DYNAMICS OF PROVINCIAL PER CAPITA GNP IN INDONESIA MODELING WITH GMM DYNAMIC PANEL ECONOMETRIC APPROACH

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ABSTRACT

This research aims to analyze determinants factors of economic growth among provinces in Indonesia during the period of 2016–2022 using a dynamic panel data approach. Gross Regional Domestic Product (GRDP) per capita serves as the main indicator of regional economic performance. The independent variables include road length, number of schools, average length of schooling, life expectancy, labor force participation rate (TPAK), skilled labor, and the Information and Communication Technology Development Index (ICT-DI). The estimation results show that human capital variables, especially average length of schooling and life expectancy, have a positive and significant effect on increasing GRDP per capita. The TPAK variable also shows a significant contribution in driving economic growth. On the other hand, physical infrastructure variables such as road length and number of schools have a significant negative effect, indicating that infrastructure development is not effective enough if it is not accompanied by an increase in quality and utilization. The skilled labor and ICT-DI variables do not show a statistically significant effect, indicating that there is still a gap between technological capacity and workforce skills. In addition, this research finds a process of economic convergence among provinces, with a convergence speed of 0.5094, which means around 50% of the gap in GRDP per capita can be corrected within one year. This finding emphasizes the importance of a development strategy that balances physical investment and strengthens the quality of human resources and digital transformation to support sustainable and inclusive regional economic growth.

Keywords: GRDP Per Capita, GMM, Convergence

INTRODUCTION

Economic growth is one of the main indicators in assessing a country's economic performance, as well as the basis for formulating long-term development strategies. In Indonesia, the dynamics of economic growth during the period 2016-2022 show a very complex phenomenon, influenced by the interaction of various domestic and global factors, ranging from the world economic slowdown, geopolitical tensions such as the trade war between the United States and China, to the crisis due to the COVID-19 pandemic which shook almost all sectors of the national economy(García-Algarra et al., 2025). Data from the Central Bureau of Statistics (BPS) shows fluctuations in the rate of economic growth: after an upward trend in 2017-2018, there was a slowdown in 2019, and even a contraction in 2020, before finally recovering in 2021-2022. This fluctuation is a challenge for Indonesia, which is working to realize its vision of becoming a developed country by 2045, where inclusive and sustainable economic growth is a key prerequisite(Ledhem & Mekidiche, 2021).

The most commonly used indicator in measuring economic growth, as well as a measure of people's welfare, is per capita income, which is calculated from Gross Domestic Product (GDP) divided by population (Șerban et al., 2022). However, given the geographical characteristics of Indonesia as an archipelago with a high level of inter-regional development disparities, measurement at the national level alone is not sufficient to describe the reality of development at the regional level. Therefore, Gross Regional Domestic Product (GRDP) per capita at the provincial level is a very important indicator to evaluate economic performance, map disparities, and formulate place-based development policies (Magazzino et al., 2021).

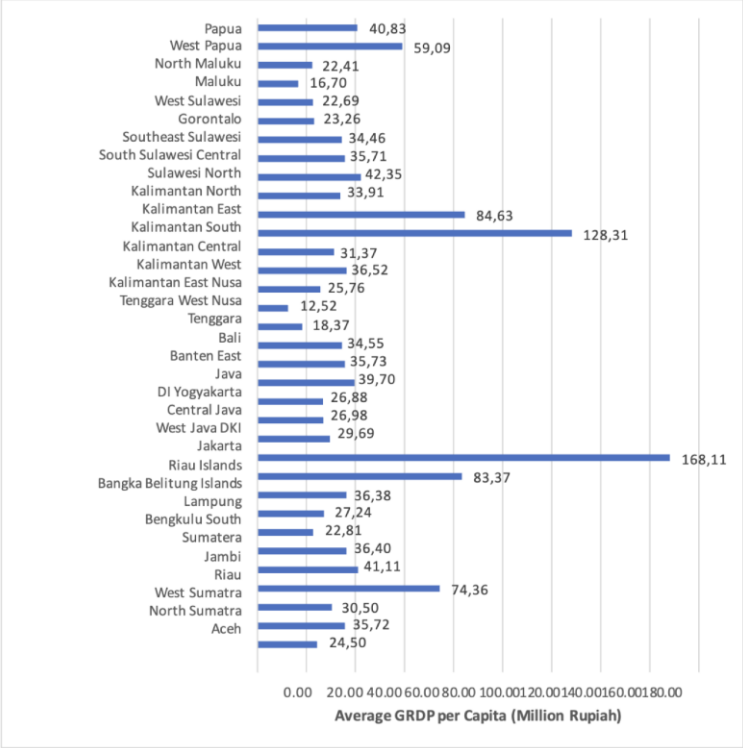

Figure 1.
Average Gross Regional Domestic Product per capita of Provinces in Indonesia Year 2016-2022
Source: Badan Pusat Statistik

BPS data shows that during 2016-2022, there is a stark disparity between the province with the highest GRDP per capita-DKI Jakarta at IDR 168.11 million-and the province with the lowest GRDP per capita-East Nusa Tenggara at only IDR 12.52 million (BPS, 2023). This gap emphasizes the need for a more targeted and data-driven policy approach to encourage convergence of economic growth between regions.

Classical to modern economic literature has highlighted the importance of factors such as physical capital (infrastructure), human capital (education and health), labor, and technology in influencing economic growth (Castelló-Climent & Domenech, 2022). In the Indonesian context, physical infrastructure such as the length of roads, the number of education and health facilities are basic elements that support economic activity, facilitate the distribution of goods and services, and increase people's accessibility to public services (Oshchepkov et al., 2023).

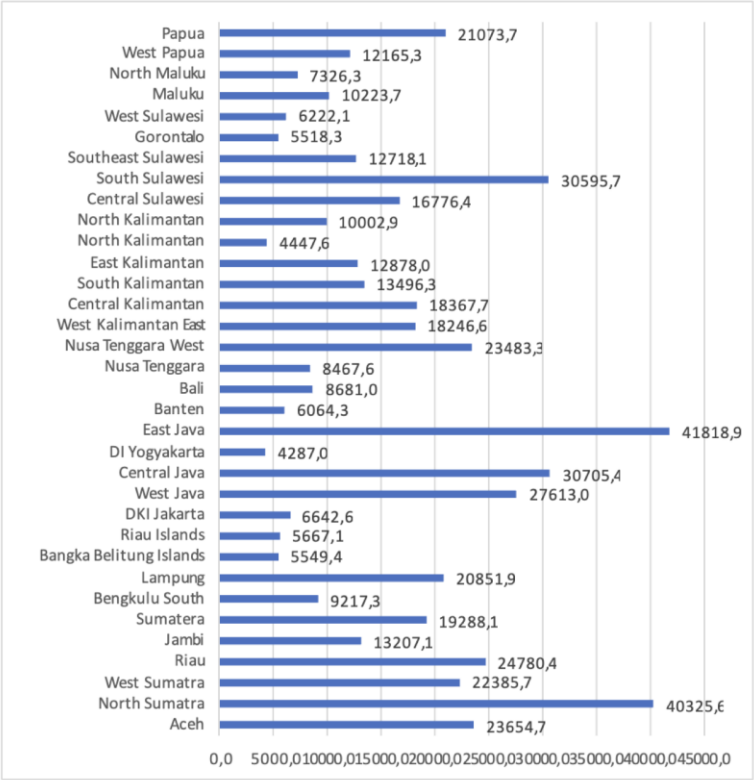

Figure 2.
Average Road Length of Each Province in Indonesia Year 2016-2022
Source: Badan Pusat Statistik

However, BPS data shows that the additional length of roads nationally during 2016-2022 is only around 10,259 km, with a very uneven distribution between provinces. Similarly, the number of education and health facilities shows growth, but the disparity between regions is still very visible. This raises crucial questions regarding the effectiveness of infrastructure investment in driving regional economic growth(Sanli & Arslan, 2025).

In addition to physical capital, human capital, measured through average years of schooling (RLS) and life expectancy (UHH) is also a major determinant of economic growth according to endogenous growth theory(Yetkiner et al., 2024). Improving the quality of education and health is believed to increase productivity, innovation, and economic competitiveness of a region.

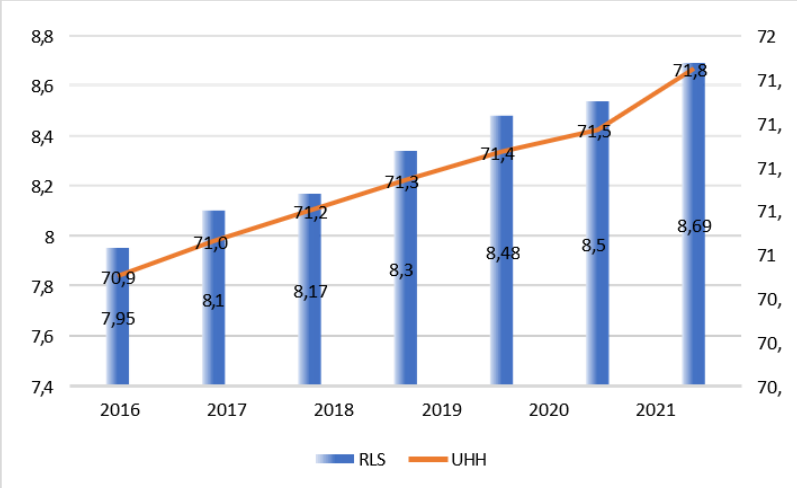

Figure 3.
Development of Average Years of Schooling and Life Expectancy in Indonesia 2016-2022
Source: Badan Pusat Statistik

However, BPS data for 2016-2022 shows that the national average years of schooling is still around 7-8 years, with significant gaps between provinces such as DKI Jakarta (11.1 years) and Papua (6.84 years). Similarly, life expectancy is highest in DKI Jakarta and DI Yogyakarta (74-75 years), while lowest in Papua (65-66 years). Previous research shows that average years of schooling and life expectancy have a positive effect on GRDP per capita growth, but regional disparities are still a major problem that has not been solved completely(JAMILU et al., 2024).

In terms of employment, the Labor Force Participation Rate (LPR) and the proportion of skilled labor have also received considerable attention in the economic growth literature (Garang & Erkekoglu, 2021).

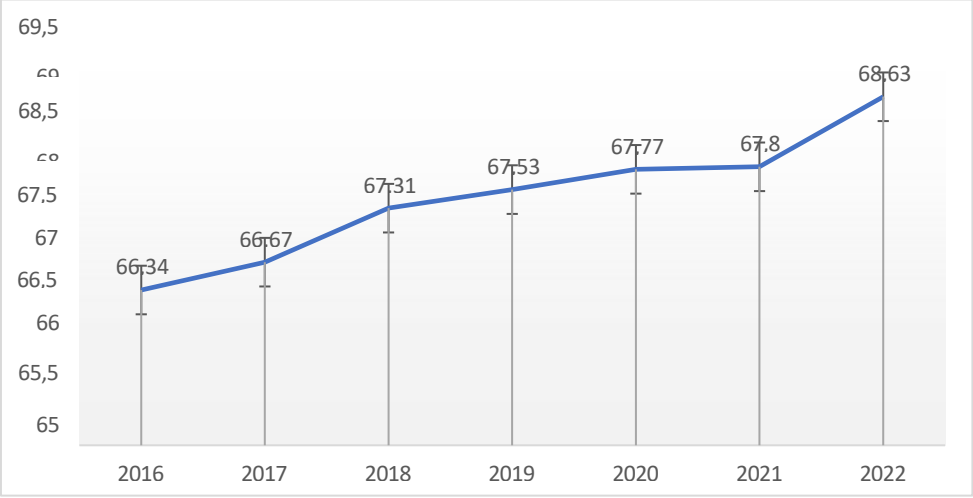

Figure 4.
Development of Labor Force Participation Rate (TPAK) 2016-2022
Source: Badan Pusat Statistik

A high TPAK indicates a region's capacity to optimize its human resources to support economic activity. However, during the 2016-2022 period, the national TPAK only ranges from 66-68 percent, and the proportion of educated labor is still very low outside Java. Research shows that an increase in TPAK contributes positively to GRDP per capita, although the effect of skilled

labor is not fully optimal due to the mismatch between skills and labor market needs (Coşkun & Demir, 2022).

Technological development, particularly through the Information and Communication Technology Development Index (IP-ICT), is increasingly recognized as a lever for modern economic growth (Gürler & Kara, 2023). This index reflects not only the availability of digital infrastructure, but also the readiness of human resources in utilizing technology to drive productivity and innovation. However, BPS data shows that in 2022, the IP-ICT gap between provinces is still wide: DKI Jakarta recorded a score of 9.0, while Maluku and Papua only 3.6. This phenomenon indicates that digital transformation has not been evenly distributed, and has not been able to significantly increase GRDP per capita in all provinces (Simionescu, 2022).

A review of previous research across countries shows mixed results regarding the determinants of regional economic growth. In India, Kumari & Sharma (2017) found a positive effect of economic and social infrastructure on growth, while Sabir & Musarrat (2020) in Pakistan found a negative effect of road length but positive on life expectancy. Research in Indonesia is also still limited to a static panel data approach, without integrating all aspects of physical capital, human capital, labor, and technology simultaneously in a dynamic framework (Bello & Ch'ng, 2022). There is no comprehensive study that uses the Generalized Method of Moments (GMM) to examine the dynamic influence of these variables on GRDP per capita among provinces in Indonesia, so this research gap is the main reason for the importance of this study.

Based on the explanation above, there are several research gaps that can be clearly identified. First, there is a lack of studies that simultaneously examine the influence of physical capital, human capital, labor, and technology in a dynamic panel framework at the provincial level in Indonesia. Second, most studies still use a static panel approach, without accommodating time dynamics and endogeneity among variables that are crucial to produce robust estimates. Third, there is no empirical mapping of the convergence of GRDP per capita between provinces using the GMM approach, even though the phenomenon of regional economic disparity is a central issue in the formulation of national development policies (Sheikh et al., 2024). Fourth, the aspect of mismatch between the number of skilled labor and the needs of the labor market and the not optimal utilization of ICT to encourage regional economic growth has not been widely studied empirically.

This study aims to fill the literature gap by analyzing the effect of road length, education facilities, health facilities, average years of schooling, life expectancy, labor force participation rate, skilled labor, and IP-ICT on provincial economic growth in Indonesia as measured by GRDP per capita (Das, 2023). The test is conducted with a dynamic panel data regression approach using the Generalized Method of Moments (GMM) method that is able to accommodate time dynamics and endogeneity between variables. Thus, this research is expected to provide theoretical contributions through the enrichment of empirical models of regional economic growth based on dynamic panel data, as well as practical contributions in formulating more inclusive and data-based regional development policies.

The novelty of this research lies in the multidimensional integration of physical capital (road length, education facilities, health), human capital (RLS, UHH), labor (TPAK, skilled labor), and technology (IP-ICT) in one GMM dynamic panel model that has never been done in the context of provinces in Indonesia for the period 2016-2022. The originality of the research also appears from testing the convergence of GRDP per capita between provinces and mapping the long-term impact of the determinant variables simultaneously. This study also empirically tests

whether investment in physical infrastructure, education, health, and digital transformation can really accelerate economic convergence and reduce regional disparities in Indonesia.

The formulation of the problems raised in this study are: "What is the effect of road length, education facilities, health facilities, average years of schooling, life expectancy, labor force participation rate, skilled labor, and IP-ICT on provincial economic growth in Indonesia as measured by GRDP per capita, and how is the process of convergence of GRDP per capita between provinces during the period 2016-2022 based on the GMM dynamic panel econometric model?"

RESEARCH METHOD

This research uses a quantitative approach with an associative design, which aims to analyze the causal relationship between various determinants and Gross Regional Domestic Product (GRDP) per capita in 34 provinces in Indonesia during the period 2016-2022. The type of data used is secondary data in the form of panel data (a combination of cross-section and time-series data), which is collected from the official report of the Central Statistics Agency (BPS) and supported by references from books, journals, and previous research. This panel data consists of data from 34 provinces (excluding 4 new provinces in Papua) with an observation time span of seven years. Observed variables include: GRDP per capita (a key indicator of regional economic growth), road length (km) as a proxy for economic infrastructure, number of schools (units) as educational infrastructure, number of health facilities (units) as health infrastructure, average years of schooling (years) and life expectancy (years) as proxies for human capital, labor force participation rate (percent) and number of skilled labor (people) as indicators of labor, and Information and Communication Technology Development Index (IP-ICT) as a proxy for technological progress.

The research model is constructed based on Solow growth theory and endogenous growth theory, with the following basic equation:

$$PDRB_{KAPITA}=PJLN+JSKL+JFK+RLS+UHH+TPAK+SLB+\text{IPTIK}$$

Description:

PDRBKAPITA	=	Gross Regional Domestic Product per capita (million rupiah)
PJLN	=	Road length (Km)
JSKL	=	Number of Schools (unit)
JFK	=	Number of Health Facilities (unit)
RLS	=	Average Years of Schooling (years)
UHH	=	Life Expectancy (UHH) (years)
TPAK	=	Labor Force Participation Rate (percent)
SLB	=	Number of Skilled Labor (people)
IPTIK	=	Information and Communication Technology Development Index (points)

Where all variables except TPAK were transformed to natural logarithm form to obtain elasticity interpretation and reduce heteroscedasticity. The analysis was conducted using STATA 17 software, which allows the estimation of a Generalized Method of Moments (GMM) dynamic panel model to address potential endogeneity, simultaneity, and lag effects of economic growth.

Model testing was conducted systematically in two stages: selection of the best estimation model between FD-GMM and SYS-GMM based on the results of the Sargan Test (instrument validity) and the Arellano-Bond Test (second-order residual autocorrelation), where the SYS-GMM model was selected because it met the criteria for instrument validity (Sargan Test p-value > 0.05) and there was no autocorrelation (AR(2) p-value > 0.05). Significance tests were conducted simultaneously (Wald test) and partially (Z test) with a significance level of 1% and 5%. Hypothesis testing is carried out for all independent variables, while the lag coefficient value of GRDP is used to calculate the level of β-convergence between provinces with the formula, namely the value of -ln(δ).

All data analyzed is provincial aggregate data that is open and published by BPS, so it does not raise issues of privacy or human research ethics. This study is committed to maintaining scientific integrity and methodological transparency, so that the entire analysis process can be replicated by other researchers using the same data and analysis code.

RESEARCH RESULTS

Development and Dynamics of Interprovincial Research Variables 2016-2022

Gross Regional Domestic Product per Capita (GRDP per Capita)

Gross Regional Domestic Product (GRDP) per capita is an important indicator to measure the level of prosperity and average economic output per individual in a region. Although it does not directly reflect income distribution, GRDP per capita provides a preliminary picture of production capacity, purchasing power, and relative welfare levels between regions. In Indonesia, with its diverse regional characteristics, the analysis of GRDP per capita is crucial to understanding the inequality and dynamics of economic growth among provinces.

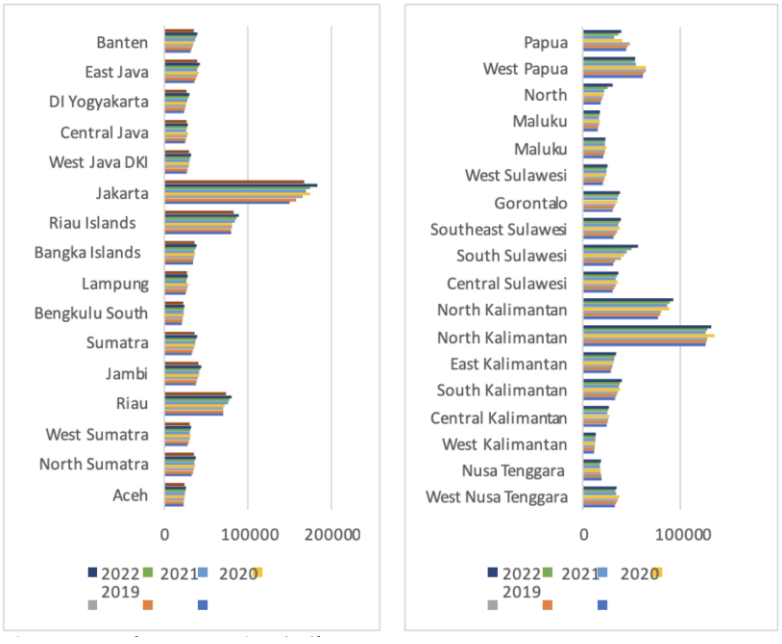

Figure 5.
Provincial GRDP per capita in Indonesia 2016-2022
Source: Badan Pusat Statistik

GRDP per capita shows an increasing trend in aggregate across all provinces despite fluctuations due to the COVID-19 pandemic. DKI Jakarta recorded the highest GRDP per capita (average of IDR 168.11 million/year), while NTT recorded the lowest (average of IDR 12.52 million/year). This confirms the existence of very real regional economic inequality.

Length of Provincial Roads

Infrastructure, particularly road networks, is a key element in supporting regional economic growth as it improves production efficiency, distribution, and inter-regional connectivity. Roads not only facilitate the mobility of people and goods, but also strengthen economic integration and access to public services. In Indonesia, road length is an important indicator of a province's basic infrastructure readiness. An equitable distribution of road networks plays a role in reducing regional inequality, encouraging the growth of productive sectors, and increasing regional competitiveness.

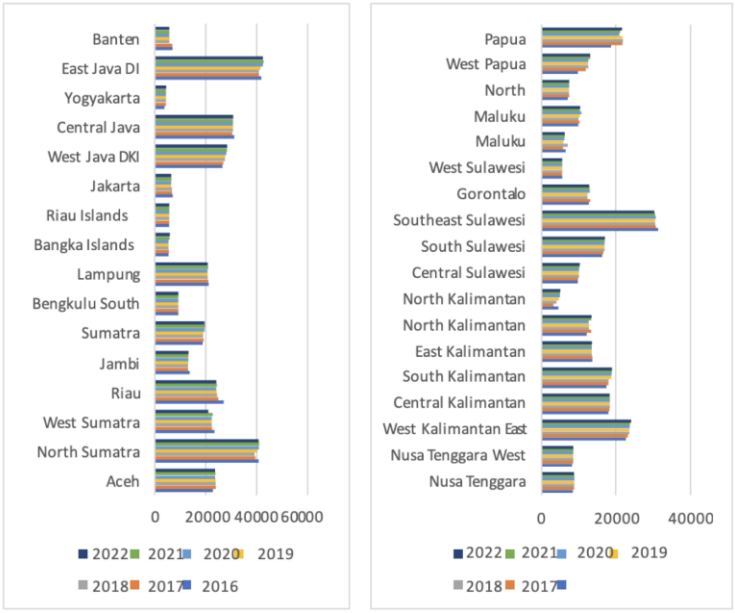

Figure 6.
Length of Provincial Roads in Indonesia 2016-2022
Source: Badan Pusat Statistik

Road length has increased in almost all provinces, with the highest average in East Java (41,818 km) and the lowest in DI Yogyakarta (4,287 km). In the eastern region, Papua has a relatively high road length (21,073 km), but with complex geographical challenges.

Number of Schools

The number of schools in Indonesia reflects the capacity of the formal education infrastructure at various levels. The provinces in Java, particularly West Java and East Java, have the highest number of schools - more than 36,635 units each - along with the high population and number of districts/municipalities. In contrast, around 18 provinces, especially in eastern Indonesia, such as North Maluku, Papua, West Papua, NTT, and North Kalimantan, have a total number of schools below 4,800 units.

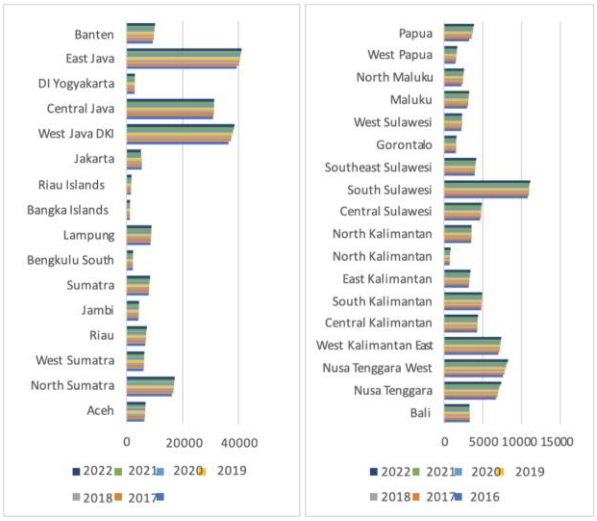

Figure 7.
Number of SD/MI, SMP/MTs, SMA/MA, SMK (Units) in Provinces in Indonesia 2016-2022
Source: Badan Pusat Statistik

West Java and East Java dominate the highest number of schools (>36,635 units), while West Papua and North Kalimantan have the lowest number (<1000 units). This shows the concentration of education infrastructure in areas with large populations.

Number of Health Facilities

Health facilities such as hospitals and health centers are important elements of social infrastructure that play a role in improving the quality of public health and labor productivity. Data for the period 2016-2022 shows an increasing trend in the number of health facilities in almost all provinces in Indonesia, although with variations in growth rates. Provinces with high urbanization and population levels such as DKI Jakarta, West Java, and East Java have the largest number of facilities, in line with the greater need for health services.

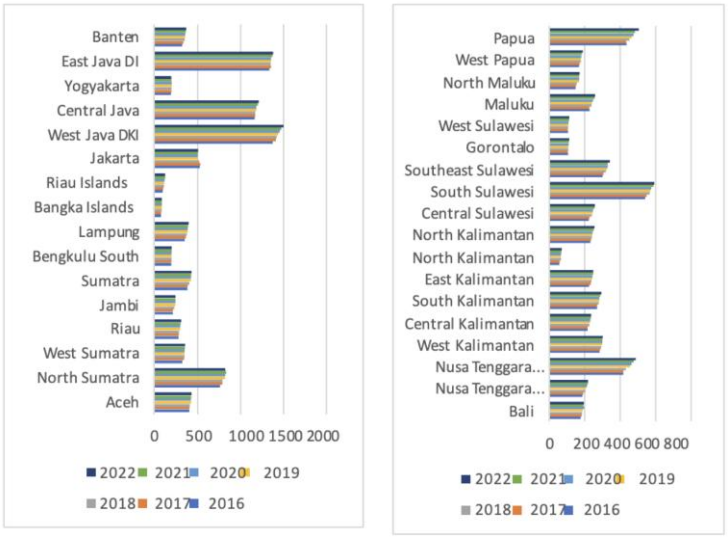

Figure 8.
Number of Hospitals and Health Centers (Units) in Provinces in Indonesia 2016-2022
Source: Badan Pusat Statistik

The provinces with the highest number of health facilities are West Java, East Java, and Central Java; the lowest are North Kalimantan, Maluku, and West Papua. This is strongly related to the population and distribution challenges in the archipelago.

Average Years of Schooling (RLS)

The average years of schooling (RLS) is an important indicator in human capital development as it reflects the number of years of formal education undertaken by the population aged 25 years and above. The higher the RLS, the better the quality of education and potential labor productivity in a region. During 2016-2022, most provinces showed a stable trend of increasing RLS.

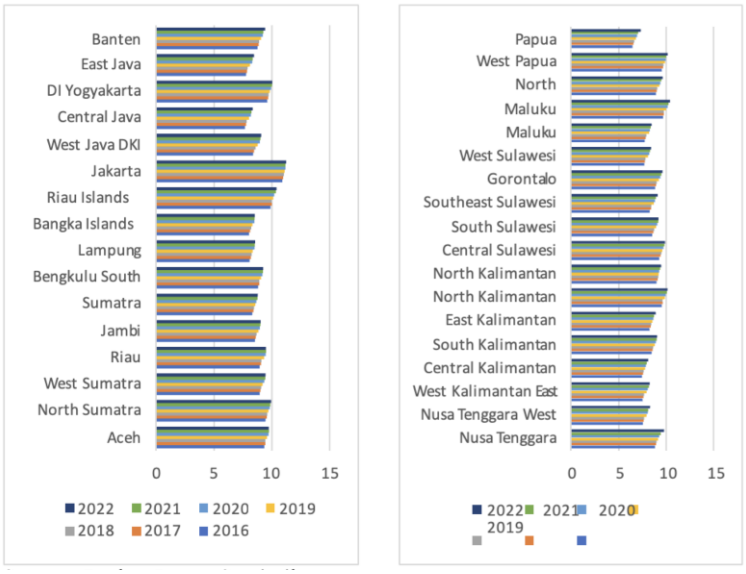

Figure 9.
Average Years of Schooling olah (years) of Provinces in Indonesia 2016-2022
Source: Badan Pusat Statistik

DKI Jakarta, DI Yogyakarta, and Bali recorded the highest RLS (above 9 years), while Papua had the lowest (6.84 years). This shows significant differences in access and quality of education between regions.

Life Expectancy (UHH)

Life expectancy (UHH) is a key indicator of community well-being, reflecting access to health services, nutrition, sanitation, and a decent living environment. Over the period 2016-2022, all provinces in Indonesia showed a steady upward trend in UHH, signaling continued progress in the health sector. Provinces such as Bali, DI Yogyakarta, Central Java, and East Java consistently recorded the highest UHH, reaching 73-75 years in 2022, reflecting the success of the health system and good quality of life. Meanwhile, provinces such as West Sumatra, Jambi, and Central Kalimantan are in the range of 70-72 years with gradual improvement.

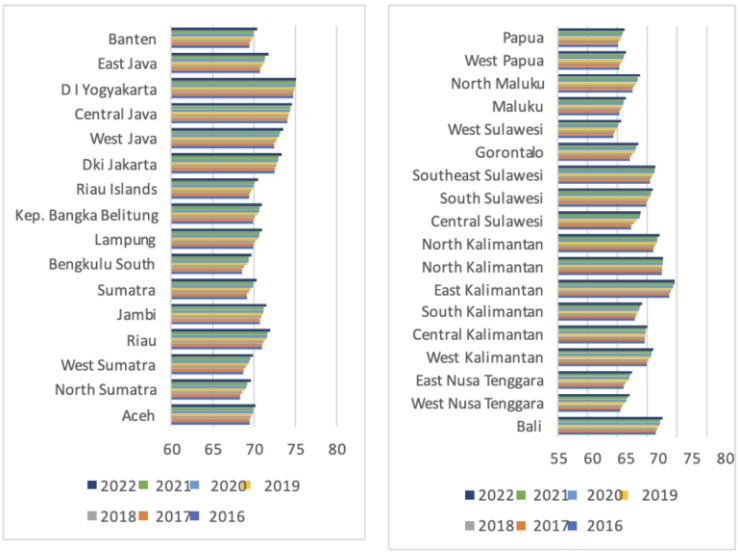

Figure 10.
Life Expectancy/UHH (Years) of Provinces in Indonesia 2016-2022
Source: Badan Pusat Statistik

UHH increased in all provinces, highest in DI Yogyakarta and DKI Jakarta (74-75 years), lowest in Papua (65-66 years). This illustrates the inequality in access to health services.

Labor Force Participation Rate (TPAK)

The Labor Force Participation Rate (TPAK) reflects the proportion of the working-age population (15 years and over) who are economically active, either working or looking for work, and is an important indicator to assess labor market conditions and regional productivity. During the 2016-2022 period, BPS data shows that Papua Province recorded the highest average TPAK in Indonesia, at 76.85%.

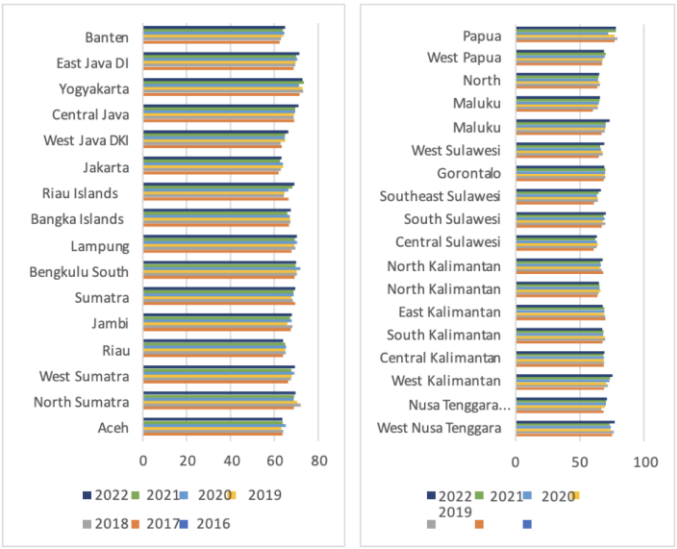

Figure 11.
Labor Force Participation Rate (percent) of Provinces in Indonesia 2016-2022
Source: Badan Pusat Statistik

TPAK is highest in Papua (76.85%) and Bali (75.05%), lowest in DKI Jakarta, Aceh, and North Sulawesi

Total Skilled Labor

In a modern economy, a highly educated workforce with technical, professional and digital skills is key to improving productivity, industrial competitiveness and technology adoption. In Indonesia, the economic shift from the commodity sector to value-added manufacturing and services requires a more equitable distribution of skilled labor across regions. During 2016-2022, almost all provinces recorded an increase in the number of skilled labor, driven by rising average years of schooling and expanding access to higher education. Although growth slowed in 2020 due to the pandemic, it recovered in 2021-2022.

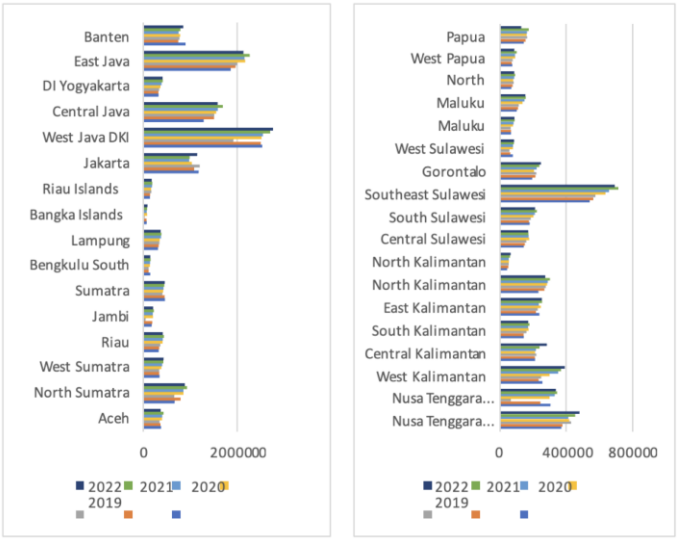

Figure 12.
Number of Skilled Labor (jiw a) Provinces in Indonesia 2016-2022
Source: Badan Pusat Statistik

West Java, East Java, and Central Java have the highest number of skilled labor (>1.5 million people each, while West Papua and North Kalimantan have the lowest (<100 thousand people).

Information and Communication Technology Development Index (ICT)

In the era of global digital transformation, a region's ability to provide reliable ICT infrastructure and empower its people productively is key to successful development. The Information and Communication Technology Development Index (IPTIK), compiled by BPS with a score range of 0-10, plays an important role in measuring the readiness of each province to face the industry 4.0 era. IPTIK covers aspects of device and network availability, internet usage intensity, and basic digital skills, which reflect the quality of human capital, public service efficiency, and regional investment competitiveness.

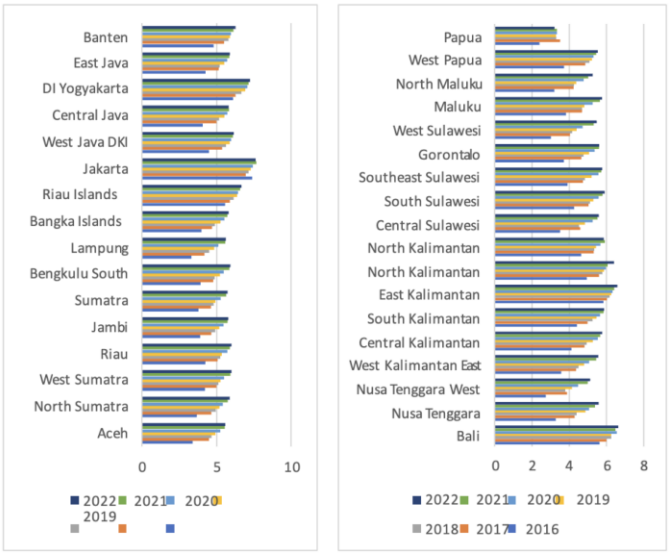

Figure 13.
Information and Communication Technology Development Index (points) of Provinces in Indonesia 2016-2022

DKI Jakarta, Bali, and DI Yogyakarta have the highest IPTIK (>7 on a scale of 0-10, while Papua, West Papua, and Maluku have the lowest (<3.6).

Descriptive Statistical Analysis

Table 1.
Descriptive Statistical Analysis

Variable	Observation	Mean	Std, Dev	Minimum	Maximum
GRDP per capita	238	42438,27	31772,57	11469	183598
Road length	238	15963,21	9964,74	3183	42521
Number of schools	238	7923,82	9574,09	754	41294
Total Health Facilities	238	381,22	333,04	56	1499
Average Years of Schooling	238	8,94	0,87	6,48	11,3
Life Expectancy	238	69,85	2,56	64,31	75,08
TPAK	238	67,99	3,52	60,18	79,02
Total Skilled Labor	238	454081,7	560733,6	28084	2770036
IPTIK	238	5,24 ,	0,94	2,41	7,66

Source: Data processed, Stata 17

Dynamic Panel Model Estimation Results (SYS-GMM)

In GMM Dynamic Panel Analysis, there are 2 models that must be tested to get the best model. These two types of models are First Difference Generalized Method of Moments (FD-GMM) and System Generalized Method of Moments of Blundell-Bond (SYS-GMM). To

determine the best model, it is necessary to conduct several tests, namely the Sargan Test, Arrelano Bond Test.

Table 2.
Sargan Test Results

Model	P-value	Description
First Difference GMM (FD- GMM)	0,0367	Invalid instrument
System Generalized Method of Moments from Blundell-Bond (SYS-GMM)	0,0534	The instrument is valid

Source: Data processed, Stata 17

The Arellano Bond test is used to ensure that the error term is not serially correlated in AR(2) so that the estimate obtained is consistent with the null hypothesis that there is no autocorrelation, namely the p-value of AR(2) >0.05.

Table 3.
Arellano Bond Test Results

Model	P value AR(2)	Description
First Difference GMM (FDGMM)	0,6262	No autocorrelation
System Generalized Method of Moments of Blundell-Bond (SYS-GMM)	0,2461	There is no autocorrelation

Source: Data processed, Stata 17

Based on tables 4.2 and 4.3, the System Generalized Method of Moments from Blundell-Bond (SYS-GMM) has met the requirements of the Sargan test and the arrelano bond test, so the model chosen in this study is the System Generalized Method of Moments from Blundell-Bond (SYS-GMM),

Table 4.
Estimation Results

Variable	Coefficient	Std. Error	z-Statistic	p-value
Lag1_LPDRB_KAP	0,600802	0,041351	14,53	0,000
LPJG_JLN	-0,120962	0.027165	-4.45	0,000
LJLH_SKL	-0.320577	0.082903	-3.87	0.000
LFK	0.269417	0.054887	4.91	0.000
LRLS	0.302191	0.097604	3.10	0.002
LUHH	3.147605	0.467756	6.73	0.000
TPAK	0.005473	0.001238	4.42	0.000
LSLB	0.001322	0.004110	0.32	0.748
LIPTIK	-0.228805	0.021735	-10.53	0.000

C	-7.447541	1.770862	-4.21	0.000
p value	0,00000			

Source: Data processed, Stata 17

Based on Table 4.4, the variables of road length and number of schools (SD/MI, SMP/MTs, SMA/MA, SMK) have a negative and significant effect on GRDP per capita at 1% significance level, while the number of health facilities, average years of schooling (RLS), life expectancy (UHH), and labor force participation rate (TPAK) have a positive and significant effect. The number of skilled labor has a positive but insignificant effect, while the Information and Communication Technology Development Index (ICT) has a negative and significant effect. The GMM dynamic panel equation model shows that the lag variable of GRDP per capita has a positive and significant effect on the current GRDP per capita, and the Wald test shows that all independent variables have a significant effect.

Table 5.
Long-term Estimation Results

Variable	Coefficient	Std. Error	z-Statistic	p-value
LPJG_JLN	-0.3030136	0.0597831	-5.07	0.000
LJLH_SKL	-0.8030531	0.2222708	-3.61	0.000
LFK	0.6748966	0.1719417	3.93	0.000
LRLS	0.7569957	0.2257742	3.35	0.001
LUHH	7.884824	1.249206	6.31	0.000
TPAK	0.0137103	0.0027344	5.01	0.000
LSLB	0.0033135	0.0103942	0.32	0.750
LIPTIK	-0.573163	0.0811038	-7.07	0.000

Source: Data processed, Stata 17

Based on the estimation results of the long-term influence on GRDP per capita in Table 4.5, it can be seen that the pattern of influence of the independent variables in the long term is generally consistent with the influence observed in the previous short term. Both the direction of the relationship (positive or negative) and the level of statistical significance of most variables remain similar, indicating the stability of the causal relationship between variables over a longer period.

Effect of Road Length on GRDP Per Capita

The estimation results show that road length has a negative and significant effect on GRDP per capita. This finding indicates that during the 2016-2022 period, the increase in road length has not been able to boost regional economic growth. This is due to the mismatch between the increase in quantity and quality of road infrastructure, such as the lack of maintenance and low construction standards. Damaged roads increase logistics costs and reduce the efficiency of distribution of goods and services. In addition, poorly targeted road construction-for example, in areas with low economic activity-becomes a fiscal burden without any real economic impact. The coefficient of

-0.1209 indicates that every 1% increase in road length reduces GRDP per capita by 0.1209%, and in the long run by 0.3030%.

Effect of Number of Schools on GRDP Per Capita

The number of schools (SD/MI, SMP/MTs, SMA/MA, SMK) has a negative and significant effect on GRDP per capita. The increase in the number of schools has not been followed by an increase in the quality of education, relevant curriculum, or teacher competence. Access to education has increased, but without adequate quality, it will not produce a productive and innovative workforce. In addition, building schools in areas with few students or low demand risks creating budget inefficiencies. The negative coefficient of -0.3206 indicates that a 1% increase in the number of schools can reduce GRDP per capita by 0.3206%, and in the long run by 0.8030%.

Effect of Number of Health Facilities on GRDP Per Capita

The number of health facilities, such as hospitals and health centers, is shown to have a positive and significant influence on GRDP per capita. Access to good health services reduces morbidity and mortality, and increases labor productivity in general. A healthy society is better able to work effectively and consistently, thus contributing more to economic output. In addition, equitable health facilities improve the quality of human capital and strengthen social stability. The estimation results show that a 1% increase in health facilities can increase GRDP per capita by 0.2694% (long term 0.6748%).

The Effect of Average Years of Schooling (RLS) on GRDP Per Capita

RLS has a positive and significant effect on GRDP per capita. Education is the main driver of economic growth because it forms adaptive, innovative and productive human capital. More educated workers are better equipped to deal with technological change and have greater capacity to drive economic efficiency. In addition to direct economic benefits, education also improves social indicators such as health and social stability, which in turn boosts investment and growth. Every 1% increase in RLS can increase GRDP per capita by 0.3022%, and in the long run by 0.7569%.

The Effect of Life Expectancy (UHH) on GRDP Per Capita

Life expectancy shows a positive and significant effect on GRDP per capita, which indicates the importance of health in economic development. Healthy workers are more productive and can contribute longer in economic activities. In addition, UHH reflects the success of health services, nutrition, and people's lifestyles which all play a role in increasing economic output. Regions with higher UHH tend to have greater GRDP per capita. The positive coefficient of 3.14% indicates that every 1% increase in UHH can increase GRDP per capita by 3.14% (long run 7.88%).

Effect of Labor Force Participation Rate (TPAK) on GRDP per capita

TPAK also shows a positive and significant influence on GRDP per capita. Increased participation of the working-age population in the labor market expands the production and consumption base, and increases fiscal capacity through taxes. Labor productivity increases when TPAK is high, especially when supported by productive formal sectors. Estimates show that every 1% increase in TPAK will increase GRDP per capita by 0.0055% (long term 0.0137%). This underscores the importance of inclusive employment policies and improving the quality of the workforce.

Effect of Skilled Labor on GRDP Per Capita

Skilled labor shows a positive but insignificant influence on GRDP per capita. This discrepancy is most likely caused by the unequal distribution of skilled labor between regions, the low capacity of labor absorption by the formal sector, and the skill mismatch between education

and market needs. In addition, many educated workers still work in the informal sector with low productivity. Without strong innovation infrastructure and industrial ecosystem, the contribution of skilled labor is not optimal. The coefficient is very small (0.0013-0.0033) and not statistically significant.

Effect of Information and Communication Technology Development Index (ICT) on GRDP per capita

IPTIK shows a negative and significant effect on GRDP per capita. Although ICT infrastructure is developing (internet access, smartphones), its utilization is not optimal. Many regions are not ready in terms of human resources and business ecosystem to transform digitally. Without improved digital skills and business model adaptation, ICT development does not generate added value. The negative coefficient of -0.2288 (long-run -0.5713) indicates that a 1% increase in ICT decreases GRDP per capita if not accompanied by resource readiness and economic innovation.

Convergence of GRDP per capita among provinces in Indonesia

GMM analysis shows the existence of beta (β) convergence among provinces, with a significant lag coefficient of GRDP per capita of 0.6008. This means that provinces with low per capita income tend to grow faster than established provinces. This is in line with Solow's neoclassical growth theory which states that regions with low initial capital will develop faster towards equilibrium. These results suggest that, despite the disparities, economic growth among regions in Indonesia is headed in the direction of long-term convergence.

CONCLUSIONS

Based on the results of the analysis that has been carried out on the dynamics of GRDP per capita in Indonesian provinces during the 2016-2022 period, it can be concluded that GRDP per capita growth is influenced by various interrelated factors, both in terms of physical infrastructure, human capital, labor, and information and communication technology. So that it can be concluded that several things as follows:

1. The results show that road length has a negative and significant effect, both in the short and long term. This indicates that investment in road infrastructure has not been followed by economic efficiency that supports the increase in output per capita. This may be due to the uneven distribution of roads, low quality, or unconnected infrastructure with productivity centers.
2. The number of education facilities has a negative and significant effect. This indicates that there is a phenomenon of over-supply of educational facilities in areas with low economic demand and capacity, so that the facilities built have not generated economic value added that is directly visible in GRDP per capita.
3. The number of health facilities shows a positive and significant effect, both in the short and long term. This suggests that investment in the health sector has a real impact in boosting labor productivity and supporting the increase in per capita income
4. Average years of schooling has a positive and significant effect. This finding reinforces that improving the quality of human capital through education plays an important role in promoting productive economic activity and community welfare.
5. Life expectancy shows a very strong and significant positive effect, indicating that public health as human capital is strongly related to productivity and economic output in the region.
6. Labor Force Participation Rate (TPAK) has a positive and significant effect, indicating that the more economically active labor force, the greater the contribution to the increase of

regional per capita income.

7. The number of skilled labor shows a positive but insignificant effect, both in the short and long term. This could be due to the mismatch between the skills possessed and the industry needs in each province.
8. The Information and Communication Technology Development Index (ICT) has a negative and significant effect, indicating the possibility of ICT use that is not economically productive in some regions.
9. There is β-convergence among provinces in GRDP per capita. This supports Solow's convergence theory that lagging regions will grow faster towards their steady-state condition.

Suggestion

Based on the empirical findings obtained from the dynamic panel data regression model using the Generalized Method of Moments (GMM) method, there are several suggestions that can be conveyed to support the improvement of regional economic growth through GRDP per capita in Indonesia.

1. Planning Infrastructure Roads that Integrated Economy.
2. Reformulation Strategy Development Facilities Education.
3. Strengthening Health Facilities as a Support for Long-Term Productivity.
4. Investment in Improved Quality Human Capital.
5. Strengthening Workforce Capacity through Vocational and Industry Linkages.
6. The labor force participation rate (TPAK) is proven to have a significant effect on economic growth. Therefore , efforts to increase
7. More Productive Utilization of Information and Communication Technology.
8. Strengthening Policy Convergence Economic Region.

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