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Does the Smart Indonesia Program Have an Impact on Spatially Inclusive Economic Growth?

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ABSTRACT

This study examines the impact of the Smart Indonesia Program (SIP) on the Inclusive Economic Development Index (IEDI) in cities and regions of West Java using a regional approach and Geographically Weighted Panel Regression (GWPR) for spatial analysis. The findings reveal that the effects of SIP vary across regions in accordance with the three Pillars of the IEDI. Regarding Pillar 1 (economic growth), SIP exhibits a significant influence in areas near growth centers with adequate educational infrastructure, such as Bandung City and Regency, West Bandung, Cimahi, Depok and Sumedang. For Pillar 2 (poverty and inequality), SIP plays a critical role in regions with high poverty levels, including Cianjur, Cirebon, Bekasi City, and Kuningan, by reducing financial barriers to education and narrowing access gaps. Concerning Pillar 3 (access and opportunity expansion), SIP is significant in high absolute number of poor residents in these areas, which markedly increases the risk of school dropout, such as Cianjur, Cirebon, Bekasi, and Kuningan. At the aggregate IEDI level, SIP proves significant in Sukabumi City and Regency, Kuningan, Majalengka, Garut, Banjar City, and Sumedang. This significance arises from a combination of factors, including high poverty levels, low net enrollment rate, school and teacher infrastructure, and low consumption. This study highlights that SIP has a significant contribution to inclusive development in West Java, although its effectiveness remains spatially differentiated depending on regional socio-economic conditions and the availability of educational infrastructure.

1. INTRODUCTION

Improving the quality of human resources through education is a key prerequisite for inclusive economic growth. The Smart Indonesia Program (SIP) is a government policy instrument aimed at expanding access to education for children from poor and vulnerable households, with the objective of reducing structural barriers to school participation. By providing direct cash transfers to eligible students, the SIP not only seeks to reduce school dropout rates but also forms part of a long-term human capital development strategy aimed at enhancing productivity and promoting equitable welfare outcomes. Furthermore, the SIP represents a form of Conditional Cash Transfer (CCT) designed to alleviate the financial burden of education for low-income households and to increase school participation as a key indicator of the effectiveness of national education policy [1].

In theory, the effectiveness of the SIP can be explained through the human capital theory and capability approach. CCT programs have been shown to stimulate greater investment in education and health, which in turn helps strengthen human capital as a key driver of sustainable economic growth. These results align with evidence showing that the CCT program consistently increases school enrolment rates and lowers the likelihood of student dropouts in developing countries [1]. Thus, SIP can be understood as a tangible form of inclusive development that focuses on equal access to education and improving individual capabilities. Conditional assistance programs in Indonesia have a significant effect on improving school participation and public health, although their long-term influence on economic growth has not yet been fully optimized [2]. Meanwhile, the SIP program has been shown to be effective in reducing disparities in access to education in Indonesia [3].

Students receiving PIP have a lower risk of dropping out compared to those who do not, confirming the program's effectiveness in supporting educational continuity, although challenges in targeting and monitoring persist [4]. A report by the Ministry of Education and Culture also confirms that PIP has successfully expanded access to education; however, it continues to face obstacles related to the uneven distribution of assistance across regions.

These indicate that educational assistance policies, such as SIP, play a significant role in promoting inclusive economic growth by improving access to education. SIP beneficiaries are less likely to drop out, highlighting the program's effectiveness in supporting educational continuity, despite persistent challenges in targeting and monitoring [5]. A report from the Ministry of Education and Culture further confirms that SIP has succeeded in expanding access to education; however, it continues to face obstacles related to the unequal distribution of assistance across regions.

SIP is considered to be in line with the needs of the community and has a clear legal basis and objectives in supporting equitable access to education. In terms of input, the mechanism for distributing and receiving assistance has been carried out in accordance with the applicable technical guidelines. In terms of process, the procedures for disbursement, distribution, utilization, and supervision of funds have been implemented in accordance with regulations. However, in terms of product, the program results have not been fully optimal because the dropout rate is still increasing, which demonstrated that the goal of 12 years of compulsory education has not been fully achieved [6].

The SIP in vocational schools has been shown to support disadvantaged students in continuing their education and reducing dropout rates; however, its implementation faces challenges such as delayed funding, insufficient socialization, as well as administrative and coordination issues. Enhancing data systems and governance is necessary to improve the program's effectiveness and the accuracy of beneficiary targeting [7]. These local findings underscore the importance of good governance to ensure that SIP can contribute optimally to promoting inclusive economic growth through education.

In addition to the direct assistance provided through the SIP, several structural variables are used as control factors in determining the effectiveness of the SIP in improving access to education and supporting inclusive economic growth. One crucial structural variable is the availability of schools and educational infrastructure. The number and quality of school facilities determine enrollment capacity and the overall learning environment. SIP assistance may not achieve optimal outcomes if the distribution of schools across regions remains uneven and limited.

In rural areas, basic facilities such as access to clean water and waste management systems also contribute positively to learning outcomes, although not all types of infrastructure investment exhibit consistent effects. The study concludes that the effectiveness of educational investment depends not only on the size of the budget but also on the type and quality of facilities that directly support the learning process. Therefore, education policies should be more targeted and evidence-based in order to maximise their impact on student achievement [7].

In addition, conditional assistance programs such as SIP have the potential to enhance educational aspirations among beneficiary households. Empirical evidence from Indonesia indicates that participation in CCT programmes can raise parents' aspirations for their children's education, thereby reinforcing human capital investment and supporting long-term improvements in the quality of human resources [7].

The availability of road infrastructure is a critical factor influencing the accessibility of SIP. Regions and municipalities with limited transportation networks face significant challenges in enabling students to attend school, even when they receive SIP assistance. Improvements in rural road infrastructure have been shown to substantially enhance children's access to education in remote areas by reducing travel time and transportation costs, thereby promoting higher school attendance, particularly among low-income households.

Nevertheless, these benefits are not evenly distributed, as communities with underdeveloped social and economic infrastructure continue to encounter barriers in fully utilising such improvements. Overall, rural road development generates substantial social benefits by expanding educational opportunities and supporting long-term human capital development [8].

Furthermore, the net enrolment rate (NER) serves as an initial indicator of the education system's performance. A high NER indicates that a large proportion of school-age children are attending school at the appropriate level, enabling the SIP to support the continuity of education. Conversely, in regions with a low NER, SIP must be complemented by additional interventions to prevent early school dropout. The prevalence of poverty is also a critical factor affecting both the urgency and effectiveness of SIP. A high poverty rate signals an increased need for educational assistance to ensure that children from economically disadvantaged households maintain access to and continuity in education. The number of poor residents serves as a key basis for designing educational assistance policies. The SIP is therefore specifically designed to expand access to education for children from poor and vulnerable families.

Empirically, the relationship between poverty and access to education has been widely documented in international studies. The research shows household economic conditions are a crucial determinant of children's educational participation. The study shows that although Ghana experienced expanded access to basic education and declining poverty rates, economic disparities continued to shape educational trajectories [5]. Children from poorer households were more likely to face barriers in progressing to higher levels of education, limiting their ability to benefit from the stronger economic returns associated with secondary and post-basic schooling. This aligns with broader empirical evidence indicating that poverty increases the risk of school dropout or non-enrollment, while improvements in household welfare enhance educational continuity. Therefore, the Ghana case provides concrete international evidence that reducing poverty and strengthening educational support policies are essential to ensuring sustained participation in formal education among vulnerable children.

Furthermore, the multidimensional poverty approach emphasizes that poverty is not solely related to income limitations but also associated with restricted access to basic services, including education. Research on multidimensional poverty shows that poor households often face structural barriers such as limited ability to afford education costs, lack of supporting learning facilities, and economic pressure that encourages children to work rather than continue their education [7]. Other studies also indicate that household economic constraints influence school choices and the quality of education accessible to children from low-income groups, thereby reinforcing the importance of inclusive education policy interventions [8]. Therefore, educational assistance SIP has strong justification as a form of social protection aimed at reducing inequality in educational access while simultaneously breaking the intergenerational cycle of poverty. Thus, the higher the poverty rate in a region, the greater the urgency for providing educational assistance to improve school participation and strengthen inclusive human capital development.

Educational cash transfer programs in Indonesia have demonstrated a cumulative effect in improving school participation rates, particularly among low-income households [3]. In this regard, the persistently high level of poverty not only indicates a substantial need for such interventions but also provides an important basis for evaluating the effectiveness of SIP as a social protection mechanism to support human capital development and advance inclusive economic growth.

This study empirically examines the impact of the Program Keluarga Harapan (PKH) on the welfare of low-income households in Indonesia by using household consumption expenditure as a proxy for well-being and applying econometric methods to identify causal effects. The findings indicate that program participation leads to a positive and statistically significant increase in household consumption, suggesting improvements in purchasing power and short-term welfare. However, the effects vary across wealth groups, with households in the lowest wealth quantile experiencing comparatively smaller gains. This uneven impact reflects structural constraints, including limited access to complementary services, administrative barriers, and reduced capacity of the poorest households to utilize transfers effectively. Overall, while the program demonstrates measurable welfare benefits, enhancing targeting accuracy and implementation quality is essential to ensure more inclusive and equitable outcomes [9].

An evaluation of the implementation of SIP in vocational high schools assessed both its effectiveness and the key challenges encountered [10]. The findings demonstrate that SIP has generally supported students from underprivileged families in meeting their educational needs and preventing potential school dropouts. Nevertheless, some recipients reportedly use aid funds for purposes beyond education, such as personal expenses and transportation. However, the study did not find strong evidence that such deviations are particularly prevalent among households with low consumption levels. These results highlight the need for enhanced socialization, supervision, and guidance to ensure that aid funds are utilized optimally in accordance with program objectives, thereby supporting both access to and quality of education. Collectively, these studies indicate that SIP plays a critical role in expanding educational access and fostering human capital development in Indonesia, including in West Java. At the same time, the gap between program design and field-level implementation underscores a persisting research gap.

Research linking the SIP to indicators of inclusive economic growth at the regional level remains limited. In addition, the quality of education for aid recipients has not been extensively examined, despite its importance in assessing the long-term impacts on productivity and welfare. Therefore, further research is required to evaluate SIP's contribution not only in terms of school participation rates but also in relation to regional economic transformation towards inclusive growth.

West Java Province is one of the regions with the largest absolute number of poor residents in Indonesia, despite having a relatively lower poverty rate compared to other provinces. This demographic feature highlights the critical role of the poor population in supporting the implementation of the SIP. The greater the number of children from economically disadvantaged households in the region, the higher the demand for educational assistance to prevent school dropouts. Data from Statistics Indonesia (2023) indicate that over 3.7 million individuals in West Java live below the poverty line, making school-age children from poor households the primary target beneficiaries of SIP.

Existing studies have attempted to assess the effectiveness of Indonesia's social assistance programs, including the Family Hope Program (FHP) and SIP, in reaching low-income populations; however, the evidence raises concerns regarding their targeting performance. Analyses of national datasets and quantitative evaluations consistently indicate that, despite the expansion in programme coverage, effectiveness remains limited due to persistent targeting inaccuracies. These inaccuracies are manifested in both inclusion errors where benefits are received by non-poor individuals and exclusion errors where eligible poor households are systematically left out suggesting structural weaknesses in beneficiary identification and validation mechanisms, as well as uneven implementation across regions. Moreover, empirical findings based on logit model estimations reveal that targeting outcomes in programmes such as CCT, education scholarships, and in-kind transfers are not primarily determined by poverty status. Instead, they are disproportionately influenced by urban–rural disparities, the possession of identity documentation, and inconsistencies in data quality. This misalignment indicates that existing welfare databases and eligibility criteria are insufficiently robust to accurately capture the intended beneficiaries, thereby undermining the redistributive function of these programmes and limiting their effectiveness in alleviating poverty [11].

These limitations point to a more fundamental issue, that the current architecture of social assistance delivery in Indonesia remains vulnerable to systematic exclusion and misallocation. Without substantial improvements in integrated data governance, verification protocols, and monitoring mechanisms, the expansion of social assistance risks becoming nominal rather than transformative. Therefore, strengthening data integration systems, enhancing verification processes, and improving distribution oversight are not merely administrative adjustments, but critical prerequisites for ensuring that social assistance programmes, including education support schemes, can achieve their intended objectives of reducing poverty and advancing equitable and sustainable access to education.

2. LITERATURE REVIEW

2.1 Smart Indonesia Program

SIP is designed to expand equitable access to education, particularly for children from socio-economically disadvantaged households, and constitutes a key policy instrument for advancing distributive justice in the education sector. Beneficiary identification is based on the Integrated Social Welfare and Poverty Database (DTKS) administered by the Ministry of Social Affairs, with the objective of improving targeting accuracy and ensuring that assistance is directed to the most vulnerable populations.

The state's obligation to enhance educational quality is constitutionally mandated, as articulated in the Preamble to the 1945 Constitution, which explicitly establishes the goal of educating the nation. This commitment is further reinforced by Article 31(1), which affirms that every citizen has the right to education. These provisions establish a normative foundation for sustained government intervention in the education sector. Within this framework, public expenditure on education emerges as a central policy mechanism through which the state seeks to improve educational outcomes and expand access. However, the effectiveness of such interventions remains contingent upon the extent to which policy design and implementation are able to address structural inequalities and ensure equitable distribution of educational resources.

The allocation of the education budget is regulated in Article 31 Paragraph (4) of the 1945 Constitution and Article 49 Paragraph (1) of Law No. 20 of 2003 on the National Education System, which stipulates that the education budget allocation is 20% of the regional budget (APBD) or state budget (APBN).

The realization of education spending can take the form of teacher salaries, school buildings, financial assistance for students, or government programs in the field of education. According to the theory of Rostow and Musgrave, there are three main stages of government expenditure development: the initial stage, the intermediate stage, and the advanced stage. The initial stage characterizes early economic development, during which the share of government investment in total investment is relatively high, as the government must provide essential facilities and services such as education, health, and transportation.

Education spending represents a form of investment made by the government. The role of government expenditure in education is crucial for improving the quality of the population. The SIP, as stipulated in Minister of Education and Culture Regulation No. 10 of 2020, is an educational assistance program provided by the Indonesian government to school-age children (6 to 21 years old) from underprivileged families. This program aims to improve access to and the quality of education for students from disadvantaged backgrounds, ensuring they have equal opportunities to obtain a quality education.

The program provides assistance in the form of cash transfers, internet data quotas, and textbooks. The cash transfers can be used to purchase school supplies and cover school-related expenses. Internet data assistance enables students to access online learning materials and complete school assignments, while textbook assistance helps students obtain the required learning materials. SIP is expected to have a positive impact on students from underprivileged families by enhancing both access to and the quality of education. As a result, students who receive SIP assistance are expected to achieve better academic outcomes.

This program is currently being developed by the Indonesian government, which aims to increase the number of students receiving SIP assistance each year. In addition, the government continues to enhance the quality of SIP support to maximize its impact on students from underprivileged families. According to Puslapdik, the objectives of the SIP include: increasing access to and learning opportunities in schools and universities for economically disadvantaged Indonesian students; improving educational equity across the country; enhancing student achievement in both academic and non-academic fields; ensuring the continuity of studies for students from frontier, remote, or disadvantaged areas, as well as for those attending universities in regions affected by natural disasters or social conflicts; and increasing higher education participation rates.

The SIP is a strategic program for Indonesia, contributing to national development goals aimed at creating a prosperous, independent, and dignified society. The program takes regional characteristics into account, focusing on remote areas and regions with low levels of educational attainment to address disparities in access and quality of education. SIP also emphasizes community participation in the selection of aid recipients to ensure that assistance is targeted and aligned with local needs. Furthermore, the program aligns with national education policies that underscore the importance of equitable access to high-quality education for all children in Indonesia. Based on these principles, SIP seeks to promote inclusive and sustainable educational participation and achievement. Its effectiveness is highly dependent on local contexts, including accessibility to education, supporting infrastructure, and the needs of the community.

Measuring educational performance through relevant indices, such as the Regional Development Education Index (RDEI), is crucial for evaluating the impact of education on regional development in a comprehensive manner [6]. The aforementioned studies provide an important foundation for this research, which aims to develop the RDEI as a policy evaluation tool to assess the impact of education on poverty reduction across regions and cities. Through this comprehensive approach, the study not only underscores the importance of education budget allocation but also emphasizes the relevance of education quality and its equitable distribution for public welfare.

2.2 Inclusive economic development

Inclusive economic development is an approach that emphasises the improvement of overall welfare and the expansion of equal opportunities across all segments of society. It entails the empowerment of vulnerable groups, including women, children, the elderly, local communities, and other marginalised populations [10]. Inclusive economic development therefore requires policy frameworks that ensure the benefits of economic growth are broadly shared, rather than disproportionately concentrated among elites or large corporations. The concept of inclusive growth extends beyond aggregate economic expansion by emphasising the equitable distribution of opportunities, income, and social welfare across diverse population groups.

Inclusive growth policies address structural inequalities through coordinated macroeconomic, fiscal, labor market, and social interventions to ensure that the gains from economic development are broadly shared. Without such policy alignment, economic growth may exacerbate income disparities and social exclusion, undermining long-term development sustainability. Therefore, inclusive economic development necessitates policies that integrate redistribution mechanisms, equal access to education and employment, and institutional reforms aimed at reducing inequality. By accommodating the interests of marginalized and vulnerable populations alongside broader economic objectives, inclusive policies can enhance both economic performance and social cohesion [10]. Figure 1 presents the conceptual framework of Inclusive Economic Development Index (IEDI) generated by the Ministry of National Development Planning (Bappenas).

Inclusive economic development can generate employment opportunities and increase household income, thereby contributing to the reduction of poverty and social inequality [11]. It also enhances overall societal welfare, fostering a sense of shared ownership and participation in a country's economic and social progress. To support these objectives, governments implement a range of policy measures, including the provision of social assistance to low-income households, training and skills development for less-skilled groups, and access to financing for small and medium-sized enterprises. In addition, investments in social infrastructure, particularly in education and healthcare are essential to ensure equitable access to fundamental services and resources across all segments of society.

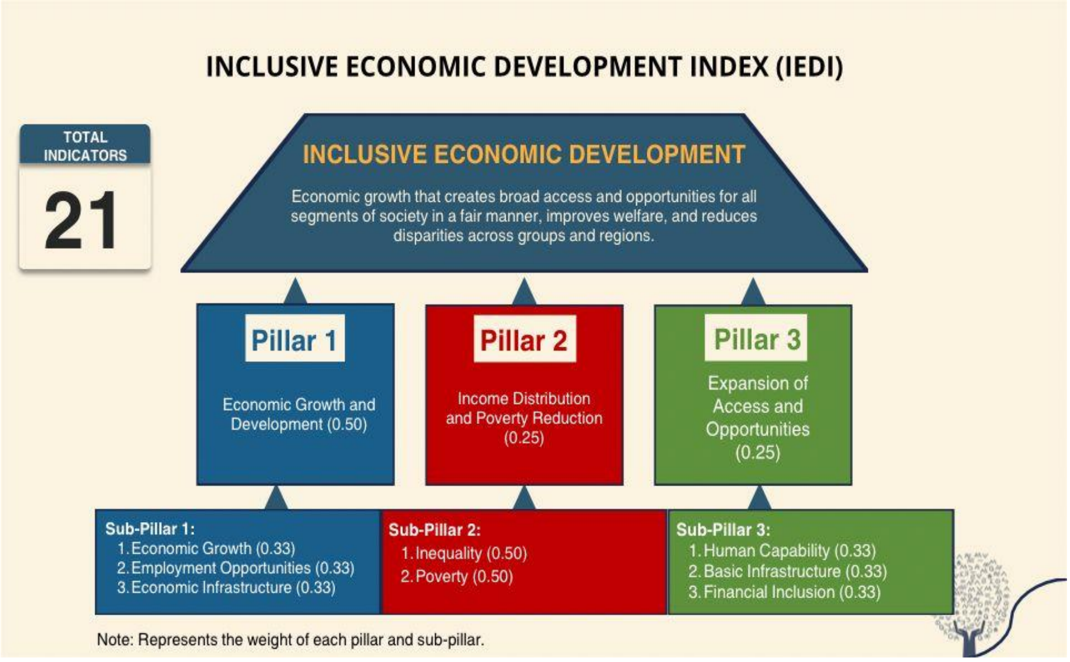

Figure 1. Inclusive Economic Development Index (IEDI) pillars
Sources: Ministry of National Development Planning/National Development Planning (Bappenas RI)

The following is a brief explanation of the three pillars. The Ministry of National Development Planning (Bappenas) divides the sub-indicators of IEDI into three indices, namely Pillar 1 (Economic Growth, Income Equality, Poverty Reduction, and Expansion of Access and Opportunities).

•Pillar 1 Economic Growth. This pillar emphasizes the importance of increasing economic productivity and expanding employment opportunities. In the context of inclusive economic development, economic growth must be sustainable, high-quality, and equitable. This can be achieved through increased investment in sectors that benefit all levels of society, such as agriculture, fisheries, micro, small and medium enterprises, and the service sector.

•Pillar 2 Income Equality and Poverty Reduction. Income equality and poverty reduction constitute a key pillar that emphasizes the enhancement of social welfare and the reduction of economic inequality. This pillar encompasses a range of policies and programs targeting populations living below the poverty line, including social and educational assistance programs, economic empowerment initiatives, and skills development interventions. Furthermore, this pillar aims to strengthen the social protection system while expanding access to health and education services.

•Pillar 3 Expansion of Access and Opportunities. This pillar underscores the importance of ensuring equitable access and opportunities for all segments of society, particularly marginalized and disadvantaged groups. It encompasses efforts to enhance access to capital, resources, and infrastructure, alongside the promotion of skills development and capacity-building initiatives.

These three pillars are inherently interrelated and mutually reinforcing in fostering inclusive economic development that is sustainable, equitable, and socially as well as environmentally beneficial. By addressing these three dimensions, economic development can become more inclusive and generate positive outcomes across all segments of society.

Each pillar of Inclusive Economic Development (IED) is assigned a specific weight based on a set of underlying policy justifications. The weighting of Pillar 1 (economic growth), Pillar 2 (poverty and inequality), and Pillar 3 (expansion of access and opportunity) is developed by the Ministry of National Development Planning (Bappenas). This weighting is fundamentally derived from the policy directions and development targets outlined in the 2020–2024 National Medium Term Development Plan (RPJMN). The RPJMN emphasizes quality economic growth, poverty reduction, inequality reduction, and expanded access to basic services as core national development priorities. Accordingly, the three-pillar structure of the IEDI reflects the principal dimensions of development embedded in the RPJMN, namely growth (pro-growth), equity (pro-poor and pro-equity), and inclusive access (pro-opportunity).

Conceptually, the weighting across pillars is not determined solely on a normative basis; rather, it is derived from the strategic priorities and key performance indicators outlined in Books I and II of the National Medium-Term Development Plan (RPJMN). It is particularly within the Macroeconomic Framework and Development Agenda sections. Pillar 1 derives its weighting from targets related to GDP growth, job creation, and structural economic transformation. Pillar 2 is based on indicators such as the poverty rate, extreme poverty, and the Gini ratio as a measure of income inequality. Meanwhile, Pillar 3 is informed by indicators related to the expansion of access to education, healthcare, basic infrastructure, financial inclusion, and social protection, all of which are also incorporated as performance indicators in the RPJMN.

In addition to the RPJMN, the weighting scheme and indicator selection are aligned with the Sustainable

Development Goals (SDGs) framework coordinated by the United Nations and integrated into the national development planning system. Within this framework, the growth dimension corresponds to Goal 8 (Decent Work and Economic Growth), the poverty and inequality dimension corresponds to Goal 1 (No Poverty) and Goal 10 (Reduced Inequalities), and the access and opportunity dimension relates to cross-cutting indicators of basic service provision. This approach is also consistent with the concept of inclusive growth advanced by the World Bank and the OECD, which emphasizes that economic growth should be accompanied by equitable distributional outcomes and expanded access to economic opportunities.

IEDI is computed using a weighted aggregation approach (i.e., a weighted composite index) structured hierarchically, comprising indicators, sub-pillars, and pillars. The following section outlines the methodological framework for calculating the IEDI.

1. Indicator Normalization

Before aggregation, all indicators are normalized to a uniform scale (e.g., 0–10) using the min–max method as follows:

For positive indicators:

$$I_{ijk}^{*} = \frac{X_{ijk} - X_{min}}{X_{max} - X_{min}} \times 10$$

For negative indicators:

$$I_{ijk}^{*} = \frac{X_{max} - X_{ijk}}{X_{max} - X_{min}} \times 10$$

I^*_{ijk} = normalized indicator value
X_{ijk} = actual indicator value k in sub Pillar j and Pillar i
X_{min} X_{max} = minimum and maximum indicator

2. Sub-Pillars Calculation

The sub-Pillars score is calculated as the weighted average of the indicators within each sub-Pillars:

$$SP_{ij} = \sum_{k=1}^{n_{ij}} w_{ijk} I_{ijk}^{*}$$

SP_{ij} = sub-Pillar value j in Pillar i
w_{ijk} = indicator weight k in sub-Pillar ($\sum w = 1$)
n_{ij} = indicator sum in sub-Pillar

3. Pillars Calculation

The score for each Pillar is calculated as a weighted aggregation of the sub-Pillars:

Pillar 1 (Economic Growth & Development)

$$P1 = 0.33SP11 + 0.33SP12 + 0.33SP13$$

Pillar 2 (Income Distribution and Poverty)

$$P2 = 0.50SP21 + 0.50SP22$$

Pillar 3 (Expanding Access and Opportunity)

$$P3 = 0.33\ SP31 + 0.33\ SP32 + 0.33\ SP33$$

4. Calculation of the Total IEDI Index

The final IEDI score is calculated as a weighted combination of the three Pillars:

$$IEDI = 0.50P1 + 0.25P2 + 0.25P3$$

3. RESEARCH METHODOLOGY

3.1 Research location

This study uses 26 cities/regions from 27 cities, excluding Banjar region in West Java Province as the unit of analysis. Banjar is excluded in the sample unit because Banjar does not have complete IEDI and supporting macro data. West Java Province is divided into four development coordination agencies, as follows: Regional Coordination Agency Bogor, which covers Bogor, Bekasi, and Sukabumi; Regional Coordination Agency Purwakarta, which covers Purwakarta, Subang, and Karawang; Regional Coordination Agency Cirebon, which covers Cirebon, Indramayu, Majalengka, and Kuningan; and Regional Coordination Agency Priangan (Garut), which covers Bandung, Sumedang, Garut, Tasikmalaya, Ciamis, and Banjar. This study covers the 2017–2023 period and therefore employs a balanced panel dataset for the analysis. Figure 2 shows the cities and regencies map in West Java.

3.2 Geographically Weighted Panel Regression method

Spatial analysis plays a crucial role in the examination of the distribution and effectiveness of educational assistance programs, as it facilitates the identification of spatial patterns, clustering, and disparities across geographic areas. Empirical evidence indicates that poverty is not randomly distributed; rather, it exhibits significant spatial clustering, suggesting the presence of spatial dependence among neighbouring regions.

Figure 2. Cities/region map in West Java

This evidence underscores the importance of incorporating spatial analytical approaches into the evaluation of social assistance programs, as their effectiveness and targeting accuracy are inherently linked to the spatial distribution of poverty. By identifying geographic clusters and spatial disparities, policymakers are better positioned to design more targeted and equitable interventions that are responsive to localised socio-economic conditions [12].

The relationship between the dependent variable y and the independent variables x1, x2, …, xn in the Geographically Weighted Regression (GWR) model for location can be written as follows [6]:

$$yi = \beta 0(ui, vi) + \sum \beta k(ui, vi) xik + \varepsilon i, i = 1,2, \ldots, n$$
$$k = 1$$

Table 1 presents the definitions of the variables used in the above equation.

Table 1. Variable definition

Variable	Variable Definition
yi	observed value of response variable i
xik	observed value of predictor variable k at observation location i
$\beta 0(ui, vi)$	constant/intercept at observation i
(ui, vi)	denotes the geographical coordinates (longitude, latitude) of observation location i
$\beta k(ui, vi)$	observed value of the k predictor variable at the i observation location
εi	observation error at the i-th observation, assumed to be identical, independent, and normally distributed with mean zero and constant variance σ^2

Conventional econometric regression frameworks are grounded in the assumption that a single, global model can be consistently estimated conditional on a given sample of data. However, this assumption may be overly restrictive, particularly in the presence of spatial heterogeneity, where relationships between variables are unlikely to be constant across geographic units. In such contexts, global models risk producing biased or misleading estimates by imposing parameter homogeneity and neglecting localised variations.

In contrast, the Geographically Weighted Panel Regression (GWPR) model relaxes this assumption by incorporating location specific weighting schemes and subsampling procedures for each cross-sectional observation. This approach enables the estimation of spatially varying parameters, thereby capturing local heterogeneity in the underlying data-generating process. Consequently, GWPR not only facilitates a more nuanced understanding of spatial dynamics but also allows for systematic comparison with global model estimates, highlighting the extent to which spatial non-stationarity influences empirical results.

GWPR has evolved to incorporate the temporal dimension by assuming that observations proximate in both space and time exert greater influence on the estimation of local parameters at location i. This extension focuses on econometric techniques based on repeated observations for each location, with particular emphasis on panel data models with fixed effects. GWPR differs from conventional geographically weighted models in that, once a bandwidth is selected, all temporal observations for each subsampled location must be assigned the same weight in order to locally replicate the pooled structure of a global model across different time periods. For notational simplicity, two types of independent variables are considered, namely x and z.

The Locally Weighted Regression (LWR) model uses a weighting function (kernel function) to approximate (·). At each target location i, the prediction is obtained by weighting the differences between the normalized values of the independent variables at point i and those at the target point, $xj - xi$ and $zj - zi$. The kernel function (see below) determines the weight that observation j receives in estimating the value of y at target point i. This can be generically represented as: y=f(x,z)+u.

The Kernel Regression model uses the kernel function based on $xj - xi$ and $zj - zi$ to weight the observations. However, only the values of yj are used to predict yi. This can be represented as:

$$y = f(y) + u$$

The Conditional Parametric Regression (CPAR) model is a special case of the LWR model which assumes that the set of explanatory variables (x, z) can be divided into portions that are fully nonparametric (x) and conditionally parametric (z). For fixed values of z, the model is a linear equation in which the coefficients vary with z:

$$y = \alpha(z) + \beta(z)x + u$$

The CPAR model becomes spatial when the conditionally parametric variables are the geographic coordinates of each point, latitude and longitude:

$$y = \alpha(la, lo) + \beta(la, lo)x + u$$

GWR model is a special case of the CPAR (LWR) model where the coordinates are replaced by straight-line distances (d) among observations and are typically omitted from the list of explanatory variables.

$$y = (d) + \beta(d)x + u$$

In economic analysis, geographic coordinates may have limited intrinsic meaning; however, spatial distance often serves as a proxy for variables such as the number of schools, road network length, and NER. Conventional GWR captures spatial heterogeneity by allowing regression coefficients to vary across locations based on geographic proximity, while its panel extension, GWPR, applies location-specific kernel weights across time periods to integrate both spatial and temporal dimensions.

However, economic interactions are not determined solely by physical distance but also by similarities in regional characteristics. To address this limitation, Similarity-based GWR extends the framework by incorporating both spatial proximity and attribute similarity into the weighting mechanism. This approach enhances the estimation of local parameters and provides a more comprehensive representation of complex and heterogeneous spatial economic processes [13].

GWPR extends conventional panel data models by incorporating spatial heterogeneity through location specific parameter estimates that vary across cross sectional units while accounting for temporal dynamics. Within this framework, the kernel function determines how observations are weighted according to their spatial proximity to a given location.

In empirical applications, however, the choice of kernel function generally exerts only a limited influence on estimation outcomes, as commonly used kernels such as the Gaussian and bi-square functions share the fundamental property of assigning monotonically decreasing weights as distance increases. Hence, differences among kernel types typically reflect alternative functional forms of spatial decay rather than substantive changes in the underlying weighting mechanism as studied by Yacim and Boshoff [14].

In contrast, bandwidth selection plays a far more decisive role in shaping model performance. The bandwidth determines the spatial extent of the local neighbourhood and governs the rate at which weights decay, thereby directly influencing the bias–variance trade-off and the stability of local parameter estimates. An adaptive bandwidth, often referred to as a variable window size, assigns a distinct bandwidth *hi* to each location, ensuring that an equal number of nearest neighbours is incorporated into every local estimation.

This approach is particularly advantageous in contexts where spatial units are unevenly distributed, as it preserves a consistent local sample size across estimation points while allowing the spatial influence structure to vary. In this study, an adaptive bi-square kernel function is employed to weight observations in each local panel estimation, providing a flexible and robust mechanism for capturing spatially and temporally varying relationships.

Methodological challenge in the application of GWR lies in the selection of an appropriate bandwidth, or, equivalently, in determining the optimal number of nearest neighbours to be included in each local estimation. This issue becomes even more complex within GWPR framework, where bandwidth optimisation procedures remain an area of ongoing methodological development. Furthermore, the application of model selection criteria such as the Akaike Information Criterion (AIC) in a GWPR setting must account for the substantial computational burden associated with processing time-series observations at each spatial location.

Another important limitation of GWR-based analyses concerns their heavy reliance on visual interpretation through spatial maps. Beyond the well-documented limitations of choropleth mapping, particularly when applied to spatial units of heterogeneous size, the interpretation of mapped local parameter estimates remains inherently relative unless accompanied by measures of statistical significance. As such, without appropriate inferential support, spatial variations observed in parameter estimates may be prone to misinterpretation [15].

This study employs the GWR method, a localized regression approach that enables the detection of spatial variations in the relationships between dependent and independent variables across the study area [15]. The fundamental principle of this model is the incorporation of geographic or locational information as weights in the estimation of model parameters. This approach is grounded in Tobler's First Law of Geography [15], which posits that spatial units located in close proximity tend to exhibit stronger relationships and greater similarity than those that are farther apart.

The data from the study area indicate the presence of spatial dependence between measurement values and geographic location. The weighting scheme in GWPR model constitutes a critical component in estimating location-specific parameters based on the spatial positions of individual observations. Consequently, the resulting parameter estimates vary across observation locations. The magnitude of the assigned weight increases as the distance between observation locations decreases, indicating that geographically proximate observations exert greater influence on local parameter estimation. The GWPR method is a form of local regression in which data are repeated across regional points for each spatial observation. In this framework, it is assumed that the temporal sequence of observations at a given geographic location represents a realization of a smooth spatiotemporal process; that is, observations that are closer in space and time are more closely related than those that are further apart [12].

GWPR is an extension of spatial regression techniques that allows regression parameters to vary across geographical locations, thereby capturing spatial heterogeneity in the relationships between independent and dependent variables. Unlike global regression models that assume constant parameter estimates across all regions, GWPR estimates local parameter values for each observation point, enabling the identification of spatially varying responses within a single study area.

This methodological approach is particularly useful for evaluating regional policy impacts, as socioeconomic variables often demonstrate different levels of influence depending on local geographic and structural characteristics. GWPR integrates spatial heterogeneity and temporal dynamics by estimating local regression coefficients at each geographic location, enabling examination of how social assistance variables interact with regional characteristics in shaping an inclusiveness index across cities and regions. Recent applications of GWPR demonstrate its ability to identify spatially varying relationships between outcome indicators and explanatory variables in panel data settings, such as poverty dynamics in West Java [16] and multidimensional local influences on food security indices in Indonesian provinces [12].

A previous empirical study [17] has demonstrated the robustness of GWPR in analyzing spatio-temporal socioeconomic data. For instance, research applying GWPR to poverty modeling in West Java shows that the influence of socioeconomic indicators on poverty varies across regions and time periods, highlighting the importance of localized parameter estimation in regional policy evaluation. Similarly, methodological developments in spatio-temporal modeling emphasize that GWPR improves analytical accuracy by incorporating spatial weighting functions and kernel-based estimations to account for geographical variations in panel datasets [18]. Furthermore, studies combining GWPR with efficiency and performance evaluation techniques reveal significant spatial heterogeneity in socioeconomic determinants across regions, demonstrating that local characteristics strongly influence development outcomes and policy effectiveness. These findings confirm that GWPR provides a comprehensive analytical framework for assessing the spatial variation of social assistance and regional characteristics in shaping inclusive economic development outcomes.

This study also includes a GWPR analysis to examine the significance and magnitude of the contribution of social assistance variables and regional characteristics to the inclusiveness index in each city/region in West Java. GWR is a statistical technique that calculates independent variables showing different reactions in different places within a single research area. GWPR calculates the parameter value for each location point so that it has different significance and regression parameter values [12]. This study uses R Studio software to process the GWPR results.

The GWPR model used is as follows:

$$\text{Pillar\_1}_{it} = \beta 0\ (u_i v_i) + \beta 1(u_i v_i)\ \text{SIP}_{it} + \beta 2(u_i v_i)\ \text{School}_{it} + \beta 3(u_i v_i)\ \text{Teacherit} + \beta 4(u_i v_i)\ \text{Road}_{it} + \beta 5(u_i v_i)\ \text{Poor}_{it} + \beta 6(u_i v_i)\ \text{Cons}_{it} + \beta 7(\text{uivi})\ \text{NER}_{it} + \varepsilon\text{it}$$

$Pillar\_2_{it} = \alpha_0(u_iv_i) + \alpha_1(u_iv_i)SIP_{it} + \alpha_2(u_iv_i)School_{it} + \alpha 3(u_iv_i)\ Teacher_{it} + \alpha 4(u_iv_i)Road_{it} + \alpha 5(u_iv_i)Poor_{it} + \alpha 6(u_iv_i)\ Cons_{it} + \alpha 7(u_iv_i)\ NER_{it} + \varepsilon_{it}$

$Pillar\_3_{it} = \gamma_0(u_iv_i) + \gamma_1(uivi)\ SIP_{it} + \gamma_2(u_iv_i)School_{it} + \gamma_3(uivi)\ Teacher_{it} + \gamma_4(u_iv_i)Road_{it} + \gamma 5(u_iv_i)Poor_{it} + \gamma 6(uivi)Cons_{it} + \gamma_7(u_iv_i)NER_{it} + \varepsilon_{it}$

$IEDI_{it} = \delta_0(u_iv_i) + \delta_1(u_iv_i)\ SIP_{it}+\delta_2(u_iv_i)School_{it} + \delta_3(u_iv_i)\ Teacherit + \delta_4(u_iv_i)Road_{it} + \delta_5(u_iv_i)Poor_{it} + \delta_6(u_iv_i)Consit + \delta_7(u_iv_i)\ NER_{it} + \varepsilon_{it}$

The explanation of the above equation is as follows:
Pillar 1: Economic Growth Index
Pillar 2: Poverty and Inequality Index
Pillar 3: Access and Opportunity Index
IEDI: Inclusive Economic Growth Index
$B_0, \beta_1, \ldots \beta_7$: Constanta and Koef variabel in city/region i
Pillar 1 $\alpha_0, \alpha_1, \ldots \alpha_7$: Constanta and Koef variable in city/region i
Pillar 2 $\gamma_o, \gamma_1, \ldots \gamma_7$: Constanta and Koef variabel city/region i
Pillar 3 $\delta_0, \delta_1, \ldots \delta_7$: Constanta and Koef variabel city/region i
IEDI u_iv_i: Coordinate Longitude, Latitude city/region i
SIP: Smart Indonesia Program in city/region i in year t
School: Number of schools in city/region i in year t
Teacher: Number of teachers in city/region i in year t
Road: Road length in city/region i in year t
Poor: Number of poor people in city/region i in year
Cons: Level of community consumption in city/region i in year
NER: Net enrolment rate for junior high schools
Eit: Error

NER measures the percentage of children of a specific official school-age group who are enrolled in the education level appropriate for their age. It reflects the degree of age-appropriate participation in education. The formula of NER is number of children of official school age enrolled at the corresponding education level divided the total population on the same official school age group. This indicator emphasizes age-appropriate participation, thereby better reflecting targeted access to education than other participation indicators. Conceptually, NER is used to assess the extent to which the education system is able to absorb the school-age population in accordance with the national education level structure.

Meanwhile, the poor variable refers to poor or vulnerable households that meet certain requirements (e.g., having a pregnant mother, toddlers, school-age children, elderly members, or members with disabilities). Assistance is provided on a conditional basis (CCT), whereby the poor must fulfil obligations such as ensuring that children attend school and utilize health services.

The GWPR method begins with a multicollinearity test to examine the independence of variables in order to avoid inconsistencies in variable significance and inefficient parameter coefficients. The next step is to select the bandwidth weight to determine the location weight function and test for spatial heterogeneity to ascertain whether there are elements of heterogeneity in the research data used.

4. ANALYSIS AND RESULTS

4.1 Multicollinearity testing

Multicollinearity testing was conducted by checking the Variance Inflation Factor (VIF) value. A variable must have a VIF value < 10 to be considered free from multicollinearity. The multicollinearity values for each variable are presented in Table 2 below.

Table 2. Multicollinearity test results

Variable	VIF Pillar 1	VIF Pillar 2	VIF Pillar 3	VIF IEDI
SIP	5.559280	1.512563	5.559280	1.514392
School	8.357045	9.116179	8.357045	9.110083
Teacher	6.953611	7.093472	6.953611	7.093489
Road	2.519321	2.418124	2.519321	2.418543
Poor	5.958521	5.640395	5.958521	5.646603
Cons	1.243599	1.412416	1.243599	1.412369
NER	1.153742	1.077082	1.153742	1.080007

The test results show that all variables have a VIF value below 10, meaning that there is no multicollinearity among all independent variables used in Pillar 1 (Economic Growth), Pillar 2 (Poverty and Inequality), Pillar 3 (Expanding Access and Opportunity), and the IEDI.

4.2 Panel regression estimation

For comparison purposes, this study uses panel regression to examine the significance of Indonesia's programs on the achievement of inclusive economic development. The output panel regression is presented in Table 3.

The results of panel regression analysis using the Fixed Effect Model method show that SIP is not significant in Pillar 1, 2, 3, and the overall IEDI. This indicates that SIP does not contribute significantly to the achievement of inclusive economic development. Therefore, this study uses the GWPR method, which captures spatial dependence and spatial heterogeneity.

Conventional panel regression assumes that the relationship between independent and dependent variables is uniform across all regions, resulting in a single set of global coefficients for all units of analysis. This approach does not consider that the mechanism of the relationship between variables can differ significantly between locations due to unique local characteristics.

GWPR overcomes this limitation by modelling regression coefficients locally in each observation area through geographical weighting based on distance, so that the relationship between variables can vary according to local spatial conditions. GWPR is able to capture spatial non stationarity, a phenomenon in which the influence of variables changes depending on their geographical location. Empirical research shows that GWPR models often provide higher goodness of fit values and more accurate models in the context of problems with strong regional variation compared to global panel regression [3].

4.3 Selection of spatial weighting

Next, the optimal weighting to be included in the GWPR modelling is selected. The selected optimal weighting determines the bandwidth value used. In selecting the optimal weighting, three kernel functions are compared, namely Gaussian, bisquare and exponential. Each of these kernel functions has fixed and adaptive kernel weighting functions. The fixed kernel function has the same bandwidth for all observation locations, while the adaptive kernel function has different bandwidths at each observation location. Table 4 show the results of the spatial weighting selection.

Table 3. Output panel regression

Variable	Pillar 1	Pillar 2	Pillar 3	IEDI
C	5.6905 0.000	6.2466 0.000	5.343764 0.000	5.814336 0.000
Smart Indonesia Program	2.67×10^{-6} (0.526)	2.61×10^{-6} 0.621	-4.87×10^{-6} 0.674	1.17×10^{-6} 0.780
School	0.0001007 (0.006)	8.50×10^{-6} 0.852	0.0004245 0.000	0.0001554 0.000
Teacher	-0.0000303 0.000	3.34×10^{-6} 0.522	-0.0000356 0.002	-0.0000217 0.000
Road	0.0000231 0.716	0.0000448 0.574	0.0000834 0.633	0.0000368 0.560
Poor	-0.0010714 0.190	-0.0015167 0.140	-0.0020582 0.358	-0.0014857 0.068
Cons	1.19×10^{-8} 0.921	-2.64×10^{-7} 0.001	3.68×10^{-7} 0.034	1.61×10^{-8} 0.795
NER	0.0002099 0.000	0.0035587 0.345	0.0115833 0.048	0.0042589 0.000
R Square	0.5256	0.1633	0.2767	0.3201

Notes: Number in parentheses shows p-value

The fixed bisquare function produces maximum R2 and minimum AIC values in Pillars 1 and 2. Thus, in Pillars 1 and 2, the fixed Gaussian weighting function is used, which has AIC values of -106.01 and -160.47. The Adaptive Bisquare function produces maximum R2 and minimum AIC values in Pillar 3 and IEDI. Therefore, in Pillars 3 and 4, the adaptive bisquare weighting function is used, which has AIC values of -9.02 and -135.43.

Table 4. Spatial weighting selection

Spatial Weighting		Adaptive Bisquare	Adaptive Gaussian	Adaptive Exponential	Fixed Bisqaure	Fixed Gaussian	Fixed Exponential
Pillar 1	R2	91.83%	77.52%	80.88%	92.77%	93.24%	92.18%
	AIC	-88.74	16.2	-2.14	-96.68	-106.01	-93.44
Pillar 2	R2	83.89%	48.26%	56.63%	86.98%	89.01%	87.06%
	AIC	-116.91	3.47	-16.92	-138.63	-160.47	-147.34
Pillar 3	R2	93.34%	71.11%	75.42%	86.10%	89.59%	88.47%
	AIC	-9.03	150.52	132.08	81.43	49.38	56.55
IEDI	R2	86.07%	75.18%	78.08%	80.48%	82.99%	84.32%
	AIC	-135.43	-78.45	-91.3	-100.69	-114.68	-124.19

The coefficient of determination produced from the GWPR model with fixed Gaussian weighting is 93.24% (Pillar 1) and 89.01% (Pillar 2). This means that the GWPR model with fixed gaussian weighting is able to explain 93.24% of the Economic Growth Index and 89.01% of the Poverty and Income Index influenced by independent variables, namely (SIP, Number of Schools, Number of Teachers, Road Length, Consumption, Poor, and NER) and the remaining 6.76% and 11% are influenced by other variables outside the model.

The coefficient of determination produced by the GWPR model with Adaptive Bisquare weighting is 93.34% (Pillar 3) and 86.07% (IEDI). This means that the GWPR model with Adaptive Bisquare weighting is able to explain 93.34% of the Access and Opportunity Expansion Index and 86.07% of IEDI influenced by independent variables, with the remaining 6.66% and 13.93% influenced by other variables outside the model.

4.4 Results of Geographically Weighted Panel Regression

4.4.1 Map of p-value distribution and The Smart Indonesia Program parameters for Pillar 1 (economic growth)

The significance of the variables and parameter coefficients in GWPR is depicted in the form of spatial maps, allowing the identification of cities/regions in West Java Province where the results are statistically significant, as well as the extent of the SIP Program's contribution to the achievement of the Economic Growth Index summarized in Pillar 1 of IEDI. Figures 3 and 4 show the distribution of probability values and the SIP influence parameters on Pillar 1 (Economic Growth).

The empirical findings indicate that the principal variable of SIP is statistically significant across several regions within the Regional Coordination Agency. This pattern is illustrated in the spatial distribution maps, where brighter colour gradations denote areas in which the SIP variable is statistically significant. Detailed probability values and parameter estimate for each region are reported in Appendix A1.

However, the spatial distribution of statistical significance is notably uneven, indicating the presence of spatial heterogeneity and potential spatial bias in the estimated effects. The concentration of significant coefficients in regions such as Bogor, Purwakarta, and Bandung suggests that the impact of the SIP on the Economic Growth Pillar of IEDI is highly context-dependent rather than uniformly distributed. This pattern is consistent with the theory of regional inequality, which posits that disparities in infrastructure, institutional capacity, and human capital endowments lead to different development outcomes across regions.

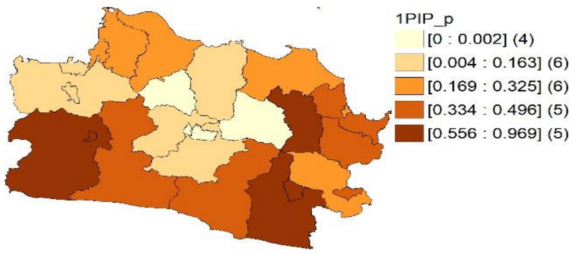

Figure 3. Probability of Smart Indonesia Program (SIP) for Pillar 1

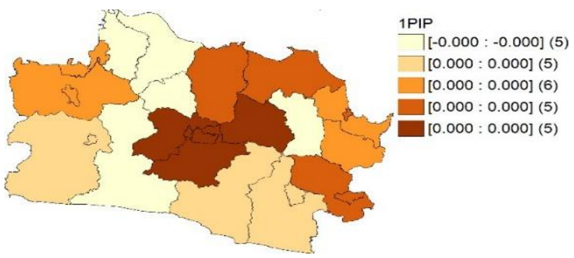

Figure 4. Coefficient parameter of Smart Indonesia Program (SIP) for Pillar 1

Furthermore, the observed spatial clustering of significant effects may also reflect the presence of spatial spillover mechanisms, whereby the benefits of educational assistance and human capital formation in one region extend to neighbouring areas through labour mobility, knowledge diffusion, and economic linkages. At the same time, the absence of significance in other regions suggests that such spillover effects are either weak or constrained by structural barriers, thereby limiting the diffusion of programme benefits. While the Economic Growth Pillar emphasizes improvements in human capital quality and labor productivity with access to education as a key driver of sustained economic growth, the spatially uneven impact of the SIP indicates that these mechanisms do not operate uniformly across space. Consequently, these findings underscore the importance of incorporating spatial considerations into policy design, as reliance on aggregate estimates may obscure underlying regional disparities and lead to suboptimal targeting of social assistance interventions.

The statistical significance of SIP across several regions suggests that the program contributes to the promotion of inclusive economic growth by expanding access to education. The empirical study highlights that economic and social progress is often concentrated in urban growth centers, while rural and peripheral areas face structural limitations such as weak infrastructure, low accessibility, and limited economic opportunities [17]. This spatial inequality suggests that SIP's impact on inclusive economic growth is likely to vary across regions depending on local socio-economic conditions, educational infrastructure, and regional development capacity. Therefore, SIP should be understood not merely as an educational assistance program but as part of a broader regional development strategy in which educational inclusion, infrastructure availability, and spatially responsive governance collectively determine its effectiveness in reducing poverty, promoting human capital development, and supporting sustainable inclusive economic growth.

Within Pillar 1, the SIP is found to be statistically significant in several areas, specifically the Bogor Area (Bogor Regency and Depok City), the Purwakarta Area (Purwakarta Regency), and the Bandung Area (Bandung Regency, West Bandung Regency, Bandung City, Cimahi City, and Sumedang Regency).

The spatial distribution map further indicates that SIP demonstrates statistical significance predominantly in regions located in proximity to the national or provincial capitals. This pattern may be attributed to the relatively well-developed educational infrastructure in these areas. Empirical indicators, including the number of schools, the availability of teaching personnel, and adequate road accessibility, suggest that such infrastructural advantages facilitate school attendance and enhance the effectiveness of SIP in improving educational participation.

Cities and regions situated in close proximity to national and provincial administrative centres tend to exhibit structural advantages in terms of access to educational infrastructure, information flows, and public service provision. The Bogor Area (encompassing Bogor Regency and Depok City), located adjacent to the Capital Region of Jakarta, and the Bandung Area (comprising Bandung Regency, West Bandung Regency, Bandung City, Cimahi City, and Sumedang Regency), positioned near the provincial capital of West Java, represent regions that experience pronounced agglomeration effects. Such spatial proximity fosters a higher concentration of educational institutions, comparatively better-qualified teaching personnel, and more integrated transportation and digital connectivity networks. These structural endowments create an enabling environment that strengthens the institutional effectiveness of SIP implementation and amplifies its contribution to inclusive economic growth.

In regions characterised by advanced educational infrastructure, SIP beneficiaries not only receive financial assistance but are also provided with substantive opportunities to improve educational outcomes, including access to higher-quality instruction, adequate school facilities, and enhanced prospects for continuing education. In contrast, in remote or peripheral areas, the effectiveness of the SIP is often constrained by structural limitations, such as an insufficient number of schools, long travel distances, and shortages of qualified teachers. These structural constraints may attenuate the program's impact on both educational participation and overall educational quality.

The effectiveness of the SIP in buffer areas further reinforces the Inclusive Economic Growth Pillar of the IEDI. Children from low-income households who are able to remain in school through SIP assistance have a greater likelihood of entering the formal labour market in major metropolitan regions, such as the Jakarta–Bogor–Depok–Bekasi metropolitan area and Greater Bandung. Consequently, the program not only reduces school dropout rates but also contributes to the development of productive human capital capable of sustaining long-term economic growth.

These findings are consistent with previous studies indicating that the effectiveness of educational assistance programs is strongly shaped by regional characteristics, particularly the availability and quality of social infrastructure [3]. Similarly, other empirical evidence suggests that SIP tends to exert the greatest impact on educational participation in areas where the supporting educational environment is well established [6]. Consequently, proximity to national and provincial capitals can be regarded as a facilitating factor that enhances the impact of SIP on inclusive economic growth.

Areas located near the national capital (DKI Jakarta) or the provincial capital (Bandung), such as Bogor Regency, Depok City, and the Greater Bandung area, exhibit relatively greater SIP effectiveness than regions situated farther from administrative centres, such as Garut, Cianjur, and Tasikmalaya. This disparity is primarily attributable to differences in educational, transportation, and labor market access infrastructure. In areas proximate to the capitals, the number of schools is greater, teacher quality is relatively higher, and educational facilities including laboratories, digital technologies, and internet access are more adequately provisioned.

Consequently, SIP recipients in these regions not only receive financial support but are also able to leverage this assistance to access genuinely available educational services. Furthermore, proximity to metropolitan economic centers (Jakarta–Bogor–Depok–Bekasi Bandung) facilitates more rapid entry of SIP recipients into the formal labor market. This, in turn, strengthens the Inclusive Economic Growth Pillar, as investments in education through SIP are directly linked to improvements in labor productivity [18].

Conversely, in regions relatively distant from administrative centers, such as Garut, Cianjur, and Tasikmalaya, the effectiveness of SIP is comparatively limited. Although cash assistance for education is provided, structural constraints including a limited number of secondary schools, long commuting distances, and shortages of qualified educators often impede the optimal utilization of the program. As a result, while SIP may reduce school dropout rates in these areas, its impact on enhancing human capital quality and job readiness is less pronounced than in the capital-adjacent regions.

Studies indicate that the effectiveness of educational assistance programs is largely shaped by regional conditions, particularly the accessibility and quality of available educational facilities [2]. This evidence suggests that SIP is more effective in promoting inclusive economic growth in regions with relatively advanced educational and economic infrastructure, such as Bogor, Depok, and the Greater Bandung area.

In contrast, in regions located farther from administrative and economic centres, the impact of the SIP appears to be more limited. While the program continues to generate measurable benefits, its effectiveness is constrained by structural deficiencies, including inadequate educational infrastructure, shortages of qualified teachers, and limited transport accessibility. Consequently, achieving a more substantial impact on the Economic Growth Pillar of IEDI requires complementary policy interventions, such as expanding school infrastructure, strengthening teacher allocation, and improving regional connectivity.

These findings are consistent with the theory of spatial inequality and the concept of the development gap, which emphasize that disparities in infrastructure endowment, institutional capacity, and access to public services lead to uneven development outcomes across regions. In this context, regions with stronger initial conditions are better positioned to absorb and maximize the benefits of social assistance programs, while lagging regions face structural barriers that limit the program's effectiveness. As a result, without targeted and spatially differentiated policy interventions, social assistance programs such as the SIP may inadvertently reinforce existing regional disparities rather than fully close the development gap.

The impact of SIP on school participation rates in Indonesia indicates that the program has a positive and statistically significant effect, particularly among children from low-income households. The effect is more pronounced at the secondary education level than at the primary level, suggesting that financial assistance becomes increasingly critical as education costs rise at higher levels. The study further confirms that educational cash transfers are effective in reducing the risk of school dropout by alleviating both direct and indirect education-related expenses. However, the program's effectiveness remains contingent upon targeting accuracy and other structural factors. Overall, the findings suggest that the SIP constitutes a relevant policy instrument for expanding access to education and reducing disparities in school participation in Indonesia [19].

These findings also indicate that educational assistance programs function as an important social protection mechanism in supporting school retention among disadvantaged students. Nevertheless, despite their effectiveness in reducing dropout rates, such programs do not consistently generate a statistically significant impact on facilitating students' transition to higher levels of education, particularly the transition to secondary schooling. This limited effectiveness in promoting educational progression can be attributed to a range of structural and administrative constraints. Existing studies highlight persistent challenges, including delays in the disbursement of financial assistance, insufficient program dissemination and public awareness, weak monitoring and evaluation mechanisms, and quota allocation systems that are not fully aligned with actual regional needs. In addition, poverty-related structural barriers, such as limited household resources and unequal access to educational facilities, further underscore the need for more targeted and effectively governed educational assistance programs [7].

Accordingly, strengthening institutional governance, improving the integration and accuracy of beneficiary data systems, ensuring the timely and transparent disbursement of funds, and reinforcing monitoring and evaluation mechanisms constitute essential policy priorities. These measures are critical for enhancing the precision, efficiency, and long-term sustainability of educational assistance programs in promoting equitable access to education and facilitating upward educational mobility among students from economically disadvantaged households.

Failure to address these systemic shortcomings risks perpetuating targeting inefficiencies, misallocation of resources, and uneven program impacts across regions. In the absence of robust institutional and data governance frameworks, educational assistance programs may fall short of their intended redistributive function, thereby limiting their effectiveness in reducing educational inequality and, in the longer term, reinforcing intergenerational poverty traps.

4.4.2 P-Value distribution map and SIP parameters towards Pillar 2 (income equity and poverty reduction)

Cianjur and Cirebon Regencies are among the ten regions with the highest number of people living in poverty in West Java. The high proportion of low-income households directly constrains families' ability to finance their children's education. In this context, SIP serves as a critical intervention in preventing school dropout among disadvantaged children.

By enabling continued school participation, the SIP contributes to breaking the cycle of intergenerational poverty and reducing disparities in educational access between low- and higher-income groups [3]. Figures 5 and 6 show the distribution of probability values and coefficient parameter SIP on Pillar 2 (income equity and poverty reduction). Detailed probability values and parameter estimate for each region are reported in Appendix A2.

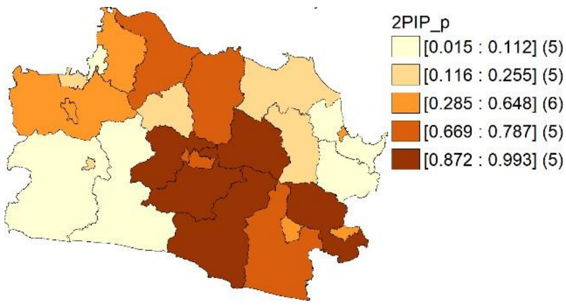

Figure 5. Probability value of Smart Indonesia Program (SIP) for Pillar 2

Kuningan Regency, although not the most populous region, exhibits a relatively high poverty rate in eastern West Java. Given limited income-generating opportunities and the predominance of the traditional agricultural sector, the SIP plays a significant role in alleviating the financial burden associated with education. This support not only reduces dropout rates but also mitigates educational inequality, which tends to be more pronounced in rural areas.

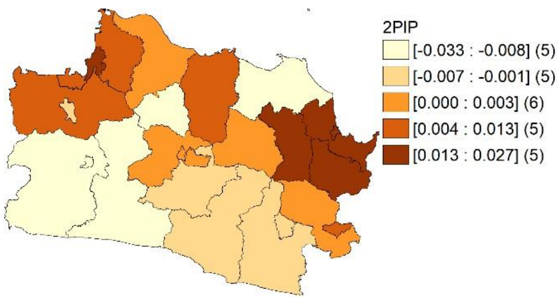

Figure 6. Coefficient parameter of Smart Indonesia Program (SIP) for Pillar 2

The city of Bekasi presents a different context. As an industrial and urban buffer city for Jakarta, although its poverty rate is not as high in relative terms as in Cianjur or Cirebon, the absolute number of poor residents remains substantial due to its large total population. Moreover, income inequality in urban areas is more pronounced, particularly between high-income formal sector workers and low-income informal sector workers. In this context, SIP functions as a vital instrument to bridge this gap, ensuring that children from poor households have comparable opportunities to continue their education as those from non-poor families [3].

Thus, the effectiveness of SIP in these four regions is strongly influenced by both the absolute number of poor residents and the degree of local socio-economic inequality. The greater the number of poor individuals, the higher the urgency and impact of SIP in reducing dropout rates. In turn, this contributes to strengthening Pillar 2 of the IEDI, which focuses on reducing poverty and narrowing income inequality through equitable access to education.

The control variables that influence the success of the Indonesia Pintar program are the availability of schools, teachers, and adequate road infrastructure. Conceptually, the success of SIP is not only determined by the amount and accuracy of educational assistance targets, but also by the readiness of the local education system to absorb and optimize the benefits of the program. The number and distribution of schools reflect the capacity and accessibility of educational services, while the number of teachers plays an important role in determining the quality of the learning process and the effectiveness of knowledge transfer. On the other hand, the availability of road infrastructure affects the level of accessibility of educational facilities, especially in reducing geographical barriers and transportation costs that can limit school participation. Therefore, SIP tends to be more effective in reducing poverty and income inequality when supported by adequate educational infrastructure, sufficient availability of educators, and good regional accessibility. In the context of regions/cities in West Java Province, variations in infrastructure capacity and educational resources are important factors that explain the differences in the success of SIP in promoting human capital development and improving regional economic welfare.

A growing body of empirical research emphasizes that access to basic education is a critical determinant of poverty reduction and human capital formation, as it enables disadvantaged households to engage in skill-enhancing opportunities that support long-term income growth. Disparities in educational infrastructure, such as uneven distribution of schools and inadequate numbers of qualified teachers, exacerbate educational inequities and hinder the capacity of education policy interventions to yield meaningful socio-economic outcomes. Moreover, infrastructure deficiencies particularly in transportation networks impede physical access to schooling and limit student participation, especially in remote regions, which can attenuate the effectiveness of targeted education programs such as SIP in reducing poverty and income inequality [20, 21].

4.4.3 P-value distribution map and Smart Indonesia Program parameters against Pillar 3 (expansion of access and opportunity)

SIP is statistically significant in Cianjur Regency, Sukabumi City and Regency, Purwakarta, Bandung and West Bandung Regency, Bandung City, and Cimahi City. This significance is attributable to a combination of factors, including a high school-age population, socio-economic vulnerability, and the availability of educational infrastructure, which collectively determine the extent to which SIP can expand access to education. Figures 7 and 8 show the distribution of probability values and coefficient parameter SIP on Pillar 3 (expansion of access and opportunity). Detailed probability values and parameter estimate for each region are reported in Appendix A3.

Regions with large population concentrations, such as Cianjur Regency, Bandung Regency, and Bandung City, tend to exhibit substantially higher numbers of school-age children. This demographic structure increases potential vulnerability to school dropout, particularly among children from low-income households. Existing empirical literature consistently demonstrates that household poverty constitutes a major structural barrier to educational participation, as financial constraints often compel families to prioritize immediate income-generating activities over long-term investment in human capital. Economic hardship frequently increases children's involvement in labor activities, which in turn reduces school enrollment rates and elevates dropout risks among socioeconomically disadvantaged groups [20].

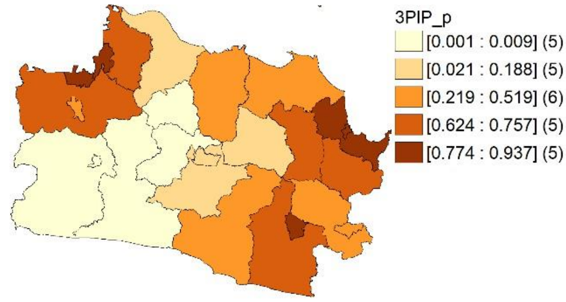

Figure 7. Probability value of Smart Indonesia Program (SIP) for Pillar 3

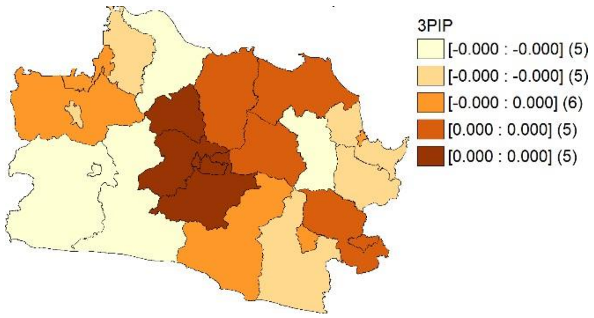

Figure 8. Coefficient parameter of Smart Indonesia Program (SIP) for Pillar 3

Educational assistance programs are widely recognized as effective policy interventions to mitigate these barriers. Evidence indicates that scholarship and financial support programs significantly enhance educational retention and continuity among disadvantaged students by alleviating both direct educational costs and opportunity costs associated with schooling [22]. Moreover, financial transfer interventions, including conditional and unconditional cash transfer schemes, have been empirically demonstrated to reduce school dropout rates and improve attendance in high-poverty settings, thereby strengthening educational accessibility for vulnerable populations [23].

Beyond short term educational outcomes, access to formal education serves as a critical mechanism for enhancing social mobility and promoting equality of opportunity. Educational attainment enables individuals from marginalized socioeconomic backgrounds to improve their long-term welfare prospects and to participate more effectively in economic development processes [24]. Within this context, educational assistance initiatives such as the SIP constitute a strategic policy instrument for expanding access to education, particularly in regions characterized by high densities of school-age populations and elevated poverty rates. By sustaining school participation among vulnerable groups, SIP contributes to human capital formation and supports broader objectives of inclusive and equitable economic development.

The socio-economic characteristics of Sukabumi City and Regency, as well as Purwakarta, which feature pockets of poverty in rural areas and urban peripheries, make SIP interventions particularly impactful. In these regions, economic constraints often constitute the primary barrier preventing children from continuing their education. By alleviating financial burdens, SIP assistance facilitates greater school participation among children from economically disadvantaged households, thereby expanding educational opportunities for groups previously vulnerable to marginalization.

The cities of Bandung and Cimahi, as urban centres with a concentration of higher and secondary education institutions, possess relatively adequate educational infrastructure, including a sufficient number of schools and qualified teachers. This facilitates more effective distribution of SIP, as aid recipients have schools that are readily accessible. In other words, the effectiveness of SIP in these cities is largely determined by the readiness of supporting infrastructure, enabling the program to promote equal educational opportunities more rapidly than in areas with limited facilities [9].

West Bandung and Purwakarta Regencies function as buffer zones for industrial and tourism activities, characterized by relatively high levels of social mobility. In these regions, economically disadvantaged and vulnerable groups benefit significantly from SIP, which enables continued access to formal education. This observation suggests that the SIP is particularly effective in contexts where opportunity gaps emerge as a result of urbanization and structural shifts in the local economy.

Accordingly, the significance of the SIP under Pillar 3 in these regions is driven by a combination of factors, including a relatively large school-age population, the presence of poor and vulnerable groups at risk of school dropout, and the availability of adequate educational infrastructure. The interaction of these factors enhances the effectiveness of the SIP in expanding access to education and broadening educational opportunities, which constitute the core objectives of Pillar 3 of IEDI.

4.4.4 Map of the distribution of p-value and Smart Indonesia Program parameters to the Inclusive Economic Development Index

Based on the estimated results, the SIP has been found to be significant in enhancing the IEDI across several cities and regions, including Sukabumi, Kuningan, Majalengka, Garut, Banjar, and Sumedang. SIP is particularly effective in improving the IEDI in areas characterized by high poverty levels, low household consumption, low NER, and limited educational and accessibility infrastructure. Figures 9 and 10 show the distribution of probability values and coefficient parameter SIP to Inclusive Economic Growth (IEDI). Detailed probability values and parameter estimate for each region are reported in Appendix A4.

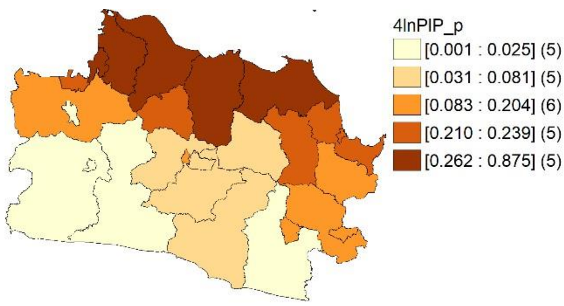

Figure 9. Probability value of Smart Indonesia Program (SIP) to Inclusive Economic Development Index (IEDI)

In Kuningan, Garut, and Banjar Regencies, the combination of a high number of poor residents and low household purchasing power increases the risk of school dropout. Furthermore, the limited number of schools and uneven distribution of teachers exacerbate disparities in access to education. In this context, SIP serves as a critical intervention to retain children from economically disadvantaged households in school by alleviating financial barriers to education [19].

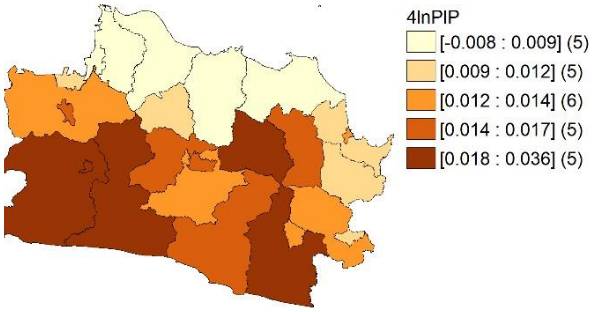

Figure 10. Coefficient parameter of Smart Indonesia Program (SIP) to Inclusive Economic Development Index (IEDI)

In Sukabumi and Garut, although the school-age population is large, challenging geographical conditions and limited road infrastructure result in uneven access to education. In this context, SIP assistance plays a critical role in alleviating transportation and school-related cost barriers [23]. In contrast, in Majalengka and Sumedang, the development of strategic infrastructure, such as airports and toll roads, promotes economic transformation but continues to leave disparities in educational access in rural areas. Here, SIP functions to protect economically disadvantaged groups, ensuring that they are not further marginalized in the development process [9]. Consequently, the effectiveness of SIP in enhancing the IEDI across these six regions is closely linked to the interplay of poverty levels, low household consumption, weak NER, and limited educational infrastructure, highlighting the program's relevance and tangible impact on inclusive development.

Relatively adequate educational infrastructure, including the number of schools, qualified teachers, and accessibility provided by road networks and transportation facilities, enables the optimal utilization of SIP assistance. Under such conditions, SIP funds function not only to cover basic needs but also to sustain school participation and continuity [9].

The effectiveness of development programs, including both infrastructure investment and educational assistance, is determined not only by the scale of financial resources allocated but also by the efficiency of governance, targeting accuracy, distribution mechanisms, and the socio-economic context of beneficiary regions. Similar to transportation infrastructure investments, which may fail to generate inclusive economic growth without effective financing and implementation, the Indonesia Smart Program (SIP) also requires strong institutional coordination, equitable distribution, and adequate educational infrastructure to maximize its long-term developmental impact [22]. Regional socio-economic characteristics further influence the effectiveness of SIP, as high poverty rates, low household consumption, and low NER significantly increase the urgency and relevance of educational assistance interventions. In disadvantaged areas, SIP plays a crucial role in reducing financial barriers to education, lowering dropout risks, and narrowing disparities in educational access across socio-economic groups [25]. Therefore, the program's contribution to improving the IEDI can be understood as the result of strategic synergy among educational infrastructure availability, effective policy implementation, and the substantial needs of vulnerable populations. This demonstrates that SIP functions not merely as an educational subsidy, but also as a broader social investment instrument capable of strengthening human capital, reducing poverty, promoting regional equality, and supporting sustainable inclusive economic growth when implemented through adaptive and regionally responsive policy frameworks.

5. DISCUSSION

The SIP has proven to have a different influence on each region in West Java when viewed from each Pillar in the IEDI.

1. Pillar 1 (Economic Growth)

SIP is statistically significant in the Bogor Area (Bogor Regency and Depok City), the Purwakarta Area (Purwakarta Regency), and the Bandung Area (Bandung Regency, West Bandung Regency, Bandung City, Cimahi City, and Sumedang Regency). The significance of these regions is primarily influenced by their proximity to major economic centres (Jakarta and Bandung) and the availability of adequate educational infrastructure. SIP operates effectively in these areas due to sufficient school and teacher resources, allowing recipients to fully utilize educational funds to support school continuity and enhance human capital quality. In turn, this contributes to strengthening the Economic Growth Pillar.

2. Pillar 2 (Poverty and Income Inequality)

SIP is statistically significant in Cianjur Regency, Cirebon Regency, Bekasi City, and Kuningan Regency. This significance is attributable to the high absolute number of poor residents in these areas, which substantially increases the risk of school dropout. SIP functions as a critical intervention to alleviate financial barriers to education and to reduce disparities in educational access between children from poor and non-poor households. Consequently, SIP in these regions contributes directly to poverty reduction and the mitigation of socio-economic inequalities.

3. Pillar 3 (Expanding Access and Opportunity)

SIP is statistically significant Cianjur, Sukabumi, Purwakarta, Bandung, and Cimahi. This significance can be attributed to the high absolute number of poor residents in these areas, which markedly increases the risk of school dropout. SIP serves as a critical intervention to alleviate financial barriers to education and to reduce disparities in educational access between children from poor and non-poor households. Consequently, SIP in these regions contributes directly to poverty reduction and the alleviation of socio-economic inequalities.

4. Inclusive Economic Development Index

Overall, SIP is statistically significant only in Sukabumi City and Regency, Kuningan Regency, Majalengka, Garut, Banjar City, and Sumedang Regency. This significance arises from a combination of factors, including high poverty levels (Kuningan, Garut, Banjar), a large school-age population (Sukabumi), limited access to education (Garut, Sukabumi), and socio-economic transformation resulting from infrastructure development (Majalengka, Sumedang). In these areas, SIP not only alleviates financial barriers to education but also prevents disadvantaged groups from being further marginalized in the development process, thereby contributing substantively to all three Pillars of the IEDI.

Poverty has been shown to exhibit a clustered spatial pattern with positive spatial autocorrelation, where regions with high poverty levels are often concentrated near other impoverished areas due to limited infrastructure, inadequate access to education and healthcare, geographic isolation, and uneven regional development [26]. This spatial concentration underscores the importance of geographically targeted poverty alleviation strategies, as uniform policy interventions may not effectively address the distinct structural challenges faced by high-poverty regions. Spatially responsive policies that prioritize infrastructure development, educational access, public services, and regional connectivity are therefore essential for reducing poverty more effectively and equitably [26].

In a similar context, the School Indonesia Program (SIP) in West Java demonstrates that social assistance effectiveness also varies significantly across regions depending on local socio-economic and spatial conditions. Under Pillar 1 (Economic Growth), SIP is more effective in areas proximate to major growth centers such as Bogor, Depok, Bandung, Cimahi, and Purwakarta, where stronger educational infrastructure supports better outcomes. Under Pillar 2 (Poverty and Income Inequality), SIP plays a more significant role in regions with larger poor populations, including Cianjur, Cirebon, Bekasi, and Kuningan. Meanwhile, under Pillar 3 (Expansion of Access and Opportunity), SIP has greater influence in regions characterized by large school-age populations and unequal educational access, such as Cianjur, Sukabumi, Greater Bandung, and Purwakarta. Overall, SIP is most significant in Sukabumi, Kuningan, Majalengka, Garut, Banjar, and Sumedang due to the combined presence of high poverty levels, limited educational opportunities, and ongoing economic transformation. These findings demonstrate that educational assistance programs can function not only as poverty reduction tools but also as strategic instruments for addressing spatial inequality, strengthening human capital, and promoting more inclusive economic growth when implemented through regionally adaptive policy frameworks.

6. NOVELTY AND RESEARCH LIMITATION

The novelty of this study lies in its application of the IEDI framework to evaluate the spatially differentiated impacts of the SIP in West Java. Unlike previous research, which generally examines SIP from the perspective of educational outcomes or poverty reduction in isolation, this study integrates the three Pillars of inclusive development economic growth, poverty and inequality reduction, and expansion of access and opportunity within a geographically weighted analytical framework. This approach not only highlights the heterogeneity of SIP's effectiveness across regions and cities but also provides empirical evidence on how regional socio-economic characteristics and educational infrastructure influence the program's outcomes. Consequently, the study offers a more comprehensive and place-based understanding of SIP's role in fostering inclusive development.

This study has several limitations. First, the analysis is confined to the province of West Java, and therefore the findings may not fully represent the heterogeneous impacts of SIP in other regions of Indonesia. Second, the study relies exclusively on secondary data, which may not capture qualitative aspects such as household perceptions, school-level variations, or local implementation challenges. Third, while the geographically weighted approach provides valuable spatial insights, it does not fully account for dynamic socio-economic changes or policy interventions that may interact with SIP over time. Future research should integrate micro-level data, longitudinal surveys, and cross-provincial comparisons to offer a more comprehensive understanding of SIP's role in promoting inclusive economic development.

Previous studies on SIP and similar CCT schemes generally focus on their direct impacts on education, such as school participation rates, dropout prevention, and household welfare outcomes. While these studies confirm the program's contribution to human capital development, they often examine these effects in isolation and without considering spatial heterogeneity. Moreover, most research emphasizes either micro-level household surveys or national-level assessments, leaving a gap in understanding how SIP interacts with regional socio-economic structures and development disparities. This study addresses this gap by employing the IEDI as an analytical framework and applying geographically weighted analysis. In doing so, it advances the literature by linking SIP not only to educational outcomes but also to broader inclusive development dimensions economic growth, poverty and inequality reduction, and expansion of access while simultaneously revealing spatial variations across regions and cities in West Java.

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APPENDIX

Appendix A1. SIP to Pillar 1: Economic Growth Index

Table A1-1. Probability SIP to Pillar 1: Economic Growth Index

No	City/District	Intercept_prob	SIP_prob	School_prob	Teacher_prob	Road_prob	Poor_prob	LnCons_prob	NER__prob
1	Bandung	0.152	0.087	0.585	0.194	0.939	0.750	0.000	0.097
2	Bandung Barat	0.205	0.06	0.063	0.117	0.045	0.06	0.001	0.710
3	Bekasi	0.702	0.302	0.343	0.008	0.871	0.018	0.068	0.313
4	Bogor	0.015	0.197	0.308	0.893	0.68	0.038	0.000	0.109
5	Ciamis	0.776	0.004	0.053	0.601	0.069	0.603	0.410	0.995
6	Cianjur	0.000	0.105	0.058	0.005	0.005	0.002	0.000	0.509
7	Cirebon	0.577	0.051	0.593	0.348	0.194	0.082	0.461	0.038
8	Garut	0.000	0.401	0.752	0.591	0.588	0.931	0.000	0.708
9	Indramayu	0.914	0.298	0.57	0.753	0.105	0.88	0.571	0.995

10	Karawang	0.224	0.138	0.695	0.293	0.104	0.098	0.005	0.972
11	Kota Bandung	0.631	0.006	0.359	0.063	0.312	0.31	0.011	0.853
12	Kota Banjar	0.397	0.148	0.111	0.897	0.27	0.516	0.87	0.634
13	Kota Bekasi	0.864	0.585	0.06	0.036	0.344	0.062	0.426	0.912
14	Kota Bogor	0.001	0.172	0.006	0.242	0.84	0.036	0.000	0.008
15	Kota Cimahi	0.475	0.011	0.133	0.069	0.077	0.126	0.004	0.727
16	Kota Cirebon	0.699	0.025	0.335	0.86	0.075	0.095	0.558	0.089
17	Kota Depok	0.129	0.205	0.813	0.443	0.652	0.084	0.003	0.468
18	Kota Sukabumi	0.053	0.769	0.116	0.608	0.204	0.193	0.002	0.335
19	Kota Tasikmalaya	0.878	0.003	0.082	0.272	0.061	0.573	0.316	0.773
20	Kuningan	0.911	0.021	0.704	0.009	0.259	0.022	0.051	0.006
21	Majalengka	0.324	0.61	0.592	0.008	0.743	0.14	0.331	0.131
22	Purwakarta	0.000	0.001	0.057	0.45	0.002	0.204	0.000	0.254
23	Subang	0.571	0.29	0.437	0.01	0.357	0.922	0.089	0.000
24	Sukabumi	0.05	0.756	0.107	0.601	0.2	0.186	0.001	0.336
25	Sumedang	0.044	0.007	0.11	0.719	0.055	0.84	0.000	0.893
26	Tasikmalaya	0.676	0.01	0.346	0.1	0.081	0.958	0.472	0.935

Table A1-2. Coefficient parameter SIP to Pillar 1: Economic Growth Index

No	City/District	Intercept	SIP	School	Teacher	Road	Poor	Ln_Cons	NER
1	Bandung	-5.041	1.6E-05	1.2E-04	-0.240	-1.5E-05	-8.1E-07	1.034	-0.035
2	Bandung Barat	-4.033	1.5E-05	4.2E-04	-0.271	-3.1E-04	-4.5E-06	0.811	-0.006
3	Bekasi	-1.231	-7.0E-06	-1.1E-04	0.525	1.1E-05	-4.1E-06	0.331	-0.013
4	Bogor	-6.894	9.9E-06	1.2E-04	0.020	-2.7E-05	-3.7E-06	0.974	-0.022
5	Ciamis	1.437	2.9E-05	-4.5E-04	-0.072	-5.7E-04	1.4E-06	0.326	0.000
6	Cianjur	-12.271	-1.4E-05	2.1E-04	0.317	-3.4E-04	-4.9E-06	1.091	0.006
7	Cirebon	4.659	3.7E-05	-3.3E-04	-0.433	-5.6E-04	4.8E-06	0.377	-0.023
8	Garut	-11.189	7.0E-06	-7.1E-05	-0.123	-1.2E-04	1.9E-07	1.253	-0.004
9	Indramayu	-1.385	2.5E-05	-4.2E-04	0.185	-7.4E-04	-6.4E-07	0.433	0.000
10	Karawang	-6.854	-1.5E-05	6.9E-05	0.314	1.9E-04	-3.5E-06	0.729	0.001
11	Kota Bandung	-1.729	2.4E-05	1.9E-04	-0.359	-1.8E-04	-2.3E-06	0.670	-0.003
12	Kota Banjar	5.821	1.9E-05	-6.5E-04	-0.023	-4.6E-04	2.6E-06	-0.105	0.017
13	Kota Bekasi	0.535	4.1E-06	-2.5E-04	0.457	-6.0E-05	-3.1E-06	0.166	0.002
14	Kota Bogor	-8.828	1.1E-05	2.6E-04	-0.138	-1.6E-05	-3.6E-06	1.234	-0.035
15	Kota Cimahi	-2.402	2.1E-05	3.4E-04	-0.329	-2.9E-04	-3.7E-06	0.719	-0.006
16	Kota Cirebon	3.522	4.9E-05	-6.9E-04	-0.097	-8.7E-04	5.1E-06	0.320	-0.022
17	Kota Depok	-4.776	9.7E-06	-3.5E-05	0.156	-2.9E-05	-3.2E-06	0.719	-0.012
18	Kota Sukabumi	-7.146	-4.0E-06	1.9E-04	0.122	-3.1E-04	-3.1E-06	0.921	-0.016
19	Kota Tasikmalaya	0.856	2.5E-05	-3.4E-04	-0.160	-4.7E-04	1.2E-06	0.424	-0.004
20	Kuningan	-0.595	2.6E-05	-1.3E-04	-0.506	-3.1E-04	5.3E-06	0.769	-0.024
21	Majalengka	5.933	6.1E-06	1.7E-04	-0.834	1.0E-04	2.9E-06	0.380	-0.013
22	Purwakarta	-15.941	-2.4E-05	3.2E-04	-0.131	3.2E-04	-2.0E-06	1.487	0.013
23	Subang	-2.488	1.2E-05	2.6E-04	-0.522	-1.5E-04	-3.2E-07	0.479	0.051
24	Sukabumi	-7.213	-4.2E-06	1.9E-04	0.123	-3.1E-04	-3.2E-06	0.924	-0.015
25	Sumedang	-7.085	2.0E-05	-2.9E-04	0.081	-3.9E-04	4.1E-07	0.864	-0.001
26	Tasikmalaya	2.561	2.0E-05	-1.9E-04	-0.273	-4.6E-04	1.1E-07	0.323	0.001

Appendix A2. SIP to Pillar 2: Poverty and Inequality Index

Table A2-1. Probability SIP to Pillar 2: Poverty and Inequality Index

No	City/District	Intercept_prob	SIP_prob	School_prob	Teacher_prob	Road_prob	Poor_prob	LnCons_prob	NER_prob
1	Bandung	0.182	0.197	0.015	0.817	0.897	0.021	0.864	0.11
2	Bandung Barat	0.697	0.016	0.164	0.727	0.104	0.39	0.084	0.688
3	Bekasi	0.909	0.779	0.000	0.001	0.011	0.529	0.361	0.549
4	Bogor	0.104	0.052	0.009	0.000	0.009	0.616	0.028	0.163
5	Ciamis	0.005	0.000	0.619	0.779	0.225	0.500	0.253	0.685
6	Cianjur	0.004	0.108	0.93	0.057	0.012	0.426	0.71	0.006
7	Cirebon	0.903	0.043	0.035	0.325	0.309	0.002	0.392	0.231
8	Garut	0.159	0.564	0.219	0.017	0.061	0.734	0.662	0.232
9	Indramayu	0.137	0.155	0.797	0.311	0.119	0.825	0.17	0.632
10	Karawang	0.477	0.674	0.008	0.047	0.417	0.531	0.81	0.619
11	Kota Bandung	0.19	0.029	0.166	0.708	0.031	0.299	0.779	0.43
12	Kota Banjar	0.041	0.000	0.159	0.742	0.027	0.124	0.256	0.27
13	Kota Bekasi	0.083	0.342	0.000	0.000	0.024	0.104	0.037	0.171
14	Kota Bogor	0.052	0.005	0.004	0.000	0.001	0.655	0.416	0.481
15	Kota Cimahi	0.471	0.020	0.172	0.942	0.06	0.377	0.257	0.881
16	Kota Cirebon	0.527	0.004	0.007	0.034	0.551	0.003	0.365	0.226
17	Kota Depok	0.008	0.14	0.028	0.000	0.014	0.365	0.003	0.032
18	Kota Sukabumi	0.000	0.505	0.593	0.375	0.019	0.793	0.247	0.013
19	Kota Tasikmalaya	0.001	0.000	0.688	0.139	0.736	0.921	0.106	0.004
20	Kuningan	0.53	0.214	0.689	0.000	0.000	0.005	0.11	0.765
21	Majalengka	0.208	0.283	0.264	0.005	0.000	0.056	0.456	0.586
22	Purwakarta	0.002	0.695	0.779	0.691	0.001	0.737	0.799	0.000

23	Subang	0.239	0.224	0.276	0.267	0.000	0.847	0.062	0.000
24	Sukabumi	0.000	0.498	0.601	0.38	0.018	0.797	0.239	0.013
25	Sumedang	0.003	0.199	0.352	0.126	0.000	0.554	0.696	0.194
26	Tasikmalaya	0.001	0.000	0.298	0.072	0.719	0.803	0.109	0.003

Table A2-2. Coefficient Parameter SIP to Pillar 2: Poverty and Inequality Index

No	City/District	Intercept	SIP	School	Teacher	Road	Poor	Ln_Cons	NER
1	Bandung	4.422	-1.1E-05	4.9E-04	-0.038	-2.5E-05	-5.4E-06	-0.044	0.032
2	Bandung Barat	1.119	-1.7E-05	2.8E-04	0.052	2.3E-04	-1.9E-06	0.365	-0.006
3	Bekasi	0.370	-1.7E-06	-5.1E-04	0.699	1.6E-04	9.6E-07	0.151	-0.008
4	Bogor	-4.160	-1.3E-05	-3.2E-04	0.839	1.5E-04	7.8E-07	0.438	-0.018
5	Ciamis	12.766	-4.1E-05	-1.1E-04	0.033	3.6E-04	1.7E-06	-0.405	-0.006
6	Cianjur	8.027	-1.5E-05	1.0E-05	0.190	3.1E-04	-1.2E-06	-0.070	-0.026
7	Cirebon	-0.912	3.5E-05	-1.2E-03	0.432	4.0E-04	7.9E-06	0.385	-0.012
8	Garut	3.498	-4.2E-06	-2.5E-04	0.530	-3.9E-04	-6.8E-07	0.079	-0.013
9	Indramayu	17.793	3.3E-05	-1.6E-04	0.502	-6.3E-04	-8.1E-07	-0.969	-0.010
10	Karawang	4.287	4.4E-06	-5.0E-04	0.622	1.1E-04	1.2E-06	-0.069	-0.012
11	Kota Bandung	4.472	-1.7E-05	2.6E-04	-0.065	3.5E-04	-2.1E-06	0.070	0.013
12	Kota Banjar	13.347	-6.7E-05	-5.7E-04	0.054	8.4E-04	6.1E-06	-0.735	0.043
13	Kota Bekasi	-5.116	-6.5E-06	-5.9E-04	1.121	1.3E-04	2.4E-06	0.396	-0.020
14	Kota Bogor	4.469	-2.0E-05	-2.4E-04	0.493	2.6E-04	-6.6E-07	-0.137	0.008
15	Kota Cimahi	2.244	-1.7E-05	2.7E-04	0.011	2.8E-04	-1.9E-06	0.257	0.002
16	Kota Cirebon	-5.172	5.9E-05	-1.8E-03	1.103	-2.7E-04	8.6E-06	0.438	-0.015
17	Kota Depok	-7.827	-9.9E-06	-3.5E-04	0.972	1.3E-04	1.5E-06	0.703	-0.033
18	Kota Sukabumi	14.438	-9.2E-06	6.7E-05	-0.219	6.1E-04	6.1E-07	-0.305	-0.038
19	Kota Tasikmalaya	17.831	-2.7E-05	-7.2E-05	0.191	-7.7E-05	-1.9E-07	-0.613	-0.042
20	Kuningan	3.110	-1.2E-05	1.4E-04	-0.987	1.8E-03	6.1E-06	0.571	0.002
21	Majalengka	7.526	-1.3E-05	4.0E-04	-0.958	1.6E-03	3.6E-06	0.282	-0.004
22	Purwakarta	9.915	-2.6E-06	-4.6E-05	-0.070	3.0E-04	4.8E-07	0.042	-0.047
23	Subang	4.837	-1.3E-05	3.8E-04	-0.212	6.0E-04	6.4E-07	0.483	-0.055
24	Sukabumi	14.443	-9.3E-06	6.5E-05	-0.214	6.1E-04	5.9E-07	-0.307	-0.038
25	Sumedang	10.180	-8.7E-06	1.6E-04	-0.341	7.8E-04	-1.2E-06	-0.084	-0.011
26	Tasikmalaya	19.768	-2.5E-05	-2.0E-04	0.294	-8.9E-05	5.1E-07	-0.680	-0.061

Appendix A3. SIP to Pillar 3: Access and Opportunity Index

Table A3-1. Probability SIP to Pillar 3: Access and Opportunity Index

No	City/District	Intercept_prob	SIP_prob	School_prob	Teacher_prob	Road_prob	Poor_prob	LnCons_prob	NER__prob
1	Bandung	0.001	0.025	0.000	0.000	0.033	0.001	0.046	0.001
2	Bandung Barat	0.030	0.000	0.000	0.000	0.904	0.001	0.505	0.007
3	Bekasi	0.698	0.889	0.056	0.558	0.288	0.423	0.135	0.412
4	Bogor	0.002	0.324	0.735	0.012	0.663	0.41	0.356	0.261
5	Ciamis	0.115	0.067	0.306	0.000	0.155	0.629	0.601	0.071
6	Cianjur	0.000	0.000	0.001	0.000	0.000	0.004	0.000	0.000
7	Cirebon	0.244	0.475	0.738	0.972	0.011	0.922	0.624	0.698
8	Garut	0.739	0.372	0.33	0.56	0.936	0.444	0.104	0.724
9	Indramayu	0.381	0.287	0.307	0.461	0.000	0.977	0.951	0.072
10	Karawang	0.664	0.783	0.007	0.101	0.215	0.393	0.124	0.352
11	Kota Bandung	0.001	0.348	0.005	0.000	0.000	0.011	0.049	0.001
12	Kota Banjar	0.221	0.109	0.581	0.000	0.261	0.485	0.484	0.198
13	Kota Bekasi	0.008	0.74	0.001	0.000	0.88	0.711	0.459	0.68
14	Kota Bogor	0.001	0.246	0.001	0.000	0.359	0.773	0.749	0.71
15	Kota Cimahi	0.042	0.015	0.001	0.000	0.03	0.006	0.611	0.023
16	Kota Cirebon	0.28	0.705	0.73	0.883	0.003	0.828	0.684	0.516
17	Kota Depok	0.001	0.39	0.672	0.008	0.808	0.423	0.218	0.216
18	Kota Sukabumi	0.000	0.000	0.000	0.231	0.495	0.000	0.000	0.000
19	Kota Tasikmalaya	0.134	0.129	0.445	0.000	0.158	0.605	0.638	0.062
20	Kuningan	0.271	0.04	0.258	0.932	0.025	0.681	0.912	0.999
21	Majalengka	0.12	0.49	0.652	0.731	0.088	0.771	0.486	0.457
22	Purwakarta	0.755	0.706	0.067	0.081	0.106	0.056	0.118	0.016
23	Subang	0.381	0.778	0.615	0.011	0.000	0.175	0.001	0.088
24	Sukabumi	0.000	0.000	0.000	0.252	0.473	0.000	0.000	0.000
25	Sumedang	0.263	0.114	0.066	0.557	0.397	0.266	0.890	0.700
26	Tasikmalaya	0.327	0.152	0.720	0.001	0.108	0.236	0.334	0.109

Table A3-2. Coefficient parameter SIP to Pillar 3: Access and Opportunity Index

No	City/District	Intercept	SIP	School	Teacher	Road	Poor	Ln_Cons	NER
1	Bandung	23.000	3.9E-05	1.3E-03	-2.236	9.6E-04	-1.4E-05	-1.068	0.131
2	Bandung	13.449	5.6E-05	1.6E-03	-1.891	-4.1E-05	-1.5E-05	-0.306	0.089

	Barat								
3	Bekasi	2.680	-1.5E-06	4.4E-04	-0.264	1.2E-04	-2.1E-06	0.439	-0.025
4	Bogor	17.506	1.1E-05	1.2E-04	-1.081	4.1E-05	2.5E-06	-0.462	0.032
5	Ciamis	10.983	-2.3E-05	2.9E-04	-0.945	5.2E-04	1.5E-06	0.275	-0.030
6	Cianjur	87.603	-1.3E-04	2.5E-03	-4.214	2.8E-03	-1.7E-05	-4.749	0.142
7	Cirebon	13.785	-1.7E-05	-2.9E-04	-0.024	-1.5E-03	-3.5E-07	-0.341	-0.006
8	Garut	1.416	1.1E-05	-3.6E-04	-0.298	4.3E-05	2.9E-06	0.571	-0.012
9	Indramayu	8.210	1.5E-05	-6.2E-04	0.405	-2.0E-03	-8.6E-08	-0.035	-0.021
10	Karawang	4.254	-4.0E-06	9.3E-04	-0.945	2.3E-04	-2.7E-06	0.693	-0.038
11	Kota Bandung	25.597	1.5E-05	1.1E-03	-2.400	1.9E-03	-1.1E-05	-1.175	0.131
12	Kota Banjar	9.490	-3.0E-05	2.8E-04	-0.949	6.4E-04	3.2E-06	0.470	-0.045
13	Kota Bekasi	11.567	3.2E-06	6.6E-04	-1.250	1.3E-05	-7.9E-07	0.208	-0.008
14	Kota Bogor	14.945	1.4E-05	5.9E-04	-1.726	1.6E-04	7.8E-07	0.101	0.008
15	Kota Cimahi	14.192	3.7E-05	1.3E-03	-1.926	7.3E-04	-1.2E-05	-0.253	0.074
16	Kota Cirebon	12.457	-8.9E-06	-2.9E-04	0.100	-1.7E-03	-7.5E-07	-0.277	-0.010
17	Kota Depok	17.858	9.4E-06	1.2E-04	-1.027	2.2E-05	2.2E-06	-0.509	0.033
18	Kota Sukabumi	24.807	-8.1E-05	7.9E-04	-0.409	-1.9E-04	-1.4E-05	-1.598	0.107
19	Kota Tasikmalaya	11.229	-1.6E-05	1.9E-04	-0.894	5.1E-04	1.4E-06	0.269	-0.036
20	Kuningan	7.407	-3.3E-05	-5.9E-04	0.022	-8.8E-04	1.4E-06	0.054	0.000
21	Majalengka	16.962	-1.8E-05	-4.4E-04	-0.275	-1.1E-03	1.1E-06	-0.440	-0.010
22	Purwakarta	3.755	-7.6E-06	1.1E-03	-1.146	3.0E-04	-6.1E-06	1.038	-0.075
23	Subang	-6.676	4.8E-06	2.7E-04	-1.172	1.3E-03	6.5E-06	1.551	-0.038
24	Sukabumi	24.824	-8.2E-05	7.9E-04	-0.393	-2.0E-04	-1.4E-05	-1.608	0.108
25	Sumedang	7.079	2.0E-05	-6.7E-04	-0.320	4.4E-04	4.6E-06	0.056	0.006
26	Tasikmalaya	8.312	-1.7E-05	-1.2E-04	-0.779	9.0E-04	5.0E-06	0.694	-0.084

APPENDIX A4. SIP to Inclusive Economic Development Index (IEDI)

Table A4-1. Probability SIP to Inclusive Economic Development Index (IEDI)

No	Kota	Intercept_prob	SIP_prob	School_prob	Teacher_prob	Road_prob	Poor_prob	LnCons_prob	NER__prob
1	Bandung	0,158	0,075	0,004	0,004	0,008	0,019	0,000	0,873
2	Bandung Barat	0,669	0,071	0,000	0,001	0,091	0,003	0,000	0,982
3	Bekasi	0,825	0,309	0,662	0,313	0,607	0,850	0,000	0,008
4	Bogor	0,829	0,103	0,003	0,007	0,427	0,021	0,000	0,735
5	Ciamis	0,392	0,156	0,575	0,001	0,938	0,837	0,032	0,074
6	Cianjur	0,805	0,007	0,000	0,000	0,991	0,001	0,001	0,603
7	Cirebon	0,983	0,239	0,332	0,001	0,826	0,588	0,008	0,055
8	Garut	0,12	0,042	0,466	0,035	0,022	0,382	0,000	0,007
9	Indramayu	0,932	0,875	0,357	0,273	0,196	0,709	0,017	0,106
10	Karawang	0,4	0,483	0,253	0,478	0,061	0,917	0,000	0,040
11	Kota Bandung	0,336	0,081	0,003	0,003	0,003	0,027	0,000	0,741
12	Kota Banjar	0,42	0,204	0,747	0,002	0,835	0,968	0,087	0,099
13	Kota Bekasi	0,737	0,739	0,442	0,777	0,562	0,644	0,000	0,047
14	Kota Bogor	0,72	0,023	0,001	0,003	0,506	0,005	0,000	0,701
15	Kota Cimahi	0,39	0,083	0,001	0,002	0,017	0,011	0,000	0,886
16	Kota Cirebon	0,878	0,228	0,244	0,001	0,777	0,627	0,006	0,052
17	Kota Depok	0,903	0,21	0,006	0,014	0,401	0,048	0,000	0,484
18	Kota Sukabumi	0,478	0,001	0,000	0,022	0,991	0,001	0,000	0,075
19	Kota Tasikmalaya	0,368	0,159	0,492	0,001	0,953	0,655	0,022	0,054
20	Kuningan	0,652	0,198	0,691	0,001	0,908	0,648	0,031	0,067
21	Majalengka	0,094	0,237	0,249	0,008	0,510	0,878	0,395	0,059
22	Purwakarta	0,109	0,211	0,001	0,001	0,000	0,075	0,000	0,320
23	Subang	0,449	0,262	0,012	0,002	0,002	0,261	0,000	0,466
24	Sukabumi	0,473	0,001	0,000	0,022	0,988	0,001	0,000	0,074
25	Sumedang	0,805	0,031	0,093	0,003	0,001	0,160	0,004	0,714
26	Tasikmalaya	0,783	0,025	0,137	0,000	0,601	0,293	0,000	0,036

Table A4-2. Coefficient parameter SIP to Inclusive Economic Development Index (IEDI)

No	Kota	Intercept	SIP	School	Teacher	Road	Poor	Ln_Cons	NER
1	Bandung	-3,075	0,014	3,7E-04	-0,397	2,9E-04	-4,3E-06	0,770	-0,001
2	Bandung Barat	-1,029	0,015	6,8E-04	-0,544	2,2E-04	-6,5E-06	0,673	0,000
3	Bekasi	0,444	-0,008	-3,6E-05	0,140	2,5E-05	2,9E-07	0,452	-0,023
4	Bogor	-0,334	0,012	1,9E-04	-0,227	3,8E-05	-3,3E-06	0,532	-0,003
5	Ciamis	2,410	0,012	6,0E-05	-0,397	-1,3E-05	-3,2E-07	0,469	-0,010
6	Cianjur	0,513	0,019	3,9E-04	-0,396	1,0E-06	-4,8E-06	0,495	0,003
7	Cirebon	-0,069	0,011	1,2E-04	-0,441	-4,2E-05	9,8E-07	0,669	-0,011
8	Garut	-3,291	0,016	8,7E-05	-0,334	3,2E-04	-1,5E-06	0,857	-0,016

9	Indramayu	0,366	0,002	2,9E-04	-0,355	-3,1E-04	8,8E-07	0,610	-0,010
10	Karawang	-1,575	-0,005	8,1E-05	-0,075	8,8E-05	1,7E-07	0,649	-0,017
11	Kota Bandung	-2,189	0,014	3,7E-04	-0,457	3,8E-04	-4,0E-06	0,739	-0,003
12	Kota Banjar	2,704	0,012	3,8E-05	-0,390	-3,7E-05	6,5E-08	0,442	-0,009
13	Kota Bekasi	0,595	-0,003	5,2E-05	-0,028	2,8E-05	-6,8E-07	0,472	-0,016
14	Kota Bogor	-0,552	0,017	2,2E-04	-0,259	3,2E-05	-4,3E-06	0,523	0,003
15	Kota Cimahi	-1,975	0,014	4,9E-04	-0,479	3,0E-04	-5,0E-06	0,723	-0,001
16	Kota Cirebon	-0,488	0,012	1,5E-04	-0,444	-5,5E-05	8,9E-07	0,700	-0,011
17	Kota Depok	-0,191	0,009	1,7E-04	-0,205	4,0E-05	-2,8E-06	0,531	-0,005
18	Kota Sukabumi	-1,486	0,036	2,7E-04	-0,270	-9,5E-07	-7,4E-06	0,476	0,021
19	Kota Tasikmalaya	2,388	0,012	7,2E-05	-0,388	-9,9E-06	-7,5E-07	0,476	-0,012
20	Kuningan	1,462	0,012	4,7E-05	-0,417	-2,1E-05	7,6E-07	0,546	-0,010
21	Majalengka	7,809	0,015	2,2E-04	-0,777	1,7E-04	3,3E-07	0,247	-0,011
22	Purwakarta	-3,422	0,010	5,1E-04	-0,499	2,5E-04	-3,3E-06	0,874	-0,008
23	Subang	-2,030	0,009	4,3E-04	-0,495	2,9E-04	-2,5E-06	0,764	-0,005
24	Sukabumi	-1,506	0,036	2,7E-04	-0,270	-1,2E-06	-7,4E-06	0,476	0,021
25	Sumedang	0,681	0,020	2,0E-04	-0,531	5,7E-04	-2,7E-06	0,562	-0,003
26	Tasikmalaya	-0,503	0,018	1,5E-04	-0,431	8,5E-05	-1,8E-06	0,696	-0,013