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Author(s)
Corresponding Author
Moh Najikhul Fajri
0000-0002-6907-8784
moh.najikhul.fajri-2021@feb.unair.ac.id
Department of Economics
Faculty Economy and Business, Airlangga University
Hore Institute Indonesia, Surabaya
Central Bank of Indonesia, Jakarta

Backtiar Putra Pratama
0000-0002-6150-9041
backtiar-economist@hore-institute.com
Hore Institute Indonesia, Surabaya

Achmad Kharisudin
0000-0002-2544-4906
kharisudin135@student.ub.ac.id
Department of Social, Economics, and Agriculture, Faculty of Agriculture, Brawijaya University

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Fiscal Decentralization and Green Development Efficiency

Evidence From the New Capital "Nusantara" Buffer Zone

Moh Najikhul Fajri, Backtiar Putra Pratama, Achmad Kharisudin

Abstract: This paper aims to analyze the effect of fiscal decentralization on green development efficiency. This paper uses efficiency analysis: Slack Based Model to measure an efficiency score and dynamic panel regression: Generalized Method of Moments to maintain a correlation between fiscal decentralization and efficiency score. This study uses the environmental quality index and regional budget expenditure as analytical fiscal variables. The results show that the original regional income positively affects the efficiency of green development. Meanwhile, provincial spending and population have negatively affected green development efficiency. The influence is due to behavior where in the short term, the region that has just been built will have an impact on reducing the efficiency level, then gradually increasing efficiency driven by the presence of local indigenous income. The uncited form of spending from local governments sometimes only focuses on the orientation of economic growth and physical achievement to slightly ignore the environmental aspect.

About the Author(s)

Moh Najikhul Fajri is a researcher at Universitas Airlangga, economist at Quickimics Hore Ins and consultant at the Central Bank of Indonesia who is interested in writing issues on monetary and banking economics, natural resources and environmental economics, urban economy, poverty economy, international economy, social geography, maritime economy, defense economics, agricultural economics, applied mathematics, and industrial organizations.

Backtiar Putra Pratama is an Economist at Quickimics Hore Ins who is interested in writing topics on tourism economics, urban economics, transportation economics, energy economics, and development economics.

Achmad Kharisudin is a student at Universitas Brawijaya who is interested in writing agricultural management, agricultural economics, and agricultural development economics.

I. Introduction

The acceleration of the construction of the new capital has made other regions compete to create adequate infrastructure. The buffer area is one of the areas that is inseparable from the impact of the physical development of the new capital. The increase and expansion of arterial road routes to the potential to open land cover are also increasingly visible. If it continues without moderation, this condition can disrupt its environmental ecosystem. The increasingly massive environmental damage and development orientation that leads to physical achievement makes it erode economic stability in the long run. Disrupted financial stability then destroys economic actors in carrying out their daily activities. Green development is one of the alternatives to the potential for environmental damage, an increasingly high imbalance resulting in ecosystem disruption. Green development is one of the pillars of sustainable development goals created to overcome the impact of global warming due to accumulated environmental damage. Green development in its application prioritizes the efficiency of natural resource utilization, actualizes sustainability aspects, and optimizes residual use. Massive green development provides benefits for the public, which are realized through creating new jobs, carbon minimization, and environmental and social goals in the long term.

Developing countries are one of the essential focuses in mitigating the occurrence of prolonged crunches. Relatively limited human resources need an intensively unique injection from the central and local governments. This attention can be realized through adequate allocation of funds. Fiscal decentralization is an essential institutional order in vertical governance structures (Rodríguez-Pose et al., 2009, pp. 2050–2055). This can directly affect the methods of economic development of the region. Fiscal decentralization undermines local information gains and cost advantages, including improving the efficiency of resource allocation within an area. Thus, fiscal decentralization can encourage regional green development. Nevertheless, it can also motivate local governments to pursue economic growth, distribute more resources to the economy's construction sector, and suppress inputs in sectors with economic benefits of sustainability, such as environmental management.

Based on regional autonomy, provinces and regencies/cities also play a decisive role in the allocation of resources. Still, it is possible that all projects can be implemented in any region (Silva et al., 2022, pp. 2834–2835). Local governments are responsible for the affairs of the relevant jurisdictions and administrative reasons, which then clarifies the restrictions on specific projects and industries regarding the requirement to reduce production capacity in various areas. This condition also provides insight that the government's behavioral preferences directly affect the direction of regional development, impacting the role of fiscal decentralization. It is very important to promote the development of regional green transformation.

The construction of the new capital city has a lot to do with land clearing and environmental damage. In addition, new capital can overspend on certain aspects and disrupt a sustainable ecosystem. Not only that, development has created competition between buffer areas to create an infrastructure that exists. The buffer area is one of the areas that is inseparable from the impact of the physical development of the new capital. The increase and expansion of arterial road lanes to potentially open up land cover are also increasingly visible. If it continues without moderation, this condition can disrupt its environmental ecosystem. This becomes a concentration for all parties to exercise moderation and control through fiscal and other decentralization policies.

Improving the efficiency of green development is the main point of efforts to promote green modernization and rationalize financial relations between central-local governments (Albouy, 2012, pp. 833–835; Lin & Zhou, 2021). Environmental preference is significant for local governments as a reflection of environmental awareness. Where the government can effectively regulate the relationship between fiscal decentralization and green development, it is necessary to integrate fiscal decentralization, regional environmental preferences, and green development into a unified strategic framework and explore the influences of fiscal decentralization at the level of green growth.

Meanwhile, the increase in the efficiency of green development is often associated with how local governments create environmental preferences to create the best consensus to offset the already massive ecological damage.

In the previous study, the measurement of green development efficiency more often uses Data Envelopment Analysis (DEA) and Slack Base Model (SBM) (J. Wu et al., 2020, pp. 8–11) and Super Efficiency Slack Base Model (SESBM), where in its application will use varied inputs and outputs. In modeling, Tone and Tsutsui (2010, pp. 148–151) found that using the DEA makes some areas inefficient in green development. Meanwhile, another research has predicted that by involving SBM, there are at least areas affected by spillover due to green development activities in the central economic area (Bao-qing, 2012; Che et al., 2018, pp. 91–93; Liu et al., 2018, pp. 890–893; Porter & Linde, 1995, pp. 109–112; K. Zhou et al., 2020, pp. 1695–1697). On the other hand, robust findings stating that the DEA cannot be estimated with certainty force some studies to use SESBM (Chen & Lee, 2020, pp. 4–8; Li & Jing, 2019, p. 101).

Previous research has conducted studies related to the determinants of green development. Foreign Direct Investment directly facilitates the diffusion and exchange of advanced technologies (Tang et al., 2014). These conditions can create sustainable green development in an area. This then prompted the disclosure of several indications, for example, that green investment has a positive impact on reducing environmental risks and achieving low-carbon growth (X. Zhou et al., 2020, pp. 19928–19932). On the other hand, generic technological innovations and specific green technology capabilities also contribute to the level of green development. Both are the main elements for achieving green growth (Wang et al., 2021, p. 223). Apart from these influences, it turns out that other factors can also have a positive impact on increasing green development, for example, such as enviro, mental decentralization (H. Wu et al., 2020, pp. 10–12), financial agglomerations (Qian et al., 2022, pp. 17–20), and advanced industrial structures and rational (Zhang et al., 2020, pp. 6–8). However, factors can also reduce green development, which is then grouped into a competition between local governments (Feng et al., 2022, pp. 9–11) and vertical fiscal imbalances (Huang & Zhou, 2020, pp. 8–11).

Only a few studies directly consider the relationship between fiscal decentralization and the green development nexus in the new capital city. In addition, fiscal decentralization can increase the economy's growth rate in the long run (Montinola et al., 1995). The condition is supported by empirical studies within one country and between countries (Arif & Ahmad, 2020, pp. 30–36; Thanh & Canh, 2020, pp. 24–28). Fiscal decentralization encourages local governments to provide more and better public goods and services. It can effectively solve the problem of heterogeneity of environmental preferences and trigger the phenomenon of competition upstream of the environment. This can improve environmental standards if done in a conducive manner (Dalmazzone & Giaccaria, 2014, pp. 158–160; Jacobsen et al., 2012, pp. 955–957; Millimet, 2003, pp. 729–733). Ji et al. (2021, pp. 7–8) revealed that fiscal decentralization can reduce CO2 emissions and significantly improve environmental quality (Ji et al., 2021). Nevertheless, the nonlinear relationship between fiscal decentralization and the two has been examined more deeply (Carniti et al., 2019; Shan et al., 2021, pp. 6–8). Fiscal decentralization does not necessarily promote economic growth and can even negatively affect economic growth (Rodriguez-Pose & Ezcurra, 2011, pp. 636–638). Local public goods, such as the environment, can also encourage supply shortages allegedly derived from local governments' free-riding behavior, which is detrimental to environmental pollution control and hinders the improvement of environmental quality.

Fiscal decentralization is critical in accelerating economic growth and maybe its most significant contributor (Zhan & Liu, 2020). The nonlinear impact of fiscal decentralization on economic growth is also massively demonstrated about it (Z. Yang, 2016, pp. 524–526). Nevertheless, other studies at different levels also emphasize that fiscal decentralization can increase environmental pollution in the local area and beyond. This then harms the existence of improving environmental quality in an area (Cheng & Zhu, 2021, p. 12). Meanwhile, this effect may decrease and then increase as the level of economic development increases, including the

Table 1. Variable Definition

Variable	Variable Definition	Unit	Data Sources
Green Development Efficiency (EFF)	Green Development Efficiency Level	Percentage	Estimation Results
Local Revenue (ln PAD)	Natural Logaritm of Region Origin Income	Percentage	Ministry of Finance
Capital Expenditures (ln BM)	Natural Logaritm of Total Capital Expenditure of Districts/Cities	Percentage	Ministry of Finance
Employee Expenditure (ln BP)	Natural Logaritm of Amount of District/ City Employee Spending	Percentage	Ministry of Finance
Provincial Expenditure (ln BPROV)	Natural Logaritm of Total Provincial Fiscal Spending	Percentage	Ministry of Finance
Population (ln Pop)	Natural Logaritm of Total Population of Districts/Cities	Percentage	BPS
Agricultural Structure (Agri)	Contribution of the Agricultural Sector to GRDP	Percentage	BPS
Mining Structure (Mining)	Contribution of the Mining Sector to GRDP	Percentage	BPS
Industrial Structure (Indus)	Contribution of the Industrial Sector to GRDP	Percentage	BPS

opposite nature of the increased degree of fiscal decentralization (Kuai et al., 2019; Safi et al., 2022).

The researchers primarily focused on the relationship between local government environmental preferences and environmental quality (X. Yang et al., 2020, pp. 2–4; X. Zhou et al., 2020, pp. 19921–19922). The central government prefers the maximization of the welfare of society at large and leads to human development. Regardless, local governments have relatively more massive short-term goals. Meanwhile, the behavior of local governments is not always in line with central government programs. This condition encourages the government to have differences in achieving goals and maximizing the program's benefits. Local governments adjust their behavioral preferences according to local conditions and typography (Bao-qing, 2012), changes in program incentives, and realizations of local activities (Ding & Deng, 2008). Not only that, but multidimensional decision-making also prefers capital investments that have faster returns and significant economic growth effects. Meanwhile, public goods such as the environment that do not have short-term economic consequences will be ignored (Y. Wang et al., 2007). Increasing local governments' environmental preferences can significantly increase the effects of ecological governance. It can also increase the accumulation of social welfare to some extent (Guo et al., 2020).

This research will detect, complement, and test the basic theory of green development (Alfred, 2021, pp. 5–7; Hahnel, 2014, pp. 23–27). Regional development is a multidimensional integration of the economy, environment, and society to improve one region's quality. This study detaches from the object bias that in previous studies is more often linked to economic aspects in general. On that basis, this study introduces fiscal decentralization into the conceptual framework and explores the impact of fiscal decentralization more comprehensively. It also strengthens the correlation between fiscal decentralization's economic and environmental effects.

This research has empirical contributions that are very important to understand the different levels of green development in the buffer area of the national capital of the archipelago. Its application will use local government's attributes and dual functions, namely being responsible for jurisdictional and administrative affairs. Regardless, the study further explores how local government behavior choice preferences affect the role of fiscal decentralization, incorporating regional environmental preferences into the framework.

II. Methods

A. Data and Variables

This study uses panel data from 12 districts and cities during 2015-2020 in East Kalimantan Province. The selection of this research object is based on the linkage of the development issue of the new candidate capital city of "Nusantara," which directly impacts the acceleration of growth and its buffer areas. On the other hand, this vulnerable use of time is based on a change of government and the massive start of development. This study uses several variables to explain the relationship between phenomena, including efficiency, original income, capital expenditure, employee expenditure, provincial expenditure, district/city population, Local GDP of the agricultural sector (agri), mining sector (mining), and industrial sector (industry).

B. Green Development Efficiency Measurement

Efficiency is the closest measurement to green development, while some of the modeling constructions follow the rules conveyed by Bajec and Tuljak-Suban (2019, pp. 8–10) and T. Yang et al. (2018, pp. 4–6). The efficiency of this study is measured by Slack Based Method (T. Yang et al., 2018). It is given at t decision, $th\ K(k=1,2,...,K)$ use of $N(n=1,2,..,N)$ inputs, the expected number of outputs, $M(m=1,2,..,M)$ and the $I(i=1,2,..,I)$ unexpected (non-desire or secondary desire) outputs in the district/city j within t a certain period. As for the calculation of the efficiency of green development, it can be expressed as follows:

$$the\ \rho_{it} = min\left[\frac{1-\frac{1}{N}\sum_{n=1}^{N}\frac{s_{nt}^{x}}{x_{nt}^{j}}}{1-\frac{1}{M+1}\left(\sum_{m=1}^{M}\frac{s_{mt}^{y}}{x_{mt}^{j}}+\sum_{i=1}^{I}\frac{s_{it}^{b}}{x_{it}^{j}}\right)}\right] \quad (1)$$

$$\sum_{k=1}^{K} z_k s_{nt}^{m} + s_{nt}^{x} = x_{nt}^{j}\ where\ n = 1,\ 2,\ ...,\ N \quad (2)$$

$$\sum_{k=1}^{K} z_k s_{mt}^{k} + s_{mt}^{y} = y_{mt}^{j}\ where\ m = 1,\ 2,\ ...,\ M \quad (3)$$

$$\sum_{k=1}^{K} z_k s_{it}^{k} + s_{it}^{b} = b_{it}^{j}\ where\ i = 1,\ 2,\ ...,\ I \quad (4)$$

$$\sum_{k=1}^{K} z_k = 1 \quad (5)$$

$$z_k \geq 0,\ s_{nt}^{x} \geq 0,\ s_{mt}^{y} \geq 0,\ and\ s_{it}^{b} \geq 0 \quad (6)$$

On this basis, then this study uses several indicators that will be used to determine efficiency, while these indicators are as follows:

Table 2. Green Development Efficiency (EFF) Composition

Items	Variable	Definition	Unit
Input	Capital	Investment	Million rupiah
	Labor	Number of the working force	Soul
Output	GDP	Gross Domestic Product	Million rupiah
	IKLH	Environmental Quality Index	Percent

C. The Effect of Fiscal Decentralization on the Green Development Efficiency

Time consistency is needed to review the strategic aspects of efficiency in general. This study uses GMM Dynamic Panel Regression, which involves elements of the time difference in specific individuals. The change in the use of analytical techniques from static panel regression to dynamic panels began with the introduction of the Anderson-Hsiao Estimator in late 1982 (Arellano & Bond, 1991, pp. 279–280; Arellano & Bover, 1995, pp. 34–35). Some recent studies have gradually begun to abandon static panel analysis. These estimates are projected to be the same as the principles of AR-MA and ARIMA analysis. Dynamic panel regression has many advantages compared to fixed panel regression. Static panel regression cannot be used when powder elements are included in its analysis. Meanwhile, dynamic panel regression accommodates elements of the lag time, both Auto-Regression (dependent lag time) and Distributional Lag (independent variable lag time). Some recent studies have gradually begun to abandon static panel analysis. Theoretical, quantitative research, such as economics, is inseparable from the existence of lag elements, both Auto-Regression (AR) and Distributional Lag (DL). This makes dynamic panel regression more

and more people use it (Anderson & Hsiao, 1982; Hansen, 1982).

Anderson and Hsiao (1982) estimator model is associated with the Instrumental Variable (IV) dynamic regression model after Sargan formulated the dynamic panel regression. Furthermore, according to the pattern of formulation, this estimate refers to one variable only so that it can be reviewed in the following equation:

$$y_{it} = \delta y_{(it-1)} + u_{it};\ i = 1, 2, 3, \dots, N;\ t = 1, 2, \dots, T \quad (7)$$

The error component is spelled out in one direction, in the form of distribution lag.

To solve the problem of autocorrelation in the dynamic equation above, the regressor in the right field is directly related. Thus, Anderson and Hsiao transforms each of its variables so that the random walk problem can be overcome consequently.

$$\Delta y_{it} = \Delta y_{(it-1)} + \Delta u_{it} \quad (8)$$

Furthermore, decreasing the above variables can trigger a correlation, so more complex steps are needed. Therefore, a more relevant estimation process is necessary for addressing heteroskedastic and in-efficiency problems. GMM becomes an alternative to expressing a large population or sample in a study. Arellano and Bond (1991) mentions that GMM is one part of dynamic panel regression. The measurement involves the lag components and the pre-determined variable as an explanatory variable. Through this process, I created an instrumental matrix as follows:

$$z = \begin{bmatrix} a & 0 & 0 & 0 \\ 0 & b & 0 & 0 \\ 0 & 0 & c & 0 \\ 0 & 0 & 0 & d \end{bmatrix} \quad (9)$$

Where successively is the coefficient. $a = y_{i,1}$; $b = y_{i,1}, y_{i,2}$; $cy_{i,1}, y_{i,2}, y_{i,3}$; $d = y_{i,1}, y_{i,2}, y_{i,3}, \dots y_{i,t-2}$

Arellano and Bond (1991) estimates the GMM with the most efficient results. The estimator of the GMM parameter itself. Meanwhile, GMM also has estimated estimates to minimize values in the following ways:

$$\hat{\delta} = \left(\left[N^{-1} \sum_{i=1}^{n} \Delta y_{i,t-1} z_i \right] \widehat{W} \left[N^{-1} \sum_{i=1}^{n} z_i \Delta y_i \right] \right)^{-1} \left[N^{-1} \sum_{i=1}^{n} \Delta y_{i,t-1} z_i \right] \widehat{W} \left[N^{-1} \sum_{i=1}^{n} z_i \Delta y_i \right] \quad (10)$$

Furthermore, modeling will be possible equal with the phenomenon. Moreover, the estimation equation will transform as follows: $W\widehat{W}$

$$\widehat{W} = \widehat{\Lambda}^{-1} \widehat{\Lambda} = N^{-1} \sum_{i=1}^{n} z_i \Delta v_i \Delta v_i' z \widehat{\delta}$$

$$\hat{\delta} = \left(\left[N^{-1} \sum_{i=1}^{n} \Delta y_{i,t-1} z_i \right] \widehat{\Lambda}^{-1} \left[N^{-1} \sum_{i=1}^{n} z_i \Delta y_{i,} - 1 \right] \right)^{-1} \left[N^{-1} \sum_{i=1}^{n} \Delta y_{i,t-1} z_i \right] \widehat{\Lambda}^{-1} \left[N - 1 \sum_{i=1}^{n} z_i \Delta y_i \right] \quad (11)$$

Using this equation, the estimation results will be the most efficient and in line with the population. This research and diagnosis process is identical to difference-GMM, which will be reviewed directly in its application. On this basis, this study uses the following empirical model:

$$\begin{aligned} EFF_{it} &= \alpha_0 + \alpha_1 EFF_{it-1} + \alpha_2 lnPAD_{it} \\ &+ \alpha_3 lnBM_{it} + \alpha_4 lnBP_{it} + \alpha_5 lnBPROV_t \\ &+ \alpha_6 lnPOP + \alpha_6 Agri_{it} + \alpha_7 mining_{it} \\ &+ \alpha_8 indus_{it} + \beta_1 D + e_{it} \end{aligned} \quad (12)$$

Where is the efficiency of green development (using SBM), PAD is the original regional income, BM is the capital expenditure of the regency/city, BP is the cost of district/city employees, $BPROV$ is the expenditure of the provincial government, POP is the population, $Agri$ is the contribution of the agricultural sector to the Local GDP, $mining$ is the contribution of t mining sector of the to the Local GDP, $indus$ is the contribution of the industrial sector to the Local GDP, D is dummy City (1=Balikpapan & Samarinda, and 0=other).

Based on previous research, local income will positively affect the efficiency of green development. Meanwhile, capital expenditures, employees, provincial fiscal expenditures, population, mining structure (mining contribution), and industrial structure (industrial contribution) negatively affect green development's efficiency. Then, the structure of agriculture (agricultural contribution) positively affects the efficiency of green development.

III. Results and Discussion

A. Descriptive Analysis

Table 3 states descriptive statistics, including measures of concentration (mean) and spread (max and min).

Table 3. Description of Statistics for SBM Estimation Result

Variable	Obs	Mean	SD	Min	Max
iklh	60	67.44	8.911	57.4	80.79
pdb	60	67559.1	84060	1981	607586
inves	58	3530580.8	5619943	45449.8	36590388
labor	56	3613.446	4619.958	49	30930

Source: Author's estimation results

Table 4. Description of Statistics for GMM Estimation Result

Variable	Obs	Mean	SD	Min	Max
eff	60	0.936	0.079	0.719	1
pad	60	7.698	0.421	6.82	8.784
bm	60	6.625	0.473	5.349	7.862
bp	60	6.719	0.461	5.951	7.781
bprov	60	9.186	0.13	8.999	9.332
pop	60	12.429	0.982	10.16	13.69
agri	60	0.1	0.115	0.011	0.419
mining	60	0.1	0.134	0	0.381
indus	60	0.1	0.157	0	0.479

Source: Author count results

Based on the calculation results above, all variables are declared free from data outliers, meaning they can be interpreted using inferential estimators. Furthermore, Table 4 presents the correlation coefficients used to test the strength between variables and multiconnilierity.

Based on the calculation results above, all variables do not have a multicollinearity relationship when tested together. Meanwhile, if compared based on the value, the overall variable has a relatively low relationship value. On the other hand, when reviewed based on their attributes, PAD, POP, AGRI, and MINING are positively correlated to efficiency. The rest of BM, BP, BPROV, and INDUS are negatively related to efficiency. Thus, these variables can be used as material for further interpretation.

B. Estimation Results

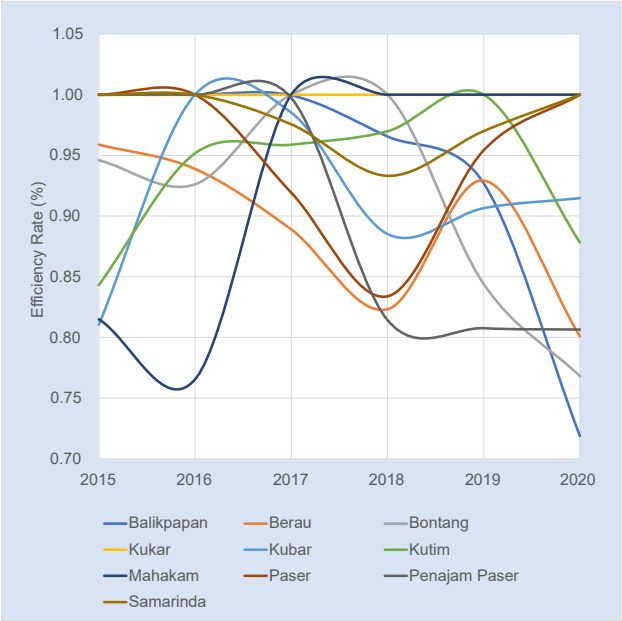
Figure 1 presents the results of the estimated efficiency of green development in the prospective buffer area of the archipelago's capital. The results of this estimate include Balikpapan City, Berau Regency, Bontang City, Kutai Kartanegara Regency, West Kutai Regency, East Kutai Regency, Mahakam Ulu Regency, Paser Regency, Penajam Paser Utara Regency, and Samarinda City during 2015-2020.

The estimates show that aggregation efficiency has decreased for Balikpapan City, Berau Regency, Bontang City, and East Kutai Regency. Meanwhile, Kutai Kartanegara Regency, West Kutai Regency, Mahakam Ulu Regency, Paser Regency, and Samarinda City experienced

Table 5. Correlation Matrix

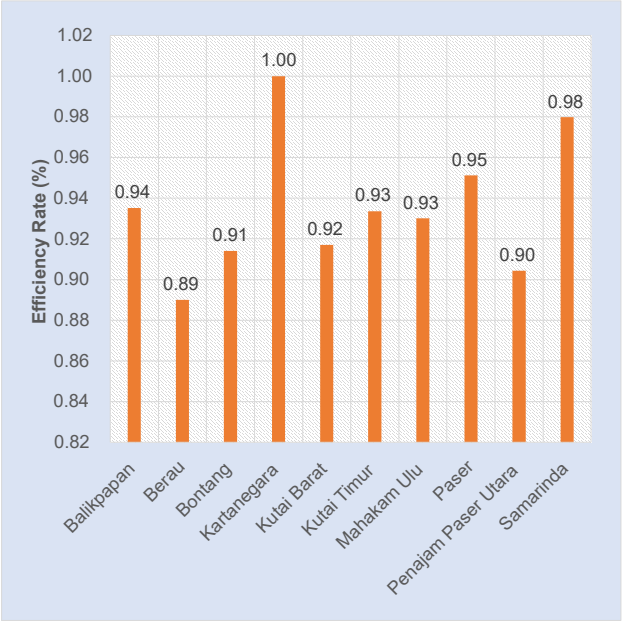
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) eff	1.00								
(2) lnpad	0.23	1.00							
(3) lnbm	-0.28	-0.10	1.00						
(4) lnbp	-0.11	-0.05	0.66	1.00					
(5)lnbprov	-0.15	0.29	0.29	0.13	1.00				
(6) pop	0.22	0.68	-0.08	0.11	0.01	1.00			
(7) agri	0.25	0.75	-0.26	-0.09	-0.01	0.37	1.00		
(8) mining	0.20	0.75	-0.05	0.22	0.01	0.41	0.91	1.00	
(9) indus	-0.04	-0.21	0.04	0.29	-0.01	0.21	-0.30	-0.31	1.00

Source: Author count results



Source: Author's estimation results

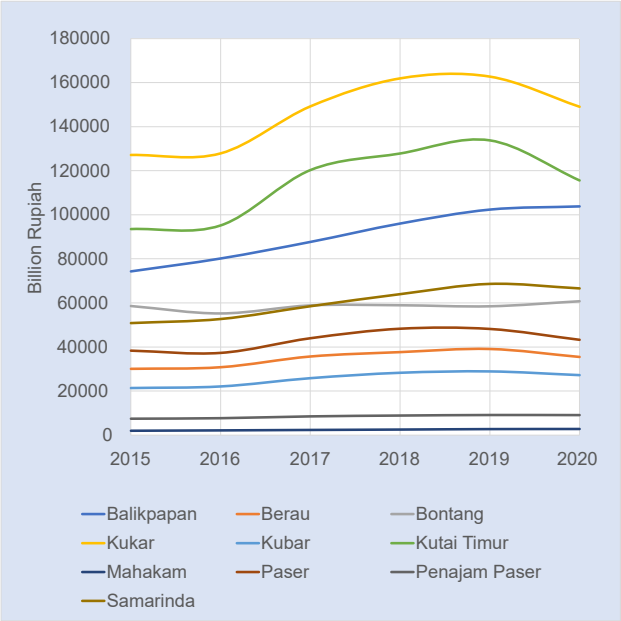
Figure 1. *The Level of Green Development Efficiency (EFF) Using SBM in the Prospective Buffer Area of the Capital of the Archipelago*



Source: Author's estimation results

Figure 2. *Average Green Development Efficiency Using SBM of Each Candidate City Buffer on East Kalimantan*

an increase. Finally, Kutai Kartanegara Regency has stayed the same during the last period. This change in the level of occurs due to the asynchronousness of the outputs produced by labor and capital inputs. This asynchronousness impacts the leakage of the environmental

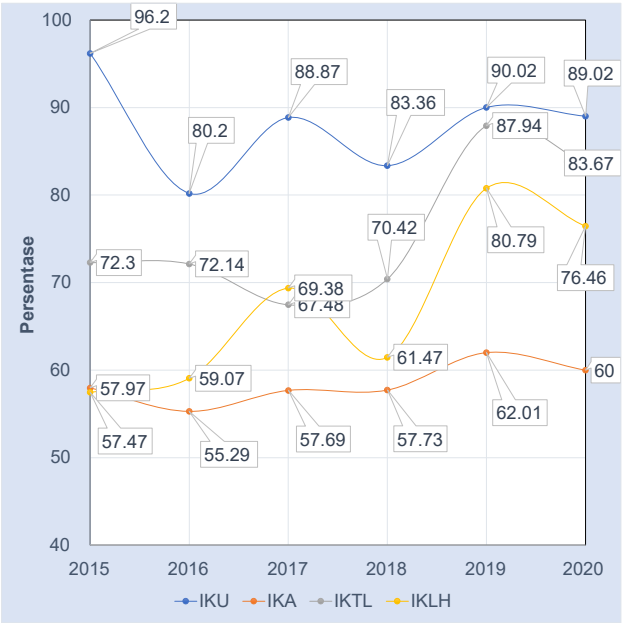


Source: BPS (2020)

Figure 3. *IKN Buffer Gross Regional Domestic Product*

quality index, which causes a decrease, se in the efficiency level. Not only that but economic activity also relatively results in air pollution is an important part of this efficiency value legitimacy process. However, if averaged, Kutai Kartanegara Regency is technically efficient. This condition suggests that the relevant district has a constant return to scale. This means that if the output is 1%, the output issued increases the same as the input. This happens because the proportional share of inputs to their output impacts reducing slack in one district so that efficiency is achieved easily. On the other hand, other districts/cities find a decreasing return to scale value, which means that when the input issued is 1 %, the proportion of output is less than 1%. This will force the region to find higher residual values increasingly and have implications for decreasing efficiency.

This increasingly dynamic development of efficiency can undoubtedly be suspected through the aspects of expected output (GDP) and desirable output (IKLH). Both are determining factors for achieving better efficiency. If viewed from the ineffectiveness of this efficiency, it can be dropped down into several indications, namely outlier output and fluctuations in environmental quality. The output outlier shows that the increasing high economic activity in some regions triggers an unbalanced share of inputs. Most of



Source: KLH (2021)

Figure 4. *Average of Environmental Quality Index of All IKN Buffer Districts/Cities*

the gap comes from the growing industrialization in the various areas of East Kalimantan. On the other hand, an increase in output results in a decrease in the quality of the environment. The air, water, and land cover quality indices have gradually decreased during 2019-2020, indicating that the impact of increased output can trigger environmental degradation.

Based on Figure 4 above indicates that the quality of life from the perspective IKN buffer is relatively good for all aspects. The environmental quality index is determined by 30% water quality, 30% air quality, and 40% land cover quality. The higher the Index indicates, the better the environment and vice versa. This is indicated by the index size above the 50% threshold. The water quality index (IKA) occupies the lowest value compared to Apple. Meanwhile, the air quality index (IKU) and land cover (IKTL) are relatively high. This condition is in line with the current situation: relatively high land cover triggers an increase in oxygen accumulation which gradually triggers an increase in IKU.

Table 6 presents the results of the estimated effect of fiscal decentralization on the efficiency of green development in the IKN buffer area using a one-step difference GMM. The results show that local income positively affects the efficiency of

Table 6. GMM-One Step Difference and System Dynamic Panel Regression Estimation Results

	(1)	(2)
	eff	eff
L.eff	0.693***	0.596***
	(0.26)	(.226)
ln pad	0.215***	0.202**
	(0.082)	(0.088)
ln bm	0.003	0.002
	(0.03)	(0.036)
ln bp	0.085	0.07
	(0.057)	(0.064)
ln prove	-0.293***	-0.276**
	(0.111)	(0.131)
ln pop	-0.049**	-0.045**
	(0.02)	(0.02)
Agri	0.399	0.335
	(0.339)	(0.361)
mining	-0.675	-0.58
	(0.415)	(0.451)
Indus	-0.072	-0.055
	(0.088)	(0.091)
Dummy Cities	-0.021	-0.018
	(0.122)	(0.111)
_cons	1.37**	1.465*
	(0.628)	(0.764)
Observations	50	50
P(AR(1)	0.9	0.89
P(Sargan)	0.8	0.82
Standard errors are in parentheses.		
*p<.01, ** p<.05, * p<.1*		

Source: Author estimation results

green development, and provincial spending and population negatively affect green development efficiency. Meanwhile, the remaining capital expenditure, employee expenditure, agricultural structure, mining structure, and industrial structure do not affect green development efficiency.

Based on the model specification information above, it is stated that the estimation equation is validly identified (P(Sargan)>0.1), ovoid from the problem of autocorrelation (P(AR (1)>0.1), and the positive lag time coefficient is significant.

C. Discussion

Based on the results of estimates, Table 6 shows that when revenue increases by 1%, the efficiency of green development increases by 0.215%, assuming ceteris paribus. Meanwhile, as provincial and population spending increased by 1%, the green development efficiency decreased by 0.293% and 0.049%, respectively, assuming ceteris paribus. This condition suggests that when the original income of the region is positively correlated to the green development efficiency. On the other hand, provincial and population spending is negatively correlated with green development efficiency. This is in accordance with previous research in which fiscal decentralization could have encouraged economic growth but could also have implications for growth itself (Rodriguez-Pose & Ezcurra, 2011). Local public goods, such as the environment, can also encourage the lack of supply allegedly due to local governments' free-riding behavior. Not only that, but high capital expenditure can also increase environmental pollution in the local area and its surroundings. Then harms the existence of improving environmental quality in an area (Cheng & Zhu, 2021, pp. 8–10). Meanwhile, this effect may decrease and then increase as the level of economic development increases, including the opposite nature of the increased degree of fiscal decentralization (Kuai et al., 2019; Safi et al., 2022). Meanwhile, high local revenues drive efficiency, according to research by Montinola et al. (1995), where fiscal decentralization can increase the rate of economic growth in the long run.

This condition is in line with the buffer state of IKN, where most of them are built-up areas so that provincial government spending can create massive environmental damage in the short term. It should be noted that massive development at the provincial level, such as infrastructure that opens new land, can directly create contingencies in the environment and natural ecosystems. This then triggers a free reader for the provincial area of development that needs to be moderated by environmental impact analysis. Meanwhile, this potential for environmental damage in the short term has implications for economic activity in urban centers. Not only that, the retention of development that is quite massive will create irregularities in the community, for example, disruption of regional accessibility, which temporarily hampers the economy.

However, behind the massive development, it will certainly be offset by an increase in local income where the region can use the funds to develop economic activity and development that is quite massive in the future. The increase in PAD will undoubtedly make the regions more active in promoting the green economy and sustainable development to create a more conducive environment. On the other hand, green development will encourage the region to avoid environmental damage. It is one of the main concerns, especially since Kalimantan is the only region in Indonesia that has been named the lungs of the world.

Green development efficiency still needs to improve; regions need to make achievements with spending for sustainable, productive sectors and utilizing local indigenous income to develop a green-based economic sector. For this reason, regions easily organize consistently for future generations to avoid environmental degradation that may cause powerlessness of the region's capacity as an ecological carrying capacity.

A stable population is one of the complements of the increased efficiency of green development. It will increase the population then, encourage the creation of new housing, force the environment to be exploited further, and cause a decrease in efficiency. A relatively stable and competent population is also a parameter for the region's success in developing an area. This indicates that the relative share of welfare remains an important part of economic activity in the short term. In the short term, this economic activity encourages other communities to migrate between regions, potentially encouraging the creation of slum areas.

The contribution of the agricultural, mining, and industrial sectors has relatively little effect on the efficiency of green development. The portion is relatively small, including the size and number, so it is not directly connected to green development.

IV. Conclusion

Based on the results of the discussion, the original income of the regency/city area has a positive effect on the efficiency of green development. Meanwhile, provincial and population spending negatively affects the efficiency of green development. The influence is due to behavior where in the short term, the region that has just been built will have an impact on reducing the efficiency level, then gradually increasing efficiency driven by the presence of local indigenous income. Meanwhile, the population is an integral part of the decline in efficiency. The arrival of the population and the increasingly high population rate will aggravate the environmental impact, especially in the slum area.

For some of this information, it is appropriate for all stakeholders to carry out strategic planning, for example, anticipating the arrival of the population by offering certain areas that still need to be built. Additionally, provincial government spending should also be used towards the green economy, for example, opening green sector industries, mining moderated by environmental impact analysis, and developing agricultural sectors integrated with sustainability systems such as single land use (intercropping) and others. On the other hand, private stakeholders should prioritize the use of waste and the environmental sector to plan green development properly. Finally, the community is undoubtedly an inseparable part of the culture and continuity of economic growth that leads to greening, for example, by caring for the environment and complying with various environmental instruments so that illegal settlements based on do not occur.

The slum areas limitations of this study include not using spatial effects in analyzing the relationship between variables so that it cannot determine the amount of runoff outside the area. In addition, the absence of information related to other sectors, including regional competitiveness, is an interesting topic to study in the future.

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