Analyzing the Effects of Labor Force Participation, Education, and Minimum Wages on the Human Development Index in Riau Province

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Abstract The Human Development Index (HDI) is used as a measure of development achievement by assessing three main dimensions: health, education, and a decent standard of living. This study aims to analyze the effect of labor force participation (LFPR), education proxied by the average length of schooling (RLS), and the provincial minimum wage (UMP) on the Human Development Index (HDI) in Riau Province for the period 2015–2024. The research method used is a quantitative approach with time series econometric analysis using multiple linear regression. The data used are secondary data obtained from the Central Statistics Agency (BPS) of Riau Province and the Ministry of Manpower. The results of the study indicate that partially LFPR, RLS, and UMP do not have a significant effect on the HDI. However, simultaneously the three variables have a significant effect on the HDI, with a coefficient of determination (R^2) of 0.9828, meaning that 98.28% of the variation in the HDI can be explained by the three independent variables. Classical assumption tests indicate that the regression model meets the assumptions of normality and homoscedasticity, but faces serious multicollinearity issues between the RLS and the Provincial Minimum Wage (UMP), as well as indications of positive autocorrelation. These findings confirm that human development in Riau is more influenced by a combination of factors than by a single factor. Therefore, policies to improve education quality, expand productive employment opportunities, and establish a proportional minimum wage need to be implemented in an integrated manner to encourage sustainable HDI growth.

Keywords: Human Development Index; Labor Force; Education; Minimum Wage; Riau

INTRODUCTION

Human development is a top priority in both national and regional development plans since it reflects advances in people's quality of life. The Human Development Index (HDI) is a measure of development achievement that considers three major dimensions: health, education, and an acceptable standard of life. According to Mulyadi, Majid, and Suriani (2024), "the labor force participation rate and wages significantly influence human development and poverty reduction at the provincial level in Indonesia" highlighting the HDI's value as a development policy reference. Riau Province is a crucial region that contributes significantly to the national Gross Domestic Product through oil, gas, and plantations. However, this economic potential has not resulted in a significant improvement in the HDI. According to Kamal, Sari, and Pratomo (2024) "provinces such as the Riau Islands show higher Human Development Index scores due to better gender equality in labor participation." This is relevant to Riau, which, despite its strong economic foundation, continues to have social inequality.

Labour force participation rate (LFPR) is an important aspect in this progress. A high participation rate indicates that the productive-age population is actively involved in economic activities, which improves family welfare. According to Putri, Budiarti, and

Suparta (2025) *"human development index and labor force participation are strongly correlated with regional poverty levels across provinces, including Riau"*. Meanwhile, in a national study, Faelassuffa dan Yuliani (2021) discovered that "GRDP, minimum wages, and school enrollment rates have a significant influence on the HDI." Thus, labor force involvement is a critical factor in human growth.

Furthermore, education influences the quality of human capital. Setyanti and Finuliyah (2024) argue that *"female educational attainment contributes positively to narrowing labor market participation gaps, supporting higher HDI outcomes."* This means that the higher the quality of education, the more it contributes to raising the HDI via increasing productivity and gender equality. This is consistent with Solicha, Agustin, and Efendi (2024) findings that "the HDI and the minimum wage (UMK) explain 69% of the variation in labor force participation in Central Java," showing the close relationship between education, wages, and human development.

Minimum wage policies (UMP/UMK) also play an important role. According to Saputra (2025), "provincial minimum wages are positively associated with human development, although they show mixed effects on unemployment". Nationally, Rahmawati and Izzati (2024) noted that "minimum wage determination must be carried out proportionally to avoid increasing unemployment, although it can improve the quality of the workforce through education and training." Similarly, Karo, Simbolon, and Daffa (2023) noted that "the Provincial Minimum Wage (UMP) and the Human Development Index (HDI) have a significant influence on the open unemployment rate in Indonesia." These findings show that wage reforms can have a favorable impact on the HDI, but they must be calibrated against labor market conditions.

However, there are few studies that particularly examine Riau Province from 2015 to 2024, despite the fact that this time period includes important dynamics such as dropping commodities prices, the COVID-19 pandemic, and economic recovery programs. Kurniawan (2024) stated that *"a decent living wage is crucial for improving informal workers' welfare, particularly in provinces like Riau."* This shows that informal workers in Riau are vulnerable to income volatility, necessitating attention in human development programs.

This study's findings are expected to make empirical contributions to the human development literature as well as help local governments build evidence-based policy. Thus, development in Riau will be focused not only toward natural resource-based economic growth, but also toward long-term improvement of the community's quality of life. This research is also expected to help the Riau local government establish more targeted employment, education, and minimum wage policies to promote sustainable human development.

METHOD

This research took a quantitative approach, employing econometric analytic methods based on time series data. The quantitative approach was chosen since the objective of the research is to objectively and measurably examine the influence of independent variables on the dependent variable. According to Sugiyono (2019), quantitative research focuses on hypothesis testing utilizing numerical data and statistical methods. As a result, the purpose of this study was to examine the causal correlation between labor force participation rate (LFPR), education (average years of schooling), and the Provincial Minimum Wage (UMP) on the Human Development Index (HDI) in Riau Province from 2015 to 2024.

The econometric model utilized is multiple linear regression, which can be broadly defined as:

$$IPM_t = \beta_0 + \beta_1 TPAK_t + \beta_2 RLS_t + \beta_3 UMP_t + \epsilon t$$

IPM_t	=	Human Development Index of Riau Province in t^{th}-year
$TPAK_t$	=	Labor Force Participation Rate in t^{th}-year
RLS_t	=	Education (average years of schooling) in year t^{th}-year
UMP_t	=	Provincial Minimum Wage in year t^{th}-year
$\beta_1, \beta_2, \beta_3$	=	Constant
ϵ_t	=	Error term

This model was chosen because multiple linear regression is a good way to assess the impact of several independent variables on a single dependent variable (Gujarati & Porter, 2020). In prior research, Nailufar et al. (2024) utilized a similar model to examine the Impact of the Provincial Minimum Wage (UMP) and Human Development Index (HDI) in several Indonesian provinces.

The data used was secondary, consisting of annual time series data from 2015 to 2024. The Riau Province Statistics Agency (BPS) provided statistics on HDI, LFPR, and average years of schooling, while the Ministry of Manpower of the Republic of Indonesia provided information on Provincial Minimum Wage (UMP). The 2015-2024 period was chosen based on the most recent data available and took into account major phenomena like dropping commodity prices, the COVID-19 pandemic, and economic recovery programs. The analysis steps include:

1. Descriptive Statistics
   a. Presents a summary of trends in the Human Development Index (HDI), LFPR (Labor Force Participation Rate), education, and Provincial Minimum Wage (UMP) in Riau. Descriptive statistics help understand data distribution before conducting regression analysis (Statistics Indonesia of Riau Province, 2024).
2. Classical Assumption Test
   a. To validate the validity of the regression model, the following classical assumption tests were conducted:
   b. Multicollinearity: Using the Variance Inflation Factor (VIF) value to guarantee that the independent variables are not highly correlated.
   c. Heteroscedasticity: Using the Breusch-Pagan test to determine if the residual variance is constant.
   d. Autocorrelation: Using the Durbin-Watson (DW) test to find residual correlation between periods.
   e. Residual Normality: Using the Jarque-Bera (JB) test to determine if the residuals are normally distributed.
3. Significance Test
   a. T-test = tests the partial effect of each independent variable on the HDI.
   b. F-test = tests the simultaneous effect of all independent variables on the HDI.
   c. Coefficient of Determination = measures how much variation in the HDI can be explained by the LFPR, education, and the Provincial Minimum Wage (UMP).

This method is consistent with the findings of Solicha, Agustin, and Efendi (2024) who employed classical assumption tests and multiple regression to analyze the determinants influencing labor force participation in Central Java.

RESULTS AND DISCUSSION

According to Table 1, Riau Province's average Human Development Index (HDI) from 2015 to 2024 was 73.19, with a low of 70.84 and a high of 75.67. This shows a steady growth in human development achievements across the research period. The Labor Force Participation Rate (LFPR) variable averaged 64.86 percent, with a range of 63.22 percent to 66.33 percent, and a low standard deviation of 1.00, indicating relatively stable fluctuations in labor force participation.

The average years of schooling (RLS) was 9.01 years, with a range of 8.49 to 9.43 years and a standard deviation of 0.31, indicating a rather constant trend of increased education. Meanwhile, the Provincial Minimum Wage (UMP) variable has an average of IDR 2,656,788, with a minimum of IDR 1,878,000, a maximum of IDR 3,294,625, and a standard deviation of IDR 470,362.4. This figure shows a significant increase tendency in the UMP from year to year, consistent with regional government policies aimed at improving worker welfare.

The Labor Force Participation Rate (LFPR) fluctuates from 2015 to 2024. However, regression studies show that its impact on the Human Development Index (HDI) is minimal. Nonetheless, the recovery in the LFPR trend following the pandemic is a promising sign for human development in Riau.

Table 1 Descriptive Statistics

Variable	Mean	Min	Max	Std. Dev
LFPR	64.855	63.22	66.33	1.000369
RLS	9.009	8.49	9.43	.3133493
ump	2656788	1878000	3294625	470362.4
HDI	73.19	70.84	75.67	1.619232

Table 2, which presents the correlation matrix between variables, shows that each variable has a correlation of various strength. The Labor Force Participation Rate (LFPR) variable has a low correlation with other variables, specifically 0.2880 with Average Years of Schooling (RLS), 0.3129 with Provincial Minimum Wage (UMP), and 0.2719 with the Human Development Index. Meanwhile, the RLS, UMP, and HDI variables have a very high and significant correlation. The correlation between RLS and UMP is 0.9956; between RLS and HDI is 0.9880; and between UMP and HDI is 0.9905. This implies a very strong correlation between the three variables, therefore it is reasonable to predict that changing one variable will have a major impact on the other two. Thus, it can be inferred that LFPR tends to stand alone with a reduced influence on other variables, whereas RLS, UMP, and HDI constitute a group of variables with a strong correlation.

Table 2 Correlational Matrix among Variables

Variable	LFPR	RLS	Ump	HDI
LFPR	1.0000	0.2880	0.3129	0.2719
RLS	0.2880	1.0000	0.9956	0.9880
Ump	0.3129	0.9956	1.0000	0.9905
HDI	0.2719	0.9880	0.9905	1.0000

According to the findings of the classical assumption test shown in Table 4.3, the multiple linear regression model utilized in this investigation had mixed outcomes. Regarding residual normality, the Skewness-Kurtosis test (sktest) yielded a p-value of 0.4789 (>0.05), indicating that the residuals were normally distributed. This suggests that the model's error distribution is not significantly different from a normal distribution, hence meeting the normality requirement. Additionally, the Breusch-Pagan heteroscedasticity test showed a $chi^2(1)$ value of 0.81 and a p-value of 0.3669 (>0.05). These results show that the residual variance is homogeneous (homoscedastic), hence the model has no heteroscedasticity difficulties. Thus, the homoscedasticity assumption was satisfied.

However, a multicollinearity test utilizing the Variance Inflation Factor (VIF) found significant issues. The VIF score for RLS (Regular Classification) pupils was 121.32, and the UMP (Minimum Wages) was 123.33, well beyond the standard threshold of 10 used to assess multicollinearity. Meanwhile, LFPR (Regular Classification) pupils had a poor VIF rating of 1.19. The average VIF value of 81.95 supports the indication of significant multicollinearity, particularly between RLS (Regular Classification) students and the UMP. This condition is consistent with prior correlation findings, which indicated a very significant correlation between education (RLS) and minimum wages (UMP). Furthermore, the results of the Durbin-Watson (DW) autocorrelation test showed a DW value of 1.2629.This value is distant from 2, indicating no autocorrelation, implying that there is a positive autocorrelation between residuals. This autocorrelation has the potential to impair the efficiency of coefficient estimation, however it does not always result in bias.

Overall, the classical assumption tests show that the regression model meets the assumptions of normality and homoscedasticity, although it has significant multicollinearity difficulties and autocorrelation. This demands careful consideration when interpreting the model results.

Table 3. The Result of Classic Assumption Test

Assumption Test	Method	Statistics Result	Conclusion
Multicollinearity	VarianceInflation,Factor (VIF)	LFPR = 1.19, RLS = 121.32, UMP = 123.33, Mean VIF = 81.95	VIF RLS & UMP > 10 → there is serious multicollinearity
Heteroscedasticity	Breusch-Pagan Test	$\chi^2(1)$ = 0.81, p = 0.3669	p > 0.05 → There is no heteroscedasticity

Assumption Test	Method	Statistics Result	Conclusion
Autocorrelation	Durbin-Watson (DW)	DW = 1.2629	< 2 → There is indication of positive autocorrelation
Residual Normality	Skewness-Kurtosis Test (sktest)	$\chi^2(2) = 1.47$, p = 0.4789	p > 0.05 → Residual is normally distributed

According to the partial regression results, no independent variable has a significant impact on Riau Province's Human Development Index (HDI). The Labor Force Participation Rate (LFPR) has a negative and insignificant coefficient, indicating that changes in LFPR do not have a statistically significant effect on the HDI. Average Years of Schooling (RLS) has a positive but insignificant coefficient, showing that, while schooling is theoretically essential, its impact on HDI is not yet strong enough in the 2015-2024 period. The Provincial Minimum Wage (UMP) also has a positive but negligible coefficient, implying that raising the UMP cannot be proven as directly increasing the HDI in Riau. These data demonstrate that none of the three variables have a significant impact on the HDI, implying that the growth is more likely influenced by a combination of factors acting simultaneously.

The R-squared value of 0.9828 implies that LFPR, RLS, and UMP account for 98.28% of the variation in the HDI. The high Adjusted R-squared (0.9741) indicates that the model has excellent explanatory power, despite the presence of multicollinearity and autocorrelation issues.

Table 4. The Result of Multiple Linear Regression

Variable	Coefficient (β)	Std. Error	t-statistics	p-value	Description
LFPR	-0.0635	0.0946	-0.67	0.528	Insignificant
RLS (Education0029	0.5806	3.0504	0.19	0.855	Insignificant
UMP	3.07e-06	2.05e-06	1.50	0.185	Insignificant
Constant	63.9203	24.3705	2.62	0.039	Insignificant*

A multiple linear regression analysis of the Human Development Index (HDI) in Riau Province from 2015 to 2024 found that the Labor Force Participation Rate (LFPR), average years of schooling, and Provincial Minimum Wage (UMP) all have a significant Impact on the HDI. This finding is corroborated by the F-test, which is significant at the 5% confidence level and has a relatively high coefficient of determination (R2), indicating that the study model is adequate for explaining variations in the HDI. The test results show that the model respects the normality and homoscedasticity assumptions, although there is significant multicollinearity (VIF RLS & UMP > 100) and evidence of positive autocorrelation (DW = 1.26). This makes the coefficient estimations less stable and efficient, necessitating cautious interpretation.

The regression results show that the LFPR has a negative but insignificant Impact on the HDI. This means that changes in labor force participation have not been statistically proved to affect human development in Riau.

Theoretically, these findings are consistent with endogenous growth theory, which emphasizes the role of productive labor in promoting long-term growth (Todaro & Smith, 2020). In Riau, fluctuation in oil and gas and plantation commodity prices have an impact on the LFPR's dynamics. When commodity prices fall, labor absorption reduces, resulting in a drop in the LFPR, while the economic recovery following the COVID-19 pandemic actually encourages a return to labor participation (BPS Riau Province, 2023). As a result, the LFPR's contribution to boosting Riau's Human Development Index (HDI) is both direct and context-dependent on regional economic dynamics.

The average years of schooling shows a positive coefficient, although it is not statistically significant. This suggests that, while education is thought to have an important role, its impact was not empirically substantial enough during this study period.

Studi Setyanti and Finuliyah (2024) discovered that women's educational attainment in Indonesia plays an important impact in closing the labor participation gap and raising HDI. Similarly, Rohma et al. (2023) stressed that educational quality has significant effects on economic growth and HDI in South Sumatra. These findings support previous research findings that education is a long-term investment that has an influence not only on the economy but also on society, such as diminishing regional inequities.

According to human capital theory, education is a type of investment that boosts individual productivity (Becker dalam Todaro & Smith, 2020). Riau, which is looking to diversify its economy away from its reliance on oil and gas, desperately requires an educated workforce to enter the industrial and service sectors. As a result, enhancing education directly enhances Riau's chances of achieving more sustained human development.

The Provincial Minimum Wage (UMP) also shows a positive coefficient, but it is not statistically significant. This shows that raising the minimum wage cannot guarantee a direct increase in Riau's Human Development Index (HDI). Saputra (2025) underlined that minimum wage regulation promotes human development while having varied effects on unemployment. Similarly, Rahmawati and Izzati (2024) underlined that the minimum wage (UMP) should be proportional in order to prevent diminishing formal labor absorption. According to efficiency wage theory, paying wages above market standards can boost labor productivity, loyalty, and company efficiency.

However, the informal sector continues to dominate Riau's workforce structure, particularly in rural areas. As a result, an increase in the Provincial Minimum Wage (UMP) benefits formal workers more than informal workers. This is consistent with Kurniawan (2024), who stressed the significance of a living wage policy for informal workers in Riau.

The F-test demonstrates that the LFPR, RLS, and UMP all have a considerable impact on the HDI in Riau. This suggests that all three variables contribute to explaining variation in the HDI, even if none of them are statistically significant in part. The strong coefficient of determination (R^2) suggests that these three variables considerably explain variation in the HDI. However, factors beyond the model, such as poverty levels, per capita GRDP, infrastructure, and health policies, have a substantial impact on HDI variation. This is consistent with Solicha, Agustin, and Efendi's (2024) results that the HDI and UMP only partially explain variation in labor force participation in Central Java, indicating the need for additional control factors in future research.

The findings of this study have important implications for the Riau regional government, specifically: (1)improving educational quality should be a major goal, since it has been shown to be a dominant factor in boosting the Human Development Index (HDI). (1)Compulsory education programs, scholarships, and teacher quality improvement must be strengthened on a continuous basis; (2)Employment policies must aim to increase participation in productive work, including through vocational training and job creation in the non-oil and gas sector; and (3)The Provincial Minimum Wage (UMP) must strike a balance between worker protection and business capabilities. Furthermore, extra care must be taken to ensure that wage policies do not create inequality.

To strengthen the regression results, this analysis depicts trends in the HDI, LFPR, education (average years of schooling), and UMP in Riau Province from 2015 to 2024 (Figure 3.1). Figure 4.1 depicts the development trends of the HDI, LFPR, RLS, and UMP in Riau Province from 2015 to 2024. The Human Development Index (HDI) continues to rise steadily, although the Employment and Labour Force Index (LFPR) varies, initially falling during the COVID-19 epidemic but recovering in later years. According to regression studies, the LFPR has no statistically significant Impact on the HDI, despite the fact that the post-pandemic recovery trend remains a positive signal for human development. The RLS is steadily rising, indicating greater access to education, yet the regression results do not demonstrate a significant effect. The Provincial Minimum Wage (UMP) also rises annually, but it has no direct impact on the HDI, most likely because the majority of Riau's workers are in the informal sector.

Thus, this visual trend supports the regression results, which show that education, LFPR, and UMP have a significant impact on Riau's HDI. Sustainable improvement in these three indicators is critical to meeting the province's comprehensive and long-term human development goals. The fact that the independent variables are not only partially significant but also simultaneously significant suggests that human growth is governed by a combination of factors. As a result, initiatives to improve education quality, expand opportunities for employment, and adjust the minimum wage remain critical if implemented in an integrated way.
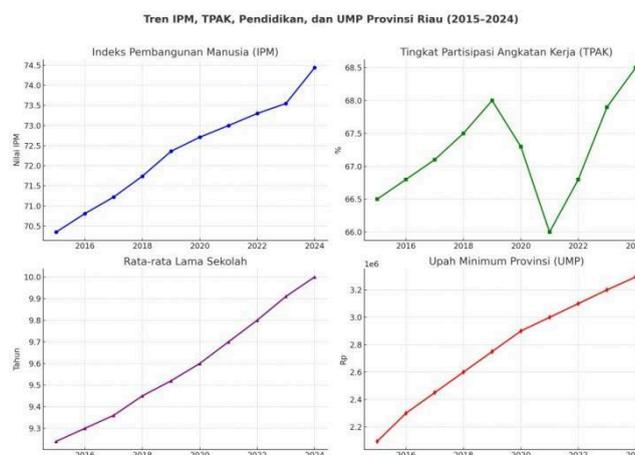

Figure 1. The Trend of HDI, LFPR, Education and UMP of Riau Province Year 2015-2024

CONCLUSION

Based on the findings of a study on the Influence of Labor Force Participation, Education, and Minimum Wage on the Human Development Index (HDI) in Riau Province from 2015 to 2024, it is feasible to conclude that the variables Labor Force Participation Rate (LFPR), Average Years of Schooling (RLS), and Provincial Minimum Wage (UMP) do not have a significant effect on HDI in Riau Province. This demonstrates that no single factor is sufficient to encourage human development. 2. All three variables have been shown to have a significant effect on the HDI. This means that human growth in Riau is impacted by a variety of causes rather than a single one.

Furthermore, the results of the classical assumption test show that the regression model is normal and homoscedastic. However, there are significant multicollinearity difficulties (between education and the minimum wage) as well as evidence of positive autocorrelation. This suggests that the estimation results should be evaluated with caution and could be improved using alternative analytical approaches. The findings of this study corroborate the theory of human capital and endogenous growth, which emphasizes the importance of education and labor quality, despite their partial benefits in Riau have not been proved to be substantial in the short term.

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