DETERMINANTS OF ECONOMY AND HUMAN DEVELOPMENT: A DECADE OF PROVINCES IN INDONESIA

Baiq Dwi Indar Parwangsa, Luluk Fadliyanti, Jaka Anggara
indardwi17@gmail.com
University of Mataram

Abstract

This study investigates how various factors affect the Human Development Index (HDI) across Indonesian provinces. It analyzes data from 30 provinces between 2013 and 2022, examining the influence of infrastructure, economic well-being (GRDP per capita), access to clean water and electricity, and unemployment and poverty rates. To account for overlapping factors, the research employs panel data regression with specific techniques to address multicollinearity. The results show that infrastructure investment and economic growth (GRDP per capita) significantly improve provincial HDI. This underlines the importance of prioritizing infrastructure development and inclusive economic strategies to achieve a better overall quality of life for Indonesians.

Keywords: *Human Development Index, Infrastructure, Indonesia, Ordinary Least Squares, Principal Component Analysis.*

INTRODUCTION

The main goal of development in the long term is to improve the welfare of the people in a country. This requires an investment in economic infrastructure development. Various studies on development are often an interesting discussion (Herdiansyah, 2022). The Human Development Index, as an ingredient of efforts to improve economic growth, is believed to affect the economic efficiency and growth of a country (Sahminan, Hermansyah & Rakhman, 2019). There are many problems of uneven infrastructure for health services, education, and also the distribution of clean water and electricity, which can reduce the quality of the human development index in a country.

Human development is one of the main goals of every country, especially for developing countries. In this case what is desired is the existence of equitable economic development in each region in a country. Because through an increase in a country's economic development is the key to improving the quality of its people. With the existence of economic development, it can directly and indirectly affect the quality of people in it (Azim, Sutjipto & Ginanjar, 2022).

The Human Development Index (HDI) is one of the important indicators to measure the level of welfare and progress of a country. HDI is calculated based on three main dimensions: health, education, and living standards. Understanding the factors that influence the HDI is essential to formulate appropriate policies to improve the quality of life of the people. This study aims to analyze the various factors that influence HDI, focusing on six main variables:

Employment conditions, Socioeconomic Status, Economic Income per Individual, Infrastructure, Regional Economic Performance, International Economic Engagement.

This study aims to analyze the impact of these factors on the Human Development Index at the Indonesian provincial level. Indonesia, with its unique characteristics as a vast archipelago, offers a rich context for analyzing the relationship between economic growth, infrastructure development and human development across its territory. This study makes a scholarly contribution to explore how these factors may influence the Human Development Index in each province. (Nainggolan et al., 2022). Indonesia with 38 provinces, with their own uniqueness and many cultures, certainly creates many differences in terms of thinking and human quality in each region. This study reveals factors that can measure human quality in each province.

Understanding the factors that influence HDI is very important to formulate the right policy. This study examines six main variables that affect HDI: labor conditions, socioeconomic status, income per individual, infrastructure, regional economic performance, and international economic engagement.

The linkages between economic growth, infrastructure development and human development form a complex relationship that shapes society. Classical economic theories, particularly those introduced by Solow (1956), emphasize the important role of capital in economic growth, stating that investment in physical capital is essential for increasing the productivity and output of the economy. However, these theories often neglect the important contribution of human capital and infrastructure to economic development.

LITERATURE REVIEW

Expanding on classical theories, Amartya Sen's Capability Approach (1999) argues that true development is achieved not only through economic growth but by expanding the capabilities to lead a good life. This framework highlights the importance of access to education, infrastructure and economic opportunities as critical to improving the human development index and thereby promoting human development.

At the micro level, investments in infrastructure such as roads, bridges and transportation systems can also improve accessibility to health and education services. This has positive implications for people's welfare and can improve the Human Development Index (HDI) of a country or region. However, it should be noted that the effectiveness of infrastructure in improving HDI also depends on equitable distribution as well as fair access for all levels of society. Infrastructure gaps between urban and rural areas, as well as between developed and underdeveloped regions, can lead to disparities in HDI achievement.

Therefore, economic and infrastructure development policies should be sustainable, taking into account the needs and aspirations of all communities. This will help reduce social disparities and improve overall quality of life, along with an increase in HDI. Thus, a holistic understanding of the relationship between economic growth, infrastructure development, and human development is key in achieving sustainable and inclusive development for society.

A statistical technique for data reduction, PCA. In an analysis, it helps in the reduction of the number of variables by indicating the order of variables whose combinations are not linearly correlated resulting in the most variance. In addition to reducing data, PCA eigenvectors are often examined to gain a better understanding of the underlying structure of the data.

Pearson (1901) and Hotelling (1933) were the first to propose PCA. This technique seeks to find the length of a linear unit combination of variables that have variances greater than a certain threshold. The first principal component is the most significant in terms of total variance. The second principal component has the largest variance among all linear combinations not associated with the first principal component, and so on. The variance of the final principal component is the lowest of all linear combinations of variable length units. Each component is orthogonal and contains a different amount of data.

Empirical studies investigating the relationship between economic indicators, infrastructure, and the Human Development Index (HDI) show significant impacts. (Leiwakabessy and Amaluddin, 2020) showed a strong relationship between human development, economic growth, and democracy in Indonesian provinces. Similarly, (Herdiansah and Pangestuty, 2022) and (Sahminan, Hermansyah, and Rakhman, 2019) developed an infrastructure index for Indonesia, highlighting the effectiveness of infrastructure investment in driving economic growth and improving human development outcomes.

Research on the infrastructure development gap and its impact on HDI (Azim, Sutjipto, and Ginanjar, 2022) underscores the important role of infrastructure in mitigating inequality and improving human development. The synergistic effect of infrastructure quality on economic growth, as identified by (Nurdina W, 2018), suggests the need to promote both to achieve maximum development impact.

RESEARCH METHODS
DATA AND VARIABLES
This study focuses on provinces in Indonesia between 2013 and 2022, evaluating the factors that influence the Human Development Index (HDI). The research uses a purposively selected sample of provinces, based on the availability and reliability of data for economic, social and infrastructure indicators. Specific indicators were: (a) provinces with comprehensive analysis of data on HDI, economic and infrastructure indicators from Statistics Indonesia (BPS), and (b) provinces with detailed records on social and economic development indicators. The data used is secondary data from the period 2013 to 2022. This approach involves all 30 provinces in Indonesia and does not involve new provinces because they have not reaped the results of relative data, it creates 300 data to be analyzed. The data used is quantitative in the form of panel data, which is a combination of time series data from 2013 to 2022 and cross section data from 30 provinces in Indonesia. Data sources are obtained from publications released by the Central Bureau of Statistics (BPS). The dependent variable in this study is the Human Development Index (HDI) which reflects the social and economic development status of a province. HDI is measured by combining indicators of life expectancy, education level, and per capita income. Data sources are obtained from publications released by the Central Bureau of Statistics (BPS).

Independent variables include economic, social, and infrastructure indicators (Table of Variables and Their Definitions). Economic indicators include Gini ratio (%), economic growth rate (GRWTH%), annual GDP (Log_GDRPAnn), foreign investment (Log_FDI), and GDP per capita (Log_GDRPPC). Social indicators include labor force participation rate (LFPR%), poverty rate (POV%), and open unemployment rate (UNEMP%). Infrastructure indicators consist of clean water distribution (WATSUP %), electricity distribution (ELECT %), and average road length (Log_RDLen). Each variable was selected based on its potential impact on HDI, with data sourced from Statistics Indonesia and other reliable sources.

To look the relationship between HDI and its factors, we use an empirical model and employ a panel data approach. This approach allows for the best results based on the characteristics and objectives of the study. We choose the approach with the best model that suits the nature of the data and the objectives of the study, following the guidelines of Wooldridge (2010). The Ordinary Least Squares Regression Model (M1) serves as an initial analysis to measure the overall impact of independent variables on HDI without considering unobserved heterogeneity. Fixed Effect Model (M2) introduces province specific to control for time invariant characteristics that may affect HDI. Random Effect Models (M3) consider interprovincial variation by introducing a unique error component for each province. These three models are explained as follows:

1) $HDI_{it} = \beta_0 + \beta_1 Economic\ Indicators_{it} + \beta_2 Social\ Indicators_{it} + \beta_3 Infrastructural\ Indicators_{it} + \epsilon_{it}$ M1

Where HDI_{it} is the Human Development Index for province i at time t. $Economics\ Indicators_{it}$, $Social\ Indicators_{it}$, and $Infrastructural\ Indicators_{it}$ represent the sets of economic and infrastructural variables, and ϵ_{it} is the error term.

2) $HDI_{it} = \beta_0 + \beta_1 Economics\ Indicators_{it} + \beta_2 Social\ Indicators_{it} + \beta_3 Infrastructural\ Indicators_{it} + \mu_i + \epsilon_{it}$ M2

Where μ_i represents the fixed effects unique to each province.

3) $HDI_{it} = \beta_0 + \beta_1 Economics\ Indicators_{it} + \beta_2 Social\ Indicators_{it} + \beta_3 Infrastructural\ Indicators_{it} + \mu_i + \upsilon_{it}$ M3

Where μ_i is the time-invariant province-specific random effect, and υ_{it} is the idiosyncratic error term.

To guarantee the results of the regression model, we use several statistical tests, namely the Hausman test to determine the fixed effect and random effect models based on the assumption results, we use the Variance Inflation Factor (VIF) to detect whether there is multicollinearity between independent variables, the Breusch-pagan test to test heteroscedasticity between independent variables in panel data, and the Wooldridge test to check for autocorrelation in the residuals of the regression model.

By using panel data regression models systematically and accompanied by statistical tests, this study aims to provide a deeper understanding of the determinants that affect HDI across Indonesian provinces. This methodology not only captures the complexity of regional development, but also ensures that the findings are robust, reliable and able to inform future research.

RESULTS AND DISCUSSION
Regression Results

We first conducted a regression model with M1, M2, M3, M4, and M5. Then we produce the results of comparing the determinants of HDI across the regression models and present the results of investigating the determinants of HDI using the panel dataset.

Comparison of HDI determinants across regression models

Variabel independen	M1		M2	M3	M4	M5	
	b/se	VIF	b/se	b/se	b/se	b/se	VIF
gini	-5.43	1.46	-7.482**	-6.625*	-6.625	-7.482	105.02
	-3.715		-2.758	-2.759	-3.851	-3.874	
lfpr	0,059	2.09	0,059*	0,056*	0,056	0,059	303.4
	-0,045		-0,024	-0,025	-0,048	-0,04	
pov	0,036	1.3	0,013	0,015	0,015**	0,013*	5.62
	-0,028		-0,012	-0,012	-0,005	-0,006	
watsup	0,049***	1.83	0,041***	0,044***	0,044*	0,041	57.11
	-0,012		-0,006	-0,006	-0,02	-0,021	
elect	0,210***	1.91	0,078***	0,095***	0,095***	0,078**	80,57
	-0,014		-0,012	-0,012	-0,026	-0,023	
grwth	0,01	1.3	-0,052***	-0,047***	-0,047***	-0,052**	2.89
	-0,037		-0,013	-0,013	-0,014	-0,015	
unemp	0,005	2.28	-0,141**	-0,130**	-0,13	-0,141	16
	-0,094		-0,047	-0,049	-0,075	-0,076	
log_gdrpann	0,530**	3.55	0,344	0,229	0,229	0,344	333.05
	-0,189		-0,196	-0,184	-0,352	-0,38	
log_fdi	-0,357**	2.66	-0,209**	-0.217***	-0,217**	-0,209*	30
	-0,114		-0,063	-0,066	-0,074	-0,078	
log_gdrppc	3.334***	1.82	5.208***	4.605***	4.605**	5.208*	426.27
	-0,291		-0,561	-0,48	-1.443	-1.945	
log_rdlen	-1.020***	1.68	0,771***	0,626***	0,626**	0,771**	190,66
	-0,21		-0,191	-0,183	-0,21	-0,263	
constant	15.491**		-5.173	1.902	1.902	-5.173	

	-5.702		-6.157	-5.381	-14.018	-19.458	
N	300		300	300	300	300	
R-squared	0,783		0,827			0,827	
F statistics.	94,35***		112.45***			97,60***	
Wald chi2				1163.46***	875.00***		
AIC	1312.031		584.994	.	.	582.994	
BIC	1356.477		629.439	.	.	623.735	
RMSE	2.113		0,663	0,698	0,698	0,629	
Chow test (F-constrained)			91,85***				
Breusch-Pagan LM				732.69***			
tes Hausman			-108.48				
Sargan-Hansen statistics.				42.31***			
Means VIF		1,99	140,96	140,96	140,96	140,96	1,99

Notes:

- Dependent variable: hdi
- Significance (two-tailed): p < 0.05 ** p < 0.01 *** p < 0.001
- M1: pooled, M2: fixed effect, M3: random effects, M4: re robust, M5: fe robust

Pooled Regression Model (M1)

In the initial pooled regression model (M1), the coefficient for the Gini ratio, a measure of income inequality, is not significantly associated with HDI (b = -5.43, SE = 3.715). Labor force participation rate (LFPR) presents an insignificant marginal effect (b = 0.059, SE = 0.045), and the poverty rate (POV) exhibits a small positive coefficient (b = 0.036, SE = 0.028) that is not statistically significant. Access to clean water (WATSUP) and electricity distribution (ELECT) are both significantly and positively correlated with HDI (b = 0.049, SE = 0.012, $p < 0.001$; b = 0.210, SE = 0.014, $p < 0.001$, respectively), suggesting that improvements in these infrastructure services strongly contribute to human development. The economic growth rate (GRWTH) and the unemployment rate (UNEMP) do not show significant relationships with HDI in this model.

Logarithmic transformations of economic variables reveal that Ln GDRP Annual (LOG_GDRPANN) has a positive and significant effect (b = 0.530, SE = 0.189, $p < 0.01$), while Ln Foreign Direct Investment (LOG_FDI) is negatively related to HDI (b = -0.357, SE = 0.114, $p < 0.01$). Ln GDRP Per Capita (LOG_GDRPPC) displays a strongly positive association with HDI (b = 3.334, SE = 0.291, $p < 0.001$), aligning with expectations that higher economic output per individual enhances human development. Intriguingly, Ln Average Road Length (LOG_RDLEN) demonstrates a significant negative impact (b = -1.020, SE = 0.21, $p < 0.001$), which may indicate that road infrastructure does not necessarily correlate with improved human development or may reflect inefficient allocation of resources.

Fixed and Random Effects Models (M2 - M5)

The fixed effects model (M2) has a more pronounced negative impact of the Gini ratio on HDI, thus yielding that income inequality impedes human development. This significant negative effect persists across random effects and robust models (M3, M4, M5).

Access to clean water remains a consistent positive significance across models, confirming the important role of water access in development, the impact of Electricity distribution although reduced, remains significantly positive in this model and attests to the importance of Electricity distribution for development. The level of economic growth in this model continues to have a negative impact on HDI, suggesting that the nature of economic growth or sectoral distribution may not necessarily favor human development. Higher levels of unemployment are detrimental to human development in this model.

The logarithmic variable, shows different results across models. Annual GDRP is reduced to a significant positive impact in this model, and GDRP Per-Capita consistently shows a positive and significant influence on HDI, which says that infrastructure development, in this model is beneficial to human development. The high average VIF values in the M1 and M3 models (ranging from 105.02 to 426.27) signaled a multicollinearity problem, which could lead to the deviation of regression coefficients and increase standard errors.

Diagnostic tests, Chow test, Breusch-pagan LM test yielded concerns of heteroskedasticity. The Hausman test and Sargan-Hansen statistic yielded two models, and favored a model that accounts for individual effects with robust estimation techniques. This choice is further supported by the M2 model which produces the lowest AIC and BIC values, indicating a better model fit than the M1 model.

The test results above underscore the complexity of measuring and analyzing human development and suggest that future research should incorporate techniques to reduce multicollinearity, thereby improving regression results and model interpretability.

To address multicollinearity among variables, Principal Component Analysis (PCA) was performed on the data consisting of 300 observations on 11 economic, social and infrastructure indicators. PCA aims to filter out linearly uncorrelated components that are not maximally influential in the data set. Initially, 11 components were grouped. The First Principal Component (Comp1) generated 27.61% of the total variance, which is the largest proportion compared to the next components. The lowest variance generated from PCA was Comp11 with a result of 1.56%.

Next, we used Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity to assess the adequacy of data sampling and the suitability of the data for performing PCA. The overall

KMO score is moderate at 0.552, while the Bartlett's Test shows a significant Chi-square statistic that proves the relationship between variables.

Panel a: Initial PCA Eigenvalues and Percentage of Variance Explained

Compoonent	Eigenvalue	Proportion	Cumulative
KOMP1	3.03751	0,2761	0,2761
KOMP2	1.63881	0,1490	0,4251
KOMP3	1.45264	0,1321	0,5572
KOMP4	1.20104	0,1092	0,6664
KOMP5	0,99609	0,0906	0,7569
KOMP6	0,97631	0,0888	0,8457
KOMP7	0,51253	0,0466	0,8923
KOMP8	0,43926	0,0399	0,9322
KOMP9	0,35055	0,0319	0,9641
KOMP10	0,22362	0,0203	0,9844
KOMP11	0,17162	0,0156	1

Panel b: KMO and Bartlett's Test Result for Initial PCA

Measure	Value
Kaiser-Meyer-Olkin (KMO)	0,552
gini	0,324
lfpr	0,439
pov	0,584
watsup	0,683
elect	0,465
grwth	0,305
unemp	0,550
log_gdrpann	0,616
log_fdi	0,663
log_gdrppc	0,732
log_rdlen	0,331
Bartlett's Test of Sphericity:	
Chi-Square	1079.593
df	55
p-value	0,000

Following the generation of the KMO measure, variables with KMO values less than 0.5 were considered inadequate for analysis and were therefore excluded. A subsequent PCA recalculated with the remaining six variables resulted in a KMO improvement of 0.725, indicating more maximized data for PCA.

Principal Component Analysis (PCA) results by removing variables with KMO <0.500

Panel a: Refined PCA Eigenvalues and Percentage of Variance Explained (Post-KMO Assessment)

Component	Eigenvalue	Proportion	Cumulative
Komp1	2.76285	0,4605	0,4605
Komp2	1.09185	0,182	0,6424
Komp3	0,770825	0,1285	0,7709
Komp4	0,662243	0,1104	0,8813
Komp5	0,460893	0,0768	0,9581
Komp6	0,251341	0,0419	1

Panel b. KMO and Bartlett's Test Result for Refined PCA

Measure	Value
Kaiser-Meyer-Olkin (KMO)	0,725
pov	0,5545
watsup	0,8832
unemp	0,7585
log_gdrpann	0,6936
log_fdi	0,7134
log_gdrppc	0,7683
Bartlett's Test of Sphericity :	

Chi-Square	510.537
df	15
p-value	0,000

Panel c. Rotated Component Matrix Post-Varimax Rotation

Variable	Komp1	Komp2	Komp3	Komp4	Komp5	Komp6
pov	0,0000	1.0000	0,0000	0,0000	-0,0000	0,0000
watsup	-0,0000	-0,0000	0,0000	1.0000	-0,0000	0,0000
unemp	1.0000	-0,0000	-0,0000	0,0000	-0,0000	-0,0000
log_gdrpann	0,0000	0,0000	0,0000	0,0000	1.0000	-0,0000
log_fdi	0,0000	-0,0000	0,0000	-0,0000	0,0000	1.0000
log_gdrppc	0,0000	-0,0000	1.0000	-0,0000	-0,0000	-0,0000

Also, a Varimax Rotation of the principal components was performed to obtain a clearer and more interpretable configuration, The unemployment rate (unemployment) has a large influence on Comp1, indicating labor market conditions. The poverty rate (pov) is prominent in Comp2, potentially indicating socio-economic status. Gross regional domestic product per capita (log_gdrppc) is an important variant of Comp3, representing individual economic output and wealth. Access to clean water (watsup) is a variant of Comp4, which emphasizes infrastructure adequacy. Annual gross regional domestic product (log_gdrpann) dominates in Comp5, which reflects regional economic performance. Finally, Comp6, dominated by foreign direct investment (log_fdi), alludes to international economic engagement.

These used components are then assigned a value for each observation, resulting in orthogonal values without multicollinearity and forming independent variables that can be used for regression analysis. The PCA results were robustly corroborated by the Bartlett's Test results, which confirmed the presence of significant correlations within the variables.

Result of Regression analysis based on the PCA scores

Independent Variables	PCA OLS Robust	PCA Fixed effect	PCA Random effect	PCA Fixed effect robust	PCA Random effect robust
	b/se	b/se	b/se	b/se	b/se
comp1_unemp	0,348	-0,210*	-0,212*	-0,210	-0,212
	-0,196	-0,104	-0,104	-0,157	-0,150
comp2_pov	0,332	0,038	0,054	0,038*	0,054**
	-0,261	-0,069	-0,070	-0,018	-0,018
comp3_log_gdrppc	1.413***	3.493***	3.016***	3.493*	3.016**
	-0,257	-0,356	-0,317	-1.335	-1.056
comp4_watsup	2.198***	0,978***	1.064***	0,978**	1.064***
	-0,248	-0,090	-0,087	-0,328	-0,297
comp5_log_gdrpann	1.165***	0,492	0,502*	0,492	0,502
	-0,251	-0,252	-0,244	-0,545	-0,542
comp6_fdi	-1.227***	-0,331**	-0,317*	-0,331	-0,317
	-0,304	-0,127	-0,128	-0,192	-0,181
_cons	69.979***	69.979***	69.979***	69.979***	69.979***
	-0,177	-0,046	-0,576	0,000	-0,651

N	300.000	300.000	300.000	300.000	300.000
R-squared	0,532	0,750	0,748	0,750	0,748
F. stats	66,72***	131,75***			
Wald chi2			777.55***		335.44***
AIC	1532.040	685.655	.	685.655	.
BIC	1557.966	711.582	.	711.582	.
RMSE	3.074	0,790	0,804	0,750	0,804
Chow Test (F-restricted)		143,82***			
Breusch-Pagan LM			732.69***		
tes Hausman		0,5897			
Sargan-Hansen stats.			16.589**		
Mean VIF	1.71	1.71	1.71	1.71	1.71

Notes:
- Dependen variable : HDI
- Significance (two-tailed) : p < 0,05 ** p < 0,01 *** p < 0,001
- Variable definition:
comp1_unemp: Score for component 1 (labor market conditions)
comp2_pov: Score for component 2 (socioeconomic status)
comp3_log_gdrppc: Score for component 3 (economic output per individual)
comp4_watsup: Score for component 4 (infrastructure)
comp5_log_gdrpann: Score for component 5 (regional economic performance)
comp6_fdi: Score for component 6 (international economic engagement)

Regression Analysis Results based on PCA scores

The regression analysis results based on PCA scores show the regression results comparing the OLS model with strong fixed and random effect models based on the new independent variables generated from the PCA process. The OLS model states that the labor market condition component of unemployment (comp1_unemp) contributes positively to HDI but is not significant, while both the FE and RE models show a significant negative relationship, thus seeing the detrimental impact of unemployment on HDI in a country.

The socioeconomic component (comp2_pov) is statistically insignificant in the OLS model, but achieves strong significance in the FE and RE models.) These results suggest that there is a positive relationship between socioeconomic status and HDI in various models, albeit not very large, thus reinforcing the importance of poverty alleviation to improve human development.

The Economic Output per Individual component (Comp3_log_gdrppc) shows a strong and positive relationship with HDI in all models. This strong relationship emphasizes the important role of individual economic productivity in driving HDI.

The infrastructure component (comp4_watsup) and the regional socioeconomic performance component (comp5_gdrpann) show a large positive impact on HDI in the OLS model, which is reiterated in the robust FE and RE models. Most notable is the impact of infrastructure, which confirms the importance of clean water access as a basic element of HDI.

In contrast, the component related to international economic engagement (comp6_fdi) shows a negative impact on HDI in the OLS model, but this impact is modest but still significant in the robust FE and RE models, suggesting a complex dynamic between foreign investment and HDI.

The FE model, with an R-squared value of 0.750 and the RE model with a squared value of 0.748 show substantial measures of fit. These Regression results with a Mean variance Inflation Factor (VIF) of 1.71 indicating low multicollinearity, support the strong preference of the FE model in the analysis of HDI determinants. The lower Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values of the FE model compared to the OLS model also support its selection. The reduced Root Mean Square Error (RMSE) of the FE model (0.750) compared to the RE model (0.804) provides additional support for its superiority in data fitting. Therefore, the FE model is chosen to be discussed in depth in this journal, with the results considered important to provide input for policies aimed at improving HDI in Indonesia.

The FE model provides results that show of the six components discussed, the most influential on HDI are the Infrastructure Component and the Economic Output per-Individual Component (Comp4_watsup) and (Comp3_gdrppc). Where the results of the FE model show the components that most affect HDI are infrastructure and regional economic performance Economic Output per Individual which includes Access to Clean Water, Electricity Distribution and GRDP Per-Capita.

The use of PCA has simplified a multifaceted set of variables into a structured form, which effectively overcomes multicollinearity and improves the accuracy of the regression model that is predicted to have a significant positive effect on HDI. The resulting components serve as suggestions for further refining the model and provide a clearer understanding of the determinants of human development.

The results of data analysis from this study explain that the infrastructure component and also the economic output component per individual show a positive sign and significantly affect the interregional human development index in 30 provinces in Indonesia. That is, if the infrastructure component and the output component per individual increase, the interregional human development index increases and vice versa. This result is in accordance with the statement of (Nainggolan et al., 2022). and also (Herdiansah and Pangestuty, 2022), and (Sahminan, Hermansyah, and Rakhman, 2019) which say that infrastructure and average economic output per person have a positive effect on human development and this result is also in accordance with classical economic theory. And also this result is in accordance with the statement (Azim, Sutjipto, and Ginanjar, 2022) which states that the importance of the role of infrastructure in human development, if an area has good infrastructure, it means that people in the region are able to become a workforce with high productivity so that it will increase economic growth and reduce inequality, then this will result in a good human development index (HDI).

(Nurdina W, 2018), also explains the importance of investing in infrastructure to be able to improve health and also make people get proper education. This has positive implications for the welfare of society and can certainly increase the Human Development Index (HDI) of a country or region. However, it should also be noted that improving HDI also depends on equitable distribution and fair access for all levels of society. Infrastructure gaps between urban and rural areas, as well as between developed and underdeveloped regions can cause disparities in improving HDI. Therefore, economic and infrastructure policies should be sustainable, taking into account the needs and aspirations of the people. This will help reduce social disparities, inequality, and improve overall quality of life, and will certainly increase HDI over time. Thus, the relationship between economic growth, infrastructure development, and human development is key to achieving sustainable development for society.

CONCLUSIONS AND SUGGESTION

Conclusion

This study confirms the importance of developing infrastructure and socio-economic factors in improving human development in all provinces in Indonesia. The research uses a comprehensive approach that emphasizes the importance of investing in basic infrastructure to improve the Human Development Index (HDI). The results provide a basis for policy-making that not only promotes economic growth but also ensures equity in the distribution of benefits across regions.

Suggestion

However, this study has limitations on secondary data and a limited number of variables. Future research is recommended to expand the scope of variables by considering aspects of environmental sustainability and social inclusion, to provide a more comprehensive understanding of the factors affecting human development relevant for diverse policy-making. To address this challenge, future research can utilize the insights provided by this study to delve deeper into the complex relationship between economic growth, infrastructure development and human development. This will guide academics and policymakers in designing effective and equitable strategies that lead to inclusive and sustainable development.

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