and Odhiambo, 2016](#)), population growth ([Yao, et.al, 2013](#)), labor productivity ([Kormaz et al., 2017](#)) and lag of economic growth ([Bandara, 2014](#)).

$$EG = f(HD, PI, PG, LP, EG_{t-1}) \quad (5)$$

In equation (6), democracy is a function of human development, lag of economic growth, and political freedom.

$$DC = f(HD, EG_{it-1}, PF) \quad (6)$$

This study compiles a panel data set covering 33 provinces of Indonesia over the period 2010–2017, a panel data simultaneous equation model is applied to examine the relationship between human development, economic growth, and democracy. Simultaneous equation models are formed from structural equations consisting of 3 endogenous variables and 9 exogenous variables. The econometric model specification consists of the human development equation (equation 7), economic growth equation (equation 8), and democracy equation (equation 9).

$$HD_{it} = \alpha_0 + \alpha_{11}EG_{it} + \alpha_{12}DC_{it} + \alpha_{13}EI_{it} + \alpha_{14}HI_{it} + \alpha_{15}DO_{it} + \alpha_{16}GR + e_{it} \quad (7)$$

$$EG_{it} = \beta_0 + \beta_{21}HD_{it} + \beta_{22}DC_{it} + \beta_{23}PI_{it} + \beta_{24}PG_{it} + \beta_{25}LP_{it} + \beta_{26}EG_{it-1} + e_{it} \quad (8)$$

$$DC_{it} = \gamma_0 + \gamma_{31}HD_{it} + \gamma_{32}EG_{it} + \gamma_{33}PF_{it} + e_{it} \quad (9)$$

Where: Human development (HD), economic growth (EG), and democracy (DC) are endogenous variables. Human development (HD) is measured by the human development index (percent). Economic growth (EG) is measured by the per capita gross regional domestic product (IDR Billion). Education infrastructure (EI) is measured by the ratio of the school's number of students. Health infrastructure (HI) is measured by the number of hospital beds per 1000 inhabitants. The dropout rate (DR) is measured by the percentage of students failing to complete a particular school (percent). Income distribution inequality (GR) is measured by the Gini coefficient (Gini ratio). Democracy (DC) is measured by a democracy index (percent). Private investment (PI) is measured by total gross domestic fixed capital formation (IDR million). Population growth (PG) is measured by the total of inhabitants. LP (labor productivity) is measured by the ratio of Gross Regional Domestic Product to workers.  $EG_{it-1}$  is a lag of economic growth. PF is political freedom (percent). All variables are transformed into a natural logarithm (Ln).

## RESULTS/FINDINGS

### Constructing a Modified Human Development Index

In this section, we attempt to construct a modified human development index by incorporating the new two dimensions (democracy and employment) and measure the human development progress in Indonesian provinces. Principle component analysis (PCA) is applied to combining components into one index (composite index), which we call the Modified Human Development Index (MHDI). The process of calculation and analysis using PCA through the following procedures: first, testing sampling adequacy and strength relationship among variables employed Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity. The KMO index ranges from 0 to 1. The sampling is adequate or sufficient if the value of Kaiser Meyer Olkin (KMO) generates value  $> 0.5$  ([Field, 2013](#)). Bartlett's test of sphericity should be significant ( $p\text{-value} < 0.05$ ) indicating the strength of the relationship between variables are suitable for PCA ([Tabachnick and Fidell, 2007](#)). Second procedure highlights the principle component selection and the result of component score calculation for measuring human development progress in Indonesian provinces.

**Table 1:** Kaiser Meyer Olkin (KMO) dan Barlett's Test of Sphericity

Kaiser-Mayer-Olkin (KMO)	0.620
Barlett's Test of Sphericity:	
• Approx. Chi-square	78.395
• Degree of freedom (df)	15
• P-value ( $\alpha=5\%$ )	$<0.0001$

Table 1 demonstrates that the Kaiser-Meyer-Olkin (KMO) yielding value of 0.62 greater than 0.50, indicates that the sample size is adequate or sufficient for applying PCA. Bartlett's test is statistically significant at a significance level of 5 % ( $0.000 < 5\%$ ), indicate that relationship or correlation among tested variables is strong and not an identity matrix. These procedures generate the final decision to apply PCA for further analysis. The next step is determining the number of factors (principal components denoted PC) that should be retained for further analysis. In the first computation, the number of PC is equal to the number of variables remaining (displayed in Table 2). Each PC has an eigenvalue which mirrors the number of variances (variance proportion) that is calculated for a given component. Generally, the first variable has the highest eigenvalues. Kaiser's criterion (using eigenvalue  $>1$ ) known as the eigenvalue-one criterion is the widest method employed to determine the number of factors in PCA analysis. The varimax rotation is used to extract the dataset and the result of the first procedure of PCA displayed in Table 2.

**Table 2:** Eigenvalue and Factor Selection

Component	Initial Eigenvalues			Rotation Of Squared Loadings		
	Total	% of Variance	Cumulative	Total	% of Variance	Cumulative
PC1	2.879	47.976	47.976	2.683	44.721	44.721
PC2	1.378	22.971	70.947	1.574	26.226	70.947
PC3	0.726	12.106	83.053			
PC4	0.576	9.598	92.651			
PC5	0.308	5.129	97.780			
PC6	0.133	2.220	100.000			

Table 2 provides a statistic summary explaining that two principal components have an eigenvalue greater than 1 and each selected principal component explains 44.72 % and 26.23 % of the variance respectively which together account for 70.95 % of the total variance. Principle components are extracted by imposing varimax rotation (rotation sums of squared loadings). The corresponding component scores are estimated using the regression method then saved as PC1 and PC2 in SPSS software. In the first principle component, all four components of MHDI have a high loading factor where the adjusted per capita expenditure variable (AEP) has the highest loading factor of 0.904 while the expected years of schooling variable (EYS) has the lowest loading factor of 0.364.

Non-standardized MHDI was calculated using a formula in equation (2) and the result of these calculations was shown in Table 3. The percentage of variance as weights on the factor score coefficients. The Non-standardized MHDI was obtained by summing the multiplication of the variance proportions of each selected component ( $vc/V$ ) with the principal component score (factor score) (PC). The total number of multiplications produces the non-standardized composite index. According to data in Table 3, the two principal components explain 70.947 % of the total variance. The first component (PC1) explains 44.721 % while the second component (PC2) can explain 22.226 % of the total variance. For example, using equation (2), a Non-standardized MHDI of Maluku province was obtained:

$$NMHDI_{Maluku} = (44.721/70.947)(-0.90026) + (22.226/70.947)(2.4056) \\ = 0.3218$$

The standardization process using a formula in equation (3) produces a modified human development index (MHDI) of 61.73 points for Maluku Province, as reported in Table 3.

**Table 3:** Comparison between Rank of MHDI And HDI-UNDP In Indonesian Province

Name of Province	NMHDI*	MHDI	Rank	HDI	Rank	Rank Difference
DKI Jakarta	0.289	100.00	1	80.06	1	0
DI Yogyakarta	0.022	94.11	2	78.89	2	0
East Kalimantan	0.190	73.90	3	75.12	3	0
Riau Island	0.358	73.61	4	74.45	4	0
Bali	0.026	68.76	5	74.3	5	0
North Sulawesi	-0.202	64.17	6	71.79	7	1
Riau	0.044	62.62	7	71.66	6	1
Maluku	-0.326	61.73	8	71.42	24	16
Aceh	0.089	60.91	9	71.24	11	2
Banten	0.803	60.29	10	70.69	8	2
West Sumatera	1.871	58.48	11	70.6	9	2
Bangka Belitung Islands	-0.056	55.98	12	70.57	17	5
Bengkulu	-0.157	54.86	13	70.52	18	5
Central Kalimantan	1.633	54.66	14	70.34	20	6
South Sulawesi	-0.191	54.60	15	70.27	14	1
Jambi	0.263	54.43	16	69.99	16	0

North Sumatera	0.606	54.32	17	69.99	12	5
South Kalimantan	-0.398	52.81	18	69.95	21	3
West Jawa	-0.677	52.39	19	69.86	10	9
Southeast Sulawesi	-0.349	52.28	20	69.79	19	1
Central Jawa	0.035	49.91	21	69.65	13	8
North Maluku	-0.039	49.16	22	68.86	26	4
East Jawa	0.814	49.05	23	68.25	15	8
South Sumatera	0.421	48.79	24	68.19	22	2
Central Sulawesi	-0.324	45.78	25	68.11	25	0
Lampung	0.033	45.74	26	67.2	23	3
West Kalimantan	-0.061	45.16	27	67.01	29	2
Gorontalo	-0.395	44.02	28	66.58	27	1
West Nusa Tenggara	-0.980	43.95	29	66.26	28	1
East Nusa Tenggara	0.322	37.07	30	64.3	31	1
West Sulawesi	-0.187	29.57	31	63.73	30	1
West Papua	-1.297	21.76	32	62.99	32	0
Papua	-2.177	0.000	33	59.09	33	0

Note: NMHDI = Non-standardized of MHDI; MHDI = Modified human development index.

The second purpose of this study is to measure and compare the human development progress in Indonesian provinces. The comparison of the human development progress of 33 Indonesian provinces is presented in Table 3. Table 3 reports that there are differences in ranking between MHDI and HDI UNDP in 24 provinces of 33 Indonesian provinces. Significant ranking differences are found in several provinces, especially Maluku, West Java, Central Java, East Java, and Central Kalimantan. The highest-ranking difference was found in Maluku Province with a difference of 16 points and placing Maluku province in the 4th rank of 33 provinces in Indonesia indicating that the importance of democracy development must be in line with economic development, education, and health to improve people's welfare. Table 3 shows that the DKI Jakarta province has the highest ranking in human development performance in Indonesia, followed by DI Yogyakarta province and East Kalimantan Province as the second and third ranks of human development progress while Papua Province has the lowest rank in achieving the human development index in comparison with other provinces in Indonesia.

### The Result of Panel Simultaneous Equation Model

The stages of analysis that must be carried out are (1) the Econometric specification in the panel data simultaneous equation model. 2) Examination of identification problems in simultaneous equation models. 3) Selecting estimation techniques in panel data (fixed effect model / random effect model), 4) Performing estimation of Panel data simultaneous equation models. 4) Interpretation and analysis of empirical findings.

**Table 4:** Examination of the Identification Problem

Order Condition (Necessary Condition)												
Equation	K-k	m-1			Result			Conclusion				
1	11 – 5	2 – 1			6 > 1			Overidentified				
2	11 – 4	3 – 1			7 > 2			Overidentified				
3	11 – 2	2 – 1			9 > 1			Overidentified				
Rank Condition (necessary and sufficient condition)												
Equation	HD <sub>it</sub>	EG <sub>it</sub>	DC <sub>it</sub>	EI <sub>it</sub>	HI <sub>it</sub>	DO <sub>it</sub>	GR <sub>it</sub>	PI <sub>it</sub>	PG <sub>it</sub>	LP <sub>it</sub>	EG <sub>it-1</sub>	PF <sub>it</sub>
1	1	-α <sub>11</sub>	0	-α <sub>13</sub>	-α <sub>14</sub>	-α <sub>15</sub>	-α <sub>16</sub>	0	0	0	0	1
2	-β <sub>21</sub>	1	-β <sub>22</sub>	0	0	0	0	-β <sub>23</sub>	-β <sub>24</sub>	-β <sub>25</sub>	-β <sub>26</sub>	0
3	-Υ <sub>31</sub>	0	1	0	0	0	0	0	0	0	-Υ <sub>32</sub>	-Υ <sub>33</sub>

Note: K = Number of Predetermined Variables (Exogenous variables and lag of endogenous variables)

k = Number of Predetermined Variables in a specified equation

m = Number of Endogenous Variables in a specified equation

Based on the order and rank condition, all equation is over-identified. In this case, we need to use two-stage least squares (2SLS) estimation.

There are two techniques are usually used for identification in a system of simultaneous equations, namely order and rank condition (Gujarati and Porter, 2009). Table 5 demonstrates the examination of the identification problem by

applying order and rank conditions. All equations are shown to be over-identified due to having more excluded exogenous variables from the equation than included endogenous variables (order condition). The order condition's rule can be satisfied due to having more than one nonzero determinant of order  $(M-1)(M-1)$ , which can be constructed from the coefficient of the variables excluded from that equation but included in other equations in the model.

The results of previous identification generate the final decision of this study to use the Two-Stage Least square method (2SLS). The next step is to determine the panel data estimation technique that fits in the simultaneous equation system by applying the Hausman test (Gujarati & Porter, 2009; Baltagi, 2005). Table 5 Column 6 shows that chi-square statistics as an indicator of the Hausman test in the three equations are significant at an alpha of 5% or reject the null hypothesis (random effect model) which implies that the fixed effect model is appropriate for this panel model. The results of the fixed effect model estimation using a cross-section weight in a system of simultaneous equations have robust standard errors shown in Table 5.

**Table 5:** Parameter Estimation by 2SLS and Fixed Effect Model (Cross-Section Weight)

Equation	Coefficient	SE	t-stat	P-Value	Other Indicators
1. Human Development					
Intercept	2.259008	0.155369	14.53961	0.0000*	F-Test =529.6842*
Economic Growth (EG)	0.083471	0.005992	13.93087	0.0000*	Adj.R <sup>2</sup> = 0.990498
Education Infrastructure (EI)	0.123141	0.017858	6.895370	0.0000*	D-W = 1.495031
Health Infrastructure (HI)	0.020726	0.002800	7.402348	0.0000*	
Dropout Rate (DO)	-0.006838	0.000922	-7.413134	0.0000*	
Income Distribution Inequality (GR)	-0.034108	0.008982	-3.797607	0.0002*	$\chi^2$ Hausman Test
Political Freedom (PF)	0.009081	0.004776	1.901324	0.0588**	= 17.474496**
2. Economic Growth					
Intercept	6.453459	0.644449	10.01392	0.0000*	F-Test =4858.097*
Human Development (HD)	2.382143	0.317945	7.492303	0.0000*	Adj.R =0.99966
Democracy (DC)	0.001832	0.016185	0.113182	0.9100	D-W =1.415813
Private Investment (PI)	0.146265	0.027906	5.241398	0.0000*	
Population Growth (PG)	-0.908118	0.028296	-32.09389	0.0000*	$\chi^2$ Hausman Test
Lag of Economic Growth (EG <sub>t-1</sub> )	0.588760	0.038244	15.39488	0.0000*	= 913.8837**
Labor Productivity (LP)	0.017645	0.010121	1.743306	0.0829***	
3. Democracy					
Intercept	-6.094974	1.539165	-3.959921	0.0001*	F-Test =10.54466*
Lag of Economic Growth (EG <sub>it-1</sub> )	0.151060	0.116112	1.300990	0.1948	Adj.R <sup>2</sup> = 0.663935
Human Development (HD)	1.562744	0.596724	2.618872	0.0095*	D-W =2.002808
Political Freedom (PF)	0.497966	0.055984	8.894806	0.0000*	$\chi^2$ Hausman Test
					= 43.41515**

Note : D-W = Durbin-Watson Statistic ; SE = Standard Error

\* = Significant at alpha of 1 %., \*\* = Significant at alpha of 5 %., \*\*\* = Significant at alpha of 10 %

## DISCUSSION/ANALYSIS

The human development equation in Table 5 shows that variable of economic growth (EG), education infrastructure (EI), health infrastructure (HI), political freedom (PF), and lag of economic growth have a positive and significant impact on human development whereas the dropout rate variable (DR) and income distribution inequality (GR) have a negative influence on human development. All estimated variables in this equation have the expected sign, in line with the theory. In detail, these empirical results explain that economic growth (EG) is statistically significant at an alpha of 1% with a regression coefficient of 0.083471, interpreted that a 1 % increase in economic growth will lead 0.08% increase in human development. The results of this empirical study support the finding of previous research (Arisman, 2018; Asmita et al 2017; Sangaji, 2016; Ranis, 2004). Following the empirical finding results, previous studies have demonstrated that economic growth plays an important role in improving human development progress. Education infrastructure (EI) and health infrastructure variables (HI) can be significant at the significance level of 1 %, explained that an increase in education and health infrastructure by 1% causes an increase of 0.12 % and 0.02 % respectively in human development. These results of the current study support the finding which is reported by Trunajaya (2015) that government intervention through the provision of education and health infrastructure has a positive impact on improving human development. Furthermore, political freedom as one of the important elements in the development of democracy is found to be significant at a significance level of 10 % interpreted as a 1% increase in political freedom would stimulate human development progress by 0.009%. These results corroborate the previous study, which was conducted



by [Klomp and Haan \(2013\)](#). They concluded that democracy is positively related to basic human capital, while regime instability has a negative link with basic human capital. [Annaka and Higashijima \(2017\)](#) confirmed that democratization has a long-run effect on reducing infant mortality as a proxy of human development.

The economic growth equation in Table 5 demonstrates that the variable of human development (HD), private investment (PI), labor productivity (LP), and lag of economic growth (EGit-1)) statistically have a positive and significant influence on economic growth. However, democracy (DC) is insignificant, which corroborate the finding of [Tavares and Wacziarg \(2001\)](#). They concluded that democracy hinders growth by reducing the rate of physical capital accumulation and by raising the ratio of government consumption to GDP. The finding results are also supported [Santhirasegaram \(2007\)](#) confirmed that democracy freedom has a negative and insignificant impact on economic growth. In this study, human development (HD) is statistically found to be significant at an alpha of 1% with a regression coefficient of 2.382143, interpreted that a 1% increase in human development causes an increase in the economic growth of 2.38 %. The results of this empirical study are in line with previous research ([Sala-I-Martin, et.al. 2004](#); [Reza and Valeecha, 2012](#); [Lawal and Whab 2011](#)). Following the empirical findings, previous studies have demonstrated that human development significantly contributes to improving economic growth. Furthermore, private investment (PI) and labor productivity (LP) can be significant at the significance level of 1 % and 10 %, explained that an increase in private investment and labor productivity by 1% causes an increase by 0.15 % and 0.02 % respectively in economic growth. These empirical results support the finding of previous studies ([Makuyana and Odhiambo, 2016](#); [Korkmaz et al, 2017](#)). In line with the current study, they found that private investment and labor productivity contribute to accelerating economic growth significantly.

The democracy equation in Table 5 reports that the variable of human development (HD) and political freedom (PF) statistically have a positive and significant impact on the democracy variable (DC) at significance level (alpha of 1 %). The human development variable (HD) has a regression coefficient of 1.562744 explaining that a 1% increase in human development causes an increase in democracy by 1.56 %. The current results are consistent with the findings of previous studies ([Saha and Zhang, 2017](#)), which concluded that the link between economic growth and democracy has a positive impact on human development, but its influence is sensitive to the process of democratization and the level of economic development of a country ([Saha and Zhang, 2017](#)). The political freedom variable (PF) has a regression coefficient of 0.497966 explaining that a 1% increase in political freedom causes an increase in democracy by 0.50 %.

## CONCLUSION

This study attempt to build a modified human development index by incorporating two new dimensions, thus it can be utilized to measure and compare human development progress in the Indonesian province. The later analysis was advanced to examine the relationship between human development, economic growth, and democracy. The finding of this study revealed that there were significant ranking differences between MHDI and HDI-UNDP in 24 provinces of 33 Indonesian provinces. The most significant rank differences were found in several provinces, especially Maluku, West Java, Central Java, East Java, and Central Kalimantan. The highest rank difference was found in Maluku Province with a difference of 16 points and placing Maluku province in the 4th rank of 33 provinces in Indonesia indicating that the importance of democracy development must be in line with economic development, education, and health.

The empirical finding of this study shows that there is a strong two-way relationship between human development and economic growth. Other important findings show that there is a significant two-way relationship between human development and democracy. However, our empirical results did not find a significant linkage between economic growth and democracy. Education and health infrastructure, as well as political freedom, have a positive relation and significant impact on human development while private investment, labor productivity, and initial economic growth have a positive and significant impact on economic growth.

## IMPLICATIONS

This research has implications for the support of current government policies of Indonesia (Jokowi-Ma'ruf Amin) that focus on developing and improving the quality of human resources. Other implications are the development of statistics and econometric models, strengthening and verifying theories related to the relationship between human development, democracy, and growth.

Finally, our recommendation states that human development policies supported by rapid economic growth and democratic stability must be one of the development priorities through government spending and support from private investment (the private sector) which focuses on the development of education and health infrastructure throughout the Indonesian province. The implication of this study.

## LIMITATION AND STUDY FORWARD

The scope of the research findings results in a broader human development index, nevertheless, this study has not highlighted several dimensions such as inequality, the environment, crime rates, and technological progress. For further studies, the use of the three-stage least square (3SLS) method will produce more efficient, accurate, and high precision estimation results.

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## AUTHORS CONTRIBUTION

The first author designed the research methodology, stages of analysis, and conducted the data analysis of the first purpose. The second author was in charge of providing and processing data, performing the calculation with EViews software, and analyzing for the second and the third purposes of this study.

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