



THE NEXUS OF INDUCING DEVELOPMENT: MEASURE PATH DISCOURSES IN INDONESIA'S DYNAMIC LANDSCAPE

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ABSTRACT

The research objective underscores the importance of human capital, innovation, and research in fostering sustainable economic growth, with a focus on principal variables such as human capital development (measured by HDI), innovation and competitiveness (driven by FDI inflows), R&D expenditure, and employment dynamics. The research results reveals that FDI, R&D spending, and employment significantly impact TFP growth, with FDI inflows identified as a push driver of TFP growth by enhancing innovation and competitiveness. This research applies the research methodology ARDL model to delve into the factors that influence Total Factor Productivity (TFP), drawing on Romer's theory of endogenous growth. The research results also highlight the role of R&D expenditure in boosting TFP, emphasizing the need for a supportive environment for research and innovation. The labor force is also found to contribute significantly to TFP. The research further explores the interaction between the labor force and R&D, suggesting the need for policies that support both workforce development and innovation for sustained prosperity. The study also incorporates the concept of employment elasticity with respect to growth as a measure of inclusive development. It concludes by advising stakeholders to prioritize the promotion of FDI inflows, entice R&D spending, and treatise labor force issues to enhance TFP growth and ensure long-term economic prosperity. This underscores the importance of stakeholders' cooperation in leveraging investments for long-term economic prosperity.

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1. INTRODUCTION

The Indonesian economy needs to cope with worldwide instability and climate alter. Sustainable development arrangements might help mitigate worldwide climate alter and worldwide political unrest. Ssenyonga (2021) discovered a discrepancy between long-term and Covid-19 economic performance, which is mostly due to the impact of the pandemic on the economy and society. A sharp drop in aggregate demand due to decreases in household and corporate spending, investment, and exports caused an increase in open unemployment and underemployment.

While the government's prompt and broader response helped to mitigate the crisis's impact on the economy and vulnerable segments of society, the Covid-19 pandemic contributed to Indonesia's already-existing fundamental problems, such as de-industrialization, a wide urban-rural, East-West, and inter-regional digital divide; unemployment and underemployment; struggling human resource development; and low participation in global value chains.

According to Romer (1994) research on endogenous growth theory, the engine of economic growth is powered by internal factors such as human resource investment, innovation, and knowledge, all of which are essential for economic progress. The study emphasizes the positive benefits of technology and skill on economic development and growth. In the aftermath of Covid-19, Romer's concept, which emphasizes technological growth as well as knowledge accumulation, gains prominence. The notion claims that the limitless capacity of knowledge can drive economic revival even during difficult times. This emphasizes the importance of investing in education, skill development, and innovation. Furthermore, the pandemic has accelerated the move to sectors that rely significantly on new concepts, implying that creating a climate that encourages the accumulation and use of knowledge is critical for both economic resurgence and labor market sustainability. Endogenous growth theory predicts two key catalysts for long-term productivity increase: research and development (R&D) and human capital as forecasted by endogenous growth theory (Grossman & Helpman, 1991; Lucas Jr, 1988; Romer, 1990; Uzawa, 1965).

Gumus & Celikay (2015) conduct an in-depth empirical examination of the relationship between R&D expenditure and economic growth, examining if this relationship varies with development level. The study uses data from 52 nations from 1996 to 2010 and using a dynamic panel data model. The findings show that R&D spending has a large and beneficial long-term impact on economic growth in all countries, which is consistent with previous research. For developing countries, the influence is first weak but gradually strengthens. This study introduces new empirical evidence to the field. Their empirical findings suggest that more resources should be devoted to R&D activities in developing countries to accelerate growth and improve economic performance.

Numerous empirical research have been carried out to demonstrate the link between human capital development and economic success. Zerihun did a study in 2014 that looked at the relationship between human capital development and economic growth in Ethiopia. The study found a strong positive relationship between human capital development and economic growth. It also showed that long-term investments in human capital indicators like education and health can boost economic growth. The study stated that as the population grows, the government should work to establish an atmosphere that supports better education and healthcare, hence boosting economic growth (Zerihun, 2014).

Gebrehiwo (2016) conducted a distinct research examining the impact of human resources on the economic development of Ethiopia from 1975 to 2011. The investigative technique utilized in this research was the autoregressive distributed lag (ARDL) method for co-integration. The projected extended-term model indicates that human capital, in the aspect of health, has a significant beneficial effect on the increase of actual GDP per person, followed by the education of human expertise. The results of this study are consistent with the endogenous development theories. The short-term adjustment factor for the error correction term (ECT) is -0.7366, suggesting a yearly adjustments of about 73.66% towards long-term equilibrium. The findings of this research suggest that notable enhancements in economic productivity can be attained with an increase in the ratio of public spending on healthcare to gross domestic product (GDP) and an raise in secondary school admissions.

In a more recent research, Hakooma & Seshamani (2017) examined the impact of human resources on the economic rise of Zambia in the short and long run, using Johansen's co-integration test and the error correction model (ECM). The research, which utilized yearly information from 1970 to 2013, discovered a sustained correlation between economic rise and human resources. The projected long-term model indicates that human resources, particularly in terms of health, are the primary catalyst for actual per person GDP expansion, with education coming in second. These results are in accordance with the theories of endogenous growth, which suggest that improvements in human capital, such as educated and fit employees, increase efficiency.

Wahyudi (2021) resolved that in order to achieve a decent economic rebound after the Covid-19 pandemic, it is essential for decision-makers to prioritize the agricultural and industrial fields because of the substantial contribution value added they make. They proposed particular tactics for the rural industry, such as investments that can improve both financial and societal rewards, thus promoting economic development. They suggested creating a positive business climate and legal stability for the industrial sector, embracing advanced technology to enhance quality, efficiency, and productivity, and offering tax incentives. They also suggested introducing mentorship and incubation initiatives to cultivate processed goods from both industries, thus boosting their value-added. The reasoning for these suggestions is that the additional value from these two industries can serve as a stimulus for economic expansion, a assertion backed by the results of their research.

The research gap in this study arises from the fact that, while numerous empirical studies have examined the relationship between variables such as human capital, foreign direct investment (FDI), and research and development (R&D) on economic growth, there remains a lack of comprehensive investigation into the specific dynamics and elasticities of these factors in the Indonesian context, particularly in the post-pandemic era. Additionally, although existing literature highlights the significance of human capital and R&D on long-term productivity, studies focusing on the interaction between labor force dynamics and R&D investment remain limited. Furthermore, while FDI inflows are acknowledged as crucial to economic growth, their precise role in enhancing innovation-driven productivity and competitiveness in Indonesia needs further exploration, especially when considering the ARDL model to test both short-term and long-term relationships. This research seeks to bridge these gaps by applying the ARDL model to better understand the interplay between these factors, thus offering nuanced policy recommendations that can help foster sustainable economic development in Indonesia.

2. RESEARCH METHODS

This paper offers an approach for analyzing the link between factors driving endogenous economic growth in the face of global uncertainty. The study employs a quantitative approach, using data from the World Bank and Penn World Table spanning 1990 to 2022. The dependent variable in this research is Total Factor Productivity (TFP), which measures a country's economic efficiency. The independent variables in the model are FDI Net Inflows, Human Development Index (HDI), Employment, and R&D. This study used the Autoregressive Distributed Lag (ARDL) analytical method, which allows for the analysis of both long-term and short-term connections among variables.

The theoretical underpinning of this model will be based on the endogenous growth model. The endogenous growth model posits that advancements in technology and human capital are key drivers of output enhancement. To accurately gauge the effect of human capital development on Indonesia's national output, this study will employ the augmented Solow human-capital-growth model, adapted from (Ghosh & Parab, 2021; Kripfganz & Schneider, 2023; Orji et al., 2020). This can be since Solow's unique demonstrate did not particularly incorporate human capital.

The center presumption of this approach is that by growing the workforce and making strides its quality through way better education and healthcare measured in HDI, output can be expanded. Hence, the increased Solow demonstrate is characterized as takes after:

$$Y = A^\sigma K^\alpha (hL_Y)^{1-\alpha}, 0 < \alpha < 1 \dots\dots\dots(1)$$

When transformed into a log-linear form, it becomes,

$$\text{Log } Y = \alpha_0 + \alpha \text{log } K + \beta \text{log } L + v \dots\dots\dots(2)$$

The author adjusted the model to include additional variables, specifically HDI and employment. These two variables are integrated to represent human capital development. Furthermore, we incorporated the variables FDI and R&D, following the approach of Ghosh & Parab (2021).

$$\text{Log } Y = \alpha_0 + \alpha_1 \text{log } K + \alpha_2 \text{log } RD + \beta \text{log } L + \alpha_3 \text{log } HDI + v \dots\dots\dots(3)$$

The empirical model for this study can be expressed functionally as:

$$D(Y) = f(D(L), D(HDI), D(RD), D(FDI)) \dots\dots\dots(4)$$

The research model applied is the ARDL model as per Ghosh & Parab (2021), Kripfganz & Schneider (2023), and Orji et al. (2020):

$$\begin{aligned} \Delta TFP_t = & \alpha_0 + \sum \beta_i \Delta TFP_{\{t-i\}} + \sum \gamma_j \Delta FDI_{\{t-j\}} + \sum \delta_k \Delta R\&D_{\{t-k\}} + \\ & \sum \varepsilon_l \Delta HDI_{\{t-1\}} + \sum \zeta_m \Delta L_{\{t-m\}} + \theta_1 TFP_{\{t-1\}} + \theta_2 FDI_{\{t-1\}} + \\ & \theta_3 R\&D_{\{t-1\}} + \theta_4 HDI_{\{t-1\}} + \theta_5 L_{\{t-1\}} + u_t \dots\dots\dots(5) \end{aligned}$$

Where as: While Δ represents the first difference operator. TFP_t represents the Total Factor Productivity at time period t . FDI_t represents Foreign Direct Investment in time period t . $R\&D_t$ represents the R&D expenditure in time period t . HDI_t refers to human capital development; where it is emphasized on the Human Development Index (HDI) at time period t . L_t refers to the labor force where it is means Employment in time period t . α_0 is a constant. $\beta_i, \gamma_j, \delta_k, \varepsilon_l$ and ζ_m are the short-run coefficient. $\theta_1, \theta_2, \theta_3, \theta_4$, and θ_5 are the long-run coefficient. u_t represents the error term at time period t . While i, j, k, l, m are the lag-order.

3. RESULTS AND DISCUSSION

3.1. RESULTS

The normality test using the Jarque-Bera method showed a probability value of 0.9936, greater than $\alpha = 5\%$, indicating that the residuals are normally distributed. The stationarity test revealed that all variables (TFP, FDI, HDI, Employment, and R&D) are stationary, with ADF statistics smaller than critical values at 1%, 5%, and 10%. The autocorrelation test had an F-statistic probability of 0.1468, greater than 5%, showing no serial correlation. The heteroskedasticity test using the Breusch-Pagan-Godfrey method showed a probability of 0.3730, confirming homoskedasticity. Multicollinearity was ruled out with VIF values below 5 for all variables, so our model is free from multicollinearity. Lastly, the stability test using Cumulative Sum (CUSUM) indicated stability throughout the observation period.

Table 1. Results of Autoregressive Distributed Lag (ARDL) Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
TFP(-1)	-0.619245	0.351098	-1.763740	0.1158
TFP(-2)	-1.456913	0.319788	-4.555865	0.0019
TFP(-3)	-0.171409	0.332641	-0.515298	0.6203
TFP(-4)	-0.896413	0.289647	-3.094846	0.0148
HDI	-3.856999	0.844843	-4.565346	0.0018
FDI_INFLOWS	0.051422	0.007069	7.274119	0.0001
FDI_INFLOWS(-1)	0.047342	0.014030	3.374406	0.0097
FDI_INFLOWS(-2)	0.032382	0.010732	3.017249	0.0166
FDI_INFLOWS(-3)	0.004212	0.006973	0.604069	0.5625
FDI_INFLOWS(-4)	0.034432	0.009185	3.748747	0.0056
RD	0.404541	0.172521	2.344881	0.0471
RD(-1)	0.348186	0.204070	1.706207	0.1264
RD(-2)	1.489482	0.285600	5.215266	0.0008
RD(-3)	0.464151	0.255493	1.816692	0.1068
RD(-4)	0.305319	0.176405	1.730785	0.1217
EMPLOYMENT	0.010808	0.011942	0.904986	0.3919
EMPLOYMENT(-1)	0.058511	0.017426	3.357704	0.0100
EMPLOYMENT(-2)	-0.030574	0.016163	-1.891656	0.0952
EMPLOYMENT(-3)	0.054399	0.016003	3.399317	0.0094
EMPLOYMENT(-4)	-0.029329	0.009215	-3.182771	0.0129
C	1.705335	0.510502	3.340506	0.0102

Source: Processed data (2024)

Based on the ARDL model results in the table 1, here are the interpretations for the significant variables at their respective lags. Foreign Direct Investment (FDI) inflows play a significant role, on the current level, the first, second, and fourth lags contributing to TFP growth. Research and Development (RD) expenditure positively affects TFP, particularly on the current level and the second lag of RD. Employment also plays a role, with significance effects observed at various lags. Overall, the model explains approximately 98.68% (from the R^2) of TFP variation, indicating a robust fit to the data. These results underscore the importance of fostering innovation (through R&D and FDI) to enhance productivity and economic performance. Policymakers might prioritize these factors to promote sustainable growth and competitiveness.

Table 2. Cointegration Bound Test Results

Test Statistic	Value	K
F-Statistic	5.997010	4
Significance	I (0) Bound	I (1) Bound
10%	2.200	3.090
5%	2.560	3.490
1%	3.290	4.370

Source: Processed data (2024)

The results of the Cointegration Bound Test in the table 2 show that the F-statistic value (5.997010) is greater than the I(0) and I(1) values at the 10%, 5% and 1% significance level. The ARDL model estimation, indicated by the significant value of the F-test Bounds statistic, demonstrates the presence of a long-term cointegration between TFP and the explanatory variables.

Table 3. Long term Error Correction Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-4.143980	0.541936	-7.646624	0.0000
D(TFP(-1))	2.524735	0.388515	6.498416	0.0000
D(FDI_INFLWS(-1))	-0.071027	0.012813	-5.543279	0.0001
D(RD(-1))	-2.258952	0.335636	-6.730370	0.0000
D(EMPLOYMENT(-1))	0.005503	0.005565	0.988945	0.3407

Source: Processed data (2024)

The author uses the error correction test to measure long-run cointegration for each variable. The error correction test results in table 3 for each coefficient show that TFP, FDI inflows, and RD coefficients indicate a significant impact on the long-run cointegration of the model.

Table 4. Elasticity labor force to growth Scaled Coefficients Sample: 1990-2019

Variable	Coefficient	Standardized Coefficient	Elasticity at Means
C	0.139436	NA	0.028235
EMPLOYMENT	0.076124	0.03167	0.971765

Source: Processed data (2024)

Table 5. Elasticity labor force to growth Scaled Coefficients Sample: 2020-2022

Variable	Coefficient	Standardized Coefficient	Elasticity at Means
C	70.31233	NA	30.36752
EMPLOYMENT	-1.059230	-0.201775	-29.36752

Source: Processed data (2024)

The elasticity of employment with respect to growth is a measure of inclusive development, as discussed in Dartanto (2013). From 1990 to 2019 (in table 4), this relationship was positive, while from 2020 to 2022 (in table 5), it turned negative. In other words, during the earlier period, employment tended to increase alongside economic growth. However, the impact of the Covid-19 pandemic likely contributed to the reversal of this trend in recent years.

Table 6. Elasticity labor force to R&D Scaled Coefficients Sample: 1990-2022

Variable	Coefficient	Standardized Coefficient	Elasticity at Means
C	-1.297445	NA	-10.48664
EMPLOYMENT	0.022506	0.390738	11.48664

Source: Processed data (2024)

From table 6, show that the elasticity of employment is positive. This means that an increase in employment is expected to result in positive increase in the RD variable, assuming all other variables remain constant.

3.2. DISCUSSION

From the results, as we had identified, on current level, the first, second, fourth lags of FDI play a role in driving TFP growth. Encouraging FDI inflows through supportive policies and incentives can foster innovation and competitiveness. R&D spending significantly impacts TFP, especially on the current level and the second lag of RD. Promoting R&D investment by creating an enabling environment for research and innovation is essential. Employment also plays a role, with significant effects observed at various lags. Based on the result, from 1990 to 2019, employment and economic growth had a positive relationship as the economy expanded. However, from 2020 to 2022, this trend reversed, likely due to the impact of the Covid-19 pandemic. Addressing employment challenges arising from crises (like pandemics) is imperative to maintaining a positive employment-growth relationship. The interplay between employment and R&D resembles a tightrope walker's balance. As employment sways, so does the RD variable, a subtle alignment of progress. In this intricate performance, policymakers might compose harmonious policies that nurture both workforce development and innovation, ensuring sustained prosperity. Cooperation and shared vision among important stakeholders are essential to leverage R&D investments for long-term economic prosperity.

To enhance human capital, it is crucial to strengthen training programs and establish connections between education and industry. A skilled workforce significantly contributes to productivity gains and fosters innovation. By promoting lifelong learning and upskilling, individuals can adapt to changing economic demands, maintaining an agile and competitive workforce. Private investment in research and development (R&D) is essential for driving technological advancements (WIPO: World Intellectual Property Organization, 2023). Partnership among industry, researcher, and government plays a pivotal role in this progress. Governments might responsible for managing R&D expenditure data, conducting examinations, and verifying information from various sources, including international organizations like the World Bank. Entice firms to engage in innovative activities stimulates R&D efforts, leading to breakthroughs that benefit the overall economy. Grants, venture capital, and tax credits can further boost R&D investments. Research and Development in investment is important to raise productivity and sustainable development (Ghosh & Parab, 2021; S. M. Juhro, 2016; S. Juhro & Trisnanto, 2018).

Study by Shah et al. (2024) investigates the impact of research and development (R&D) activities on employment across 33 industries in Japan. The study finds that innovation leads to employment growth, both overall and within major industry groups. The benefits of technological progress are particularly evident in the manufacturing sector. The study also uncovers varying patterns of employment growth determinants based on the routine intensity level of industries, aligning with the compensation theory that links innovation to job creation. These findings can guide policymakers in formulating economic strategies that promote technological development in Japan and other countries with similar workforce and macroeconomic profiles. The research uses a panel dataset from 2002 to 2017 of Japanese industry sectors to explore the relationship between R&D spending and employment. The key takeaway from the paper is that innovation significantly contributes to job creation, supporting the compensation theory that the positive impacts of innovation surpass the potential job losses due to technological progress.

Choi (2022) revealed that Korea's shift towards a knowledge-based economic model resulted in significant changes in the job market. The study found an increase in the proportion of service jobs relative to manufacturing jobs, and industries requiring specialized knowledge and skills saw growth. Seoul emerged as a focal point for job creation, becoming a center for economic activity and employment opportunities. These shifts in job creation patterns underscore the need to support and foster the development of knowledge-intensive industries,

given their critical role in job creation and economic growth. Policymakers should prioritize the growth of knowledge intensive tradable service industries, given their importance in job creation. This can be achieved through targeted policies such as incentives for investment, promoting innovation and research and development, and enhancing workforce skills and education in these sectors. Such measures can help maintain job creation and economic growth during the transition to a knowledge economy.

Consistent with Choi's (2022) observations, research conducted by Inekwe (2015) also highlighted the positive impact of R&D expenditure on the economic growth of developing countries. Specifically, Ulku (2004) found a positive correlation between per capita GDP and the level of innovation in both OECD and non-OECD countries. However, the impact of R&D on innovation was found to be significant only in OECD countries with large markets. These findings support endogenous growth theories, but they do not provide evidence for constant returns to innovation via R&D, suggesting that innovation does not continuously drive economic growth.

Creating a conducive business environment by streamlining regulations is crucial for attracting Foreign Direct Investment (FDI). Countries that support investment tend to achieve higher economic growth rates. Multinational corporations facilitate knowledge transfer and technology spillovers, contributing significantly to overall economic development. Policymakers might explore innovative financing models like public-private partnerships and investment promotion agencies to attract FDI. Developing resilience strategies to mitigate the impact of future crises on employment and economic growth is vital. Providing support to affected sectors and business units during downturns ensures stability and minimizes disruptions.

In the long run, the disparity between anticipated long-term development and current socio-economic conditions calls for a reevaluation of our vision for the future. This involves reassessing and realigning existing policies with the factors that drive best practice performance. This includes significant investments in infrastructure development, strategic investments in improving the quality of human resources by aligning the education system's processes and outcomes with both the current and future skill demands of the labor market and investing in programs for reskilling and upskilling the workforce while also improving labor policies. It also involves strengthening and empowering micro, small, and medium-sized enterprises in the economy. However, the rapid development and implementation of digitalization across all sectors of the economy, all segments of society, and in both rural and urban areas should be the central focus of the development strategy. This will create a supportive environment that strengthens and deepens the country's increased participation in global trade, facilitates the relocation of global firms to Indonesia, and promotes research and development in both urban and rural area for instance, to attract funds and investment towards agricultural and industry improvements. Also the progression of a regulatory environment conducive to innovation and the protection of intellectual property rights (Ssenyonga, 2021; Wahyudi, 2021).

4. CONCLUSION

Increased investment in research and development (R&D) is essential for facilitating economic recovery and fostering long-term growth across various sectors. R&D serves as a catalyst for innovation, driving the development of new products and technologies that enhance productivity and efficiency. Companies that prioritize R&D can differentiate themselves in the marketplace, gaining a competitive edge that allows them to attract more customers and explore new markets. Additionally, R&D promotes collaboration between businesses, research institutions, and academic entities, leading to a synergistic exchange of knowledge and expertise that accelerates innovation. This collaborative environment not only benefits individual companies but also contributes to broader economic advancement by creating a dynamic ecosystem where ideas can flourish and lead to groundbreaking advancements.

To effectively attract R&D investment, governments can implement fiscal incentives that encourage businesses to allocate resources toward innovative initiatives. In particular, high-potential sectors such as renewable energy represent critical areas for investment, as they address urgent global challenges like climate change while also driving economic growth. Collaborative efforts with international partners can further enhance the R&D landscape, creating opportunities for knowledge transfer and joint ventures that amplify the impact of research initiatives. Furthermore, financial services can support these endeavors by providing tailored financial products and risk management tools that help businesses navigate the uncertainties inherent in R&D activities. By fostering a supportive environment for innovation through strategic partnerships and targeted funding, governments can significantly enhance the capacity for sustainable economic growth.

In the context of Indonesia, there are notable opportunities for diversification in sectors such as electrical machinery and medical apparatus. These areas not only hold the potential for significant economic contributions but also support higher wage growth, thereby improving the overall quality of life. By investing strategically in its working-age population, Indonesia can harness the talents of this demographic to drive productivity and innovation. Initiatives aimed at bridging the gap between the labor market and educational institutions can facilitate a smoother transition for graduates into the workforce, ensuring that the skills developed align with industry needs. Effective communication between government entities and investors is paramount in this process, as open dialogue fosters understanding and alignment on policies that support R&D investment. Through these collective efforts, Indonesia can enhance its global competitiveness, achieve sustainable economic development, and ensure long-term prosperity for its citizens.

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