# THE IMPACT OF DIGITALIZATION ON THE HUMAN DEVELOPMENT INDEX IN ASEAN

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## Abstract

Digital transformation has driven economic modernization, requiring improvements in human well-being while ensuring energy consumption aligns with the Sustainable Development Goals. This study investigates the impact of digitalization, education, per capita income, renewable energy consumption, and economic growth on the Human Development Index (HDI) in seven ASEAN countries Indonesia, Malaysia, Singapore, Thailand, Cambodia, the Philippines, and Laos during 2015–2022, using panel data analysis and a fixed effects model. Data were obtained from the World Bank and the United Nations Development Programme. The findings reveal that individual internet usage, education expenditure, and economic growth significantly enhance HDI, highlighting the role of digital connectivity in improving quality of life. However, the study is subject to certain limitations, including the relatively short time frame, potential data availability issues, and the assumption of homogeneity across countries within the fixed effects model. Acknowledging these constraints is essential for contextualizing the findings and guiding future research toward more comprehensive, long-term, and heterogeneous analyses.

**Keywords:** Economic Growth, Education, Digitalization, IPM, Renewable Energy

## INTRODUCTION

The Human Development Index (HDI) is a multidimensional measure that reflects a nation's development beyond economic indicators alone. Introduced to shift the focus from purely economic metrics to a more human-centered evaluation of progress, HDI integrates indicators of health, education, and standard of living (Arisman, 2018). According to Rohima et al. (2023), HDI serves as a vital tool in assessing the well-being of a population, emphasizing the need for development that prioritizes human capabilities. Human capital, particularly a skilled and well-educated population, has a central role in driving economic growth and fostering societal prosperity (Adim, 2021). Consequently, nations are often categorized as developed, developing, or underdeveloped based on HDI scores, reflecting both individual well-being and the effectiveness of government development strategies (Prihastuti, 2018).

**Table 1.**
**Human Development Index in Seven ASEAN Countries**

| No | Country | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Singapore | 0,935 | 0,937 | 0,938 | 0,942 | 0,945 | 0,942 | 0,942 | 0,949 |
| 2 | Philippines | 0,696 | 0,696 | 0,700 | 0,706 | 0,714 | 0,705 | 0,692 | 0,710 |
| 3 | Indonesia | 0,698 | 0,701 | 0,708 | 0,712 | 0,718 | 0,712 | 0,707 | 0,713 |
| 4 | Malaysia | 0,792 | 0,798 | 0,800 | 0,802 | 0,805 | 0,802 | 0,798 | 0,807 |
| 5 | Thailand | 0,789 | 0,793 | 0,795 | 0,796 | 0,801 | 0,800 | 0,797 | 0,803 |
| 6 | Laos | 0,604 | 0,610 | 0,612 | 0,613 | 0,617 | 0,616 | 0,615 | 0,620 |
| 7 | Cambodia | 0,564 | 0,573 | 0,581 | 0,588 | 0,596 | 0,596 | 0,596 | 0,600 |

Source: UNDP

As shown in Table 1, ASEAN countries exhibit considerable variation in HDI rankings. Singapore, for example, holds the highest score of 0.949 and is classified as having "very high" human development. Malaysia and Thailand follow in the "high" category, while Indonesia, the Philippines, Laos, and Cambodia fall into the "medium" group. These disparities point to differing national priorities and capacities in areas such as education, health infrastructure, and economic opportunity.

A key factor in human development is education, which contributes directly to building human capital. It equips individuals with the knowledge and skills necessary to participate effectively in society and the economy (Tatyana et al., 2019). Moreover, education is a fundamental dimension of HDI. Investments in education lead to improvements in literacy, innovation, and long-term productivity (Iwan et al., 2024). In this context, digitalization has emerged as a transformative force. Technological advancements in telecommunications, e-learning platforms, and information systems have expanded access to education and knowledge, even in remote or underserved areas (UNESCO, 2024). Digital tools enhance educational quality and equity, thus supporting HDI improvement (Hilbert, 2016; Barlybaev et al., 2021).

Beyond education and digital access, economic conditions also have a significant influence on HDI. Increases in per capita income improve individual purchasing power and access to essential services, thereby raising living standards and welfare (Maidoni et al., 2015; Soebagiyo, 2000). Similarly, economic growth measured through increased output of goods and services contributes to reducing poverty and funding public goods such as healthcare and education (Syofya, 2018; Abdullah & Morley, 2014). The endogenous growth theory supports this relationship by emphasizing that sustained growth is driven by investments in human capital, innovation, and technology.

An additional but often underexplored determinant of HDI is energy consumption, particularly from renewable sources. Adequate energy supply is essential for infrastructure development, education delivery, healthcare access, and overall quality of life (Niu et al., 2013). Transitioning to renewable energy not only addresses sustainability goals but also supports long-term economic and human development by reducing dependency on fossil fuels and reallocating resources toward cleaner technologies (Kazar & Kazar, 2014; Wang et al., 2018).

Given the complexity and interrelation of these factors, this study aims to examine the effects of digitalization, education, per capita income, economic growth, and renewable energy consumption on HDI across seven ASEAN countries. The theoretical foundation is drawn from endogenous growth theory, which positions technological advancement and human capital investment as central drivers of development. The novelty of this research lies in its inclusion of digitalization and renewable energy as explanatory variables within the ASEAN context, a region that has received limited attention in this specific analytical framework.

## RESEARCH METHOD

This study aims to estimate the direction and magnitude of the influence of digitalization, education, per capita income, renewable energy consumption, and economic growth on the Human Development Index (HDI) in selected ASEAN countries. The analysis covers seven countries Singapore, the Philippines, Indonesia, Malaysia, Thailand, Laos, and Cambodia over the period 2015 to 2021. The research utilizes secondary data sourced from reputable institutions, including the World Bank and the United Nations Development Programme (UNDP).

To examine the relationship between variables, a panel data regression method is applied. Panel data analysis combines both cross-sectional and time-series dimensions, allowing for increased sample size, improved estimation efficiency, and better control for unobserved heterogeneity. The general form of the panel regression model is as follows:

$$Y_{it=}\beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The panel model was adjusted according to the research variables, resulting in the following formula:

$$HDI_{it=}\beta_0 + \beta_1 logGDPC_{it} + \beta_2 EDU_{it} + DGT_{it} + GROWTH_{it} + RE_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The inclusion of country-specific effects (μi\mu_iμi) and time effects (λt\lambda_tλt ) is intended to account for heterogeneity across countries and time, ensuring robustness in the estimation results. The expected direction of influence for each independent variable is informed by economic theory and prior empirical findings.

To determine the most appropriate estimation technique, three models were considered: Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Chow Test was conducted to compare CEM and FEM, yielding a p-value of 0.000 (< 0.1), indicating the FEM is preferable. Subsequently, the Hausman Test comparing FEM and REM also returned a p-value of 0.000, confirming the superiority of FEM.

Therefore, this study employs the Fixed Effect Model (FEM) as the final estimation technique. FEM is particularly suitable for controlling for omitted variable bias due to unobserved heterogeneity and is effective when dealing with data where individual units (countries) exhibit time-invariant characteristics, while variations occur primarily across entities rather than over time.

## RESULTS AND DISCUSSION

This research uses Eviews Software 12.0 for panel data regression analysis, applying Common, Fixed, and Random Effect Models as suggested by Syukron and Fahri (2018).

**Table 2.**
**Panel Data Regression Econometric Estimation Results**

| Variable | Regression Coefficient | | |
|---|---|---|---|
| | CEM | FEM | REM |
| C | 0,268458 | -0,591841 | 0,256871 |
| Log (GDPC) | 0,063553 | 0,161230 | 0,064382 |
| DGT | -0,000319 | -0,000463 | -0,000199 |
| EDU | 0,003605 | -0,002792 | 0,000578 |
| GROWTH | -0,001460 | -0,000745 | -0,000549 |
| RE | -0,002545 | -0,001084 | -0,002459 |
| R2 | 0,963702 | 0,995530 | 0,944050 |
| Adjusted $R^2$ | 0,960072 | 0,994412 | 0,938455 |
| F Statistic | 265,4964 | 890,8108 | 168,7315 |
| F Statistic Prob. | 0,000000 | 0,000000 | 0,000000 |

Source: Data processing using Eviews 12.0

### Chow Test

The selection of the best model between the Common Effect Model (CEM) and the Fixed Effect Model (FEM) in panel data analysis is conducted through the Chow Test (Widarjono, 2009). The hypotheses for the Chow Test are as follows: H0 indicates that the preferred model is the Common Effect Model (CEM), while Ha suggests that the Fixed Effect Model (FEM) is more appropriate. The decision is based on the probability values of the Cross-Section F and Cross-Section Chi-square tests. If the p-value is greater than 0.5, H0 is accepted, and the CEM is chosen. However, if H0 is rejected, the FEM is selected, and further analysis proceeds with the Hausman Test.

**Table 3.**
**Chow Test Result**

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| Cross-section F | 52,213227 | (6,44) | 0.0000 |
| Cross-section Chi-square | 117,282388 | 6 | 0.0000 |

Source: Data processing using Eviews 12.0 (2023)

Based on the results of the Chow Test shown in Table 3, the probability value of the Cross-section F and Cross-section Chi-square is 0.0000, meaning ($p < 0.5$), indicating that H0 is rejected, so FEM is selected and needs to be continued with the Hausman Test.

**Hausman Test**

The selection of the best model between the Random Effect Model (REM) and Fixed Effect Model (FEM) in panel data analysis is conducted through the Hausman Test. This test provides a statistical basis for evaluating whether FEM remains the more appropriate choice compared to REM, offering detailed guidance in selecting the optimal model for panel data analysis (Widarjono, 2009). The hypotheses for the Hausman Test are as follows: $H_0$: The appropriate model is the Random Effect Model (REM); $H_1$: The appropriate model is the Fixed Effect Model (FEM). In this test, REM is selected if the probability value of the Cross-section Random is greater than 0.5. If FEM is chosen based on the test result, no further testing using the Lagrange Multiplier (LM) is required.

**Table 4.**
**Hausman Test Results**

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 85,510586 | 5 | 0.0000 |

Source: Data processing using Eviews 12.0 (2023)

The results of the Hausman test analysis show that the Cross-Section Random probability value is at 0.0000 ($p < 0.5$), indicating that H0 is rejected. The Fixed Effect Model is the most appropriate model for the analysis.

**Fixed Effect Model (FEM) Estimation Model**

**Table 5.**
**Estimation Model**

$$HDI_{it} = -0{,}5918 + \underset{(0{,}0000)^{*}}{0{,}1612\log(GDPC)_{it}} - \underset{(0{,}0050)^{*}}{0{,}0004DGT_{it}} - \underset{(0{,}3007)}{0{,}0027EDU_{it}} - \underset{(0{,}0494)^{**}}{0{,}0007GROWTH_{it}} - \underset{(0{,}1344)}{0{,}0010RE_{it}}$$

R2 = 0,995530; DW = 2,301872; F = 890,8109 ; Prob. F = 0,00000

Source: Appendix 1. Note: *Significant at α = 0.01; **Significant at α = 0.05; ***Significant at α = 0.10; The numbers in brackets are the probability of the t-statistic value.

Based on the estimation results in Table 5, the Fixed Effect Model indicates that the variable log (GDPC) has a positive and statistically significant effect on the Human Development Index (HDI), with a coefficient of 0.1612 and a p-value of 0.0000. This suggests that an increase in per capita income is associated with improvements in human development. In contrast, the digitalization variable (DGT) shows a negative and significant coefficient of –0.0004 (p = 0.0050), a finding that may seem counterintuitive. Rather than attributing this solely to the misuse of technology—such as online gaming or digital fraud—a more rigorous interpretation would consider factors like digital inequality between urban and rural populations, poor data quality, or the limited impact of digital infrastructure in enhancing education and health services. These structural and contextual limitations could explain why digitalization, despite its growth, may not yet yield measurable improvements in HDI in certain regions.

Similarly, economic growth (GROWTH) also has a negative and statistically significant relationship with HDI (coefficient = –0.0007; p = 0.0494). This result points to the possibility that economic expansion in some contexts may not be inclusive. Growth concentrated in capital-intensive or extractive sectors, for example, may increase GDP without necessarily improving education or health outcomes, which are central components of HDI. Meanwhile, the variables education (EDU) and renewable energy (RE) exhibit negative but statistically insignificant coefficients, suggesting that within this model, they do not have a direct effect on HDI.

The overall model yields a very high coefficient of determination ($R^2$ = 0.9955), meaning that 99.55% of the variance in HDI is explained by the five independent variables. This is further supported by an F-statistic of 890.8109 and a corresponding p-value of 0.00000, indicating that the model as a whole is statistically robust. However, it is important to note that most of the coefficient magnitudes are quite small, highlighting a distinction between statistical significance and practical significance. While these variables may contribute to human development in measurable ways, their direct impact, as captured by this model, appears limited. Therefore, any policy implications drawn from these findings should be carefully contextualized within broader socioeconomic dynamics.

**Table 6.**
**Results of the Validity Test of the Influence of Independent Variables**

| Variable | t | Sig. t | Criteria | Conclusion |
|---|---|---|---|---|
| Log (GDPC) | 5,247955 | 0,0000 | < 0,01 | Significant at α = 0.05 |
| DGT | -2,955683 | 0,0050 | < 0,01 | Significant at α = 0.05 |
| EDU | -1,047207 | 0,3007 | > 0,10 | Not Significant |
| GROWTH | -2,020654 | 0,0494 | < 0,05 | Significant at α = 0.05 |
| RE | -1,525072 | 0,1344 | > 0,10 | Not Significant |

The validity test of the influence, known as the t-test, is presented in Table 5. Based on the data in Table 5, the independent variables that have a significant effect on the Human Development Index (HDI) include Digitalization, Gross Domestic Product (GDP), and Economic Growth. In contrast, the variables of Education and Renewable Energy do not show a significant influence.

**Discussions**

Based on the results of the panel data regression above, it can be seen that Digitalization, Per Capita Income, and Economic Growth have a significant impact on the Human Development Index (HDI) in seven ASEAN countries with a significance level of 1% and 5%. Meanwhile, Education and Renewable Energy Consumption have no significant effect. With a coefficient of 0.1612, Per Capita Income positively influences HDI. This result indicates that a 1% increase in per capita income will result in a 0.001612 increase in the HDI. This aligns with the study conducted by Adim (2021), which found that per capita income positively and significantly affects the Human Development Index in East Java Province. Singh et al. (2025) recently conducted research in 94 selected countries, finding that GDP per capita has a positive and significant effect on HDI.

Digitalization shows a negative and significant impact on the Human Development Index, with a coefficient value of -0.0004. This means that for every 1% increase in internet users, the Human Development Index will decrease by 0.0004. Technological development has a negative impact, especially in some developing countries, where internet use for unproductive activities like gaming, online gambling, and fraud does not support the improvement of human resources. This result is consistent with the study by Muhamad & Rahmi (2023), which found that technology has a negative and significant impact on HDI in West Java. Low digital literacy hinders the optimal use of technology, leading to inefficiency in internet use in society, thus failing to improve human resource quality.

Economic Growth shows a negative and significant effect on the Human Development Index. With a coefficient of -0.0007, this indicates that a 1% increase in economic growth will reduce the Human Development Index by -0.007. Economic growth that benefits mainly the middle and upper-income groups, such as capital owners, leads to inequality, while low-income communities still struggle to access quality education and healthcare, resulting in a decline in HDI. Economic growth is fluctuating in its effect on HDI, as the economic situation and various challenges faced by each ASEAN country differ. As shown in the research by Wang et al. (2018), economic growth negatively affects HDI in Pakistan. This finding is also consistent with previous studies by Umiyati et al. (2017) and Arifin (2015), which stated that economic growth does not have a significant effect on HDI because, although the economy continues to grow, poverty levels increase. This indicates that economic growth must be accompanied by a reduction in poverty levels. Meilita & Hasmarini (2024) conducted research in 43 Sub-Saharan African countries and found that economic growth does not affect HDI because rapid economic growth, when not allocated properly and wisely, will not influence HDI. However, research by Syofya (2018) and Dewi et al. (2017) found that economic growth significantly affects HDI.

Renewable Energy Consumption does not have a significant effect on the Human Development Index in ASEAN. The use of renewable energy cannot contribute to human development because its use is not yet efficient enough to support socio-demographic goals. Low production and limited resources in some countries make renewable energy consumption not significantly impact HDI. This result is consistent with the study by Wang et al. (2018), which found that renewable energy consumption is inelastic to HDI. In contrast to this finding, research by Pîrlogea (2012) and Niu et al. (2013) found that renewable energy has a strong and positive effect on human development.

Government expenditure in the education sector does not significantly affect the Human Development Index. This analysis indicates that increasing government spending in the education sector does not influence HDI. The allocation of the budget that is not fully dedicated to improving education quality, along with a lack of planning and implementation to build education, creates inequality in society's access to education. This is consistent with the research by Mongan (2019), which states that government expenditure in the education sector does not affect HDI. This suggests that investment in education needs more attention from the government (Rabab et al., 2022). In essence, higher government expenditure in the education sector should improve HDI. Research by Wijayanti (2018) found that Turkey succeeded in improving its HDI by focusing on the development of the education sector. Jam'an et al. (2024) also found that education has a positive and significant impact on HDI in Makassar city.

## CONCLUSION

This study aims to identify the factors affecting the Human Development Index (HDI) in selected ASEAN countries, such as Digitalization, Education, Per Capita Income, Economic Growth, and Renewable Energy. The methodology used is panel data regression with a fixed-effects model approach. The results show that HDI is influenced by factors such as Digitalization, Per Capita Income, and Economic Growth, while Education and Renewable Energy do not have a significant impact on this issue. This study enriches previous research on the influence of technology use and socio-economic conditions on HDI. The limitations of this study include the limited number of variables analyzed, as only Education, a component of HDI, was considered, thus not fully representing HDI comprehensively, and the relatively short observation period. To improve HDI overall, enhancing productivity and competitiveness in strategic sectors such as manufacturing and modern agriculture will drive higher per capita income. Inclusive economic growth, equitable infrastructure distribution in both urban and rural areas, and investment in labor-intensive sectors will create jobs and reduce unemployment. Focusing on infrastructure development that supports information and communication technology will open new economic opportunities. These factors will facilitate better access to education and healthcare, subsequently improving the quality of life for the population.

## REFERENCES

Abdullah, S., & Morley, B. (2014). Environmental Taxes and Economic Growth: Evidence from Panel Causality Tests. *Energy Economics*, *42*, 27–33. https://doi.org/10.1016/j.eneco.2013.11.013

Adim, A. (2021). [Pengaruh Jumlah Penduduk Dan Pendapatan Perkapita Terhadap Indeks Pembangunan Manusia (IPM) (Provinsi Jawa Timur Periode 2017-2019)]. *Jurnal Ekonomi Dan Bisnis*, *22*(1), 1–11.

Arifah, N., & Aisyah, S. (2024). Exploring The Dynamics Between Innovation And Human Development: Evidence From OIC Member Countries-Nurul Arifah et.al Exploring The Dynamics Between Innovation And Human Development: Evidence From OIC Member Countries. *Jurnal Ekonomi*, *13*, 2024. https://doi.org/10.54209/ekonomi.v13i02

Arifin, M. Y. (2015). *Pengaruh pengeluaran pemerintah sektor kesehatan, pengeluaran pemerintah sektor pendidikan dan pertumbuhan ekonomi terhadap indeks pembangunan manusia Jawa Timur 2006-2013*.

Arisman, A. (2018). Determinant of Human Development Index in ASEAN Countries. *Signifikan: Jurnal Ilmu Ekonomi*, *7*(1), 113–122. https://doi.org/10.15408/sjie.v7i1.6756

Barlybaev, A., Ishnazarova, Z., & Sitnova, I. (2021). Quality of Life of The Population: The Impact of Digitalization. *E3S Web of Conferences*, *295*, 1034.

Dewi, N., Yusuf, Y., & Iyan, R. Y. (2017). *Pengaruh kemiskinan dan pertumbuhan ekonomi terhadap Indeks Pembangunan Manusia di Provinsi Riau*.

Elfaki, K. E., & Ahmed, E. M. (2024). Digital Technology Adoption and Globalization Innovation Implications on Asian Pacific Green Sustainable Economic Growth. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(1), 100221.

Gorica, K., & Gumeni, A. (2013). Towards Sustainable Development: Relationship between HDI and GDP Per Capita in Albania. *International Journal of Scientific and Engineering Research*, *4*(12), 3–5.

Habibi, F., & Zabardast, M. A. (2020). Digitalization, Education and Economic Growth: A Comparative Analysis of Middle East and OECD Countries. *Technology in Society*, *63*(101370). https://doi.org/10.1016/j.techsoc.2020.101370

Hilbert, M. (2016). Big Data for Development: A Review of Promises and Challenges. *Development Policy Review*, *34*(1), 135–174.

Iwan, H., Isnan, P., Muhamaad, F., Muhammad, I., & Himawan, S. (2024). The Influence of Education Expenditure, Health Expenditure and Social Assistance Expenditure on Human Development Index in NTB Province in 2013-2022. *Management Studies and Entrepreneurship Journal*, *5*(1), 802–810.

Jam'an, A., Wulandari, S. A., & Warda. (2024). *The Influence of Education on the Human Development Index (IPM) in Makassar City*. https://journal.unismuh.ac.id/index.php/jeb

Kazar, G., & Kazar, A. (2014). The Renewable Energy Production-Economic Development Nexus. *International Journal of Energy Economics and Policy*, *4*(2), 312–319. www.econjournals.com

Kuswanto. (2021). The Impact of Economic Growth on the Human Development Index in Jambi Province in 2004-2019. *Asian Journal of Economics, Business and Accounting*, *21*(12).

Maidoni, D., Kadir, H., & Indrawati, T. (2015). *[Pengaruh Investasi Sumber Daya Manusia Dan Pendapatan Per Kapita Terhadap Indeks Pembangunan Manusia (IPM) Di Provinsi Riau (Disertasi Doktor, Universitas Riau)]*.

Mongan, J. J. S. (2019). Pengaruh pengeluaran pemerintah bidang pendidikan dan kesehatan terhadap indeks pembangunan manusia di Indonesia. *Indonesian Treasury Review*, *4*(2), 163–176.

Muhamad, A. R., & Rahmi, D. (2023). Pengaruh Teknologi, Tingkat Kemiskinan, Pengeluaran Pemerintah, dan Pertumbuhan Ekonomi Terhadap Indeks Pembangunan Manusia di Provinsi Jawa Barat 2007-2021. *Jurnal Riset Ilmu Ekonomi Dan Bisnis*, 45–52. https://doi.org/10.29313/jrieb.v3i1.1924

Niu, S., Jia, Y., Wang, W., He, R., Hu, L., & Liu, Y. (2013). Electricity Consumption and

Human Development Level: A Comparative Analysis Based on Panel Data for 50 Countries. *International Journal of Electrical Power & Energy Systems*, *53*, 338–347. https://doi.org/10.1016/j.ijepes.2013.05.024

Pîrlogea, C. (2012). The Human Development Relies on Energy. Panel Data Evidence. *Procedia Economics and Finance*, *3*, 496–501. https://doi.org/10.1016/s2212-5671(12)00186-4

Prihastuti, A. H. (2018). [Pengaruh Alokasi Belanja Modal Dan Pertumbuhan Ekonomi Terhadap Indeks Pembangunan Manusia Di Kabupaten/Kota Riau]. *Menata Ekonomi*, *4*(1).

Rabab, K. A. E. G., Mahmoud, M. S., & Wasem, W. E. (2022). THE IMPACT OF THE QUALITY OF EDUCATION ON SUSTAINABLE HUMAN DEVELOPMENT IN EGYPT. *Journal of Environmental Science*, *51*(7), 237–267.

Rohima, S., Junaidi, J., Nasyaya, A., & Hamira, H. (2023). Analysis of Human Development Index, Government Expenditure, Exports and Imports on Economic Growth in ASEAN-5. *Jurnal Ekonomi Pembangunan*, *12*(2), 92–101. https://doi.org/jep.v12i2.1171

Singh, K., Cheemalapati, S., RamiReddy, S. R., Kurian, G., Muzumdar, P., & Muley, A. (2025). Determinants of Human Development Index (HDI): A Regression Analysis of Economic and Social Indicators. *Asian Journal of Economics, Business and Accounting*, *25*(1), 26–34. https://doi.org/10.9734/ajeba/2025/v25i11630

Soebagiyo, D. (2000). [Disparitas Pembangunan Dan Faktor Faktor Yang Mempengaruhinya (Studi Kasus Di Daerah Sumbangsel)]. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, *1*(1), 21–34.

Sujarweni, V. W. (2019). *Metodologi Penelitian Bisnis & Ekonomi* (1st ed.). PT Pustaka Barupress.

Syofya, H. (2018). Effect of Poverty and Economic Growth on Indonesia Human Development Index. *Jurnal Ilmiah Universitas Batanghari Jambi*, *18*(2).

Syukron, M., & Fahri, H. M. (2018). *Pendekatan Regresi Data Panel untuk Pemodelan Jumlah Angkatan Kerja dan Penanaman Modal Luar Negeri terhadap PDRB Provinsi di Indonesia*.

Tatyana, B., Olha, K., Sergii, V., Tanya, K., Evgeniia, L., Vuksan, M., & Vanika, G. (2019). Influence of The Education Level of The Population on The Human Development Index. *Scientific Journal*, *5*(58).

Umiyati, E., Amril, A., & Zulfanetti, Z. (2017). Pengaruh belanja modal, pertumbuhan ekonomi dan jumlah penduduk miskin terhadap indeks pembangunan manusia di kabupaten/kota Provinsi Jambi. *Jurnal Sains Sosiohumaniora*, *1*(1), 29–37.

UNESCO. (2024). *Digital Learning and Transformation of Education*. https://www.unesco.org/en/digital-education

Wang, Z., Zhang, B., & Wang, B. (2018). Renewable Energy Consumption, Economic Growth and Human Development Index in Pakistan: Evidence form Simultaneous Equation Model. *Journal of Cleaner Production*, *184*, 1081–1090. https://doi.org/10.1016/j.Jclepro.2018.02.260

Widarjono, A. (2009). *Ekonometrika: Pengantar dan Aplikasinya (Edisi ketiga)*. Ekonisia.

Widarjono, A. (2018). *[Ekonometrika: Pengantar Dan Aplikasinya Disertai Panduan Eviews]: Vol. Edisi kelima*. Ekonisia.

Wijayanti, R. E. (2018). *Peningkatan Human Development Index (HDI) Sebagai Standar Pembangunan Negara di Turki.*

Yuris Meilita, F., & Indira Hasmarini, M. (2024). *Analysis of Factors Affecting the Human Development Index (HDI) in 43 Sub-Saharan African Countries 2018-2022*. https://journal.unismuh.ac.id/index.php/jeb