“Analysis of village fund efficiency and the variables affecting it in Indonesia”

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ANALYSIS OF VILLAGE FUND EFFICIENCY AND THE VARIABLES AFFECTING IT IN INDONESIA

Abstract

Since the reform era, Indonesia has experienced three stages of fiscal decentralization. In the third stage, the focus of the policy shifted to village development by giving authority to manage village funds. However, due to a lack of supervision and inefficient governance, this policy has not been able to improve the quality of rural development. The purpose of this study is to evaluate the level of efficiency of village fund use and analyze the variables that influence it. This study employs data envelopment analysis (DEA) to determine the level of efficiency and binary logistic regression to determine the variables that influence it in 2018 and 2021. The results show an increase in the number of provinces experiencing efficiency in managing village funds. In 2018, 10 provinces (30.30%) were declared efficient, but the remaining 23 (69.70%) were declared inefficient. In 2021, the number of provinces declared efficient increased to 14 (42.42%), while 19 (57.58%) were still considered inefficient. This finding signals that the level of village fund efficiency in Indonesia is still a major challenge toward increasing rural economic growth. The variable that significantly affects the level of efficiency is the level of education of the village head. The lack of human resources who have expertise in village fund management has resulted in low-quality implementation of village development and community empowerment programs.

Keywords fiscal decentralization, efficiency, village funds, financial governance

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INTRODUCTION

Before the reform era, the governance of state finances in Indonesia was highly centralized. The central government controlled almost all fiscal aspects, including management of natural resources and regional income. Budget allocation to regions, both provincial and district/city, was carried out through a very limited subsidy scheme and development allocation funds, making the role of local government in development relatively small. Entering the reform era that began in 1998, government governance was driven by major changes, especially in increasing the authority of local governments to regulate and plan regional development. These changes have consequences for a fiscal policy that follows a more decentralized direction in Indonesia.

Village funds are a fiscal policy tool used by the Indonesian government that aims to encourage village development and increase the prosperity of village communities. Village funds have become the main funding source for various physical development programs and community empowerment in villages throughout Indonesia. However, many reports and studies show that the management of village funds still faces several significant obstacles in its implementation. The Audit Board of Indonesia (BPK, 2022) and the Corruption Eradication Commission (KPK, 2015) stated that inefficiencies often occur in the planning, implementation, and supervision of village fund expendi-

tures. Misallocation of resources, obstructions in fund distribution, favoritism during execution, and fictitious reports are some of the inefficiencies found in the management of the village fund. These inefficiencies raise concerns that the main objectives of this policy, namely community empowerment and sustainable development, will not be achieved optimally. Villages are crucial for the nation's progress as most of Indonesia's citizens reside in these areas. The effective administration of the village fund directly enhances the living standards of those in villages. However, the lack of administrative capacity and weak supervision impede the efficient use of the village fund, resulting in less-than-optimal benefits.

1. LITERATURE REVIEW

Fiscal decentralization involves splitting control and accountability in financial governance between the central authority and regional administrations. Within a fiscal decentralization framework, regional governments receive increased power to oversee their income and spending, along with the ability to establish fiscal strategies that align with the specific requirements of their areas. The mission of fiscal decentralization is to improve efficiency, accountability, and responsiveness to development needs and public services at the regional level.

Nguyen and Anwar (2011) performed a study across 61 regions in Vietnam, intending to examine the relationship between fiscal decentralization and economic development. This study directly evaluates the impact of financial decentralization on economic progress that has been taking place in Vietnam since the mid-1990s. The empirical analysis shows that in Vietnam, economic growth has a positive relationship with revenue decentralization but also has a negative relationship with expenditure decentralization. Ding et al. (2019) focused on the years succeeding 1994, after a period of substantial fiscal decentralization recognized as the cause of China's unprecedented growth rates. This study examines the gradual introduction of the Tax Sharing System (TSS), which was implemented in phases across regions over time with the aim of econometric cognition. The results found strong evidence that TSS influences better economic outcomes.

Canavire-Bacarreza et al. (2020) analyzed the connection between financial decentralization and economic development. The results indicate that, overall, a 10% increase in subnational spending or revenue allocation from traditional decentralization measures would boost Gross Domestic Product growth per individual by 0.82 and 0.57 percentage points, respectively. Wang et al. (2021) evaluated the theory regarding the resource curse by taking into account the political risk index, the distribution of fiscal responsibilities, and how this influences financial growth. The study was conducted in 31 developed countries using data collected from 1984 to 2019. The empirical results of the use of multidimensional indexes in financial development show that the presented hypothesis is proven. Furthermore, fiscal decentralization, GDP, and an increase in the political risk index drive the financial development of the sample countries. To achieve a good level of financial progress and avoid the perceived resource curse, this study recommends promoting financial decentralization and optimizing the assessment of the political risk index. Empirical results from quantile regression form the basis for these recommendations.

Fiscal decentralization policy positively impacts economic advancement, rising income per person, and enhanced financial progress, particularly in developed nations, while successfully steering clear of the resource curse theory. The justification of fiscal decentralization is that it allows for more equitable development, improves the quality of public services, and manages resources more effectively and efficiently at the local level. However, in its implementation, strict supervision is required so that the use of funds and regional financial policies continue to run in accordance with the rules and principles of transparency, ensuring that fiscal decentralization policies are effective and efficient.

Several empirical studies have been conducted discussing the relationship between decentralization and efficiency. Wang et al. (2012) analyzed how China's local governments' fiscal practices are affected by fiscal decentralization. The findings show that counties in Henan Province, which

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are given greater budget autonomy, typically spend a smaller percentage of their annual budget on public education expenditures than other regions. The study concluded that county governments are not always more responsive to the long-term benefits to local communities generated by fiscal decentralization.

Calabrese et al. (2012) examined the welfare impacts of local public goods provision. They evaluated welfare in centralized and decentralized property tax equilibria with adequate allocations and calibrated the model. Most (if not all) of the possible welfare benefits that effective decentralization could produce are eliminated by the significant inefficiencies with decentralization and property taxes. Centralization is frequently more effective in property tax equilibrium. The inefficiency of decentralization and property taxes is caused by externalities in community choice, wherein impoverished households congregate in affluent neighborhoods and profit from utilizing comparatively less housing and evading taxes.

Azwar (2022) analyzed the impact of fiscal decentralization on the efficiency of public service delivery in the health sector in districts/cities in South Sulawesi, Indonesia. The findings suggest that overall health function spending in South Sulawesi Province has been realized and utilized quite well, although most of the funds are still used for government bureaucratic spending. The data envelopment analysis (DEA), however, indicates that most of South Sulawesi Province's districts and cities have comparatively inefficient realization and application of spending. The dynamic generalized method of moment (DGMM) analysis was applied to evaluate fiscal decentralization. The results indicate that the regional original income policy has a significant negative impact on the efficiency of spending in the health sector. In contrast, the balancing fund policy has a negative but insignificant impact.

Adam et al. (2008) concluded that the greater the degree of fiscal decentralization, the more beneficial the efficiency of the public sector in providing education and health services. This finding concurs with the findings by Sow and Razafimahefa (2015), which concluded that in advanced nations, financial decentralization enhances the efficiency of delivering public services, while in developing and underdeveloped countries, fiscal decentralization has a negative impact on efficiency. In the Indonesian context, studies on the impact of fiscal decentralization on the achievement of public services, especially in the education and health sectors, have been done, which includes Simatupang (2009) and The Directorate General of Fiscal Balance (DJPK, 2017). Ahmad (2010) focuses more on the impact of fiscal decentralization on the health sector and Doriza et al. (2012) focus on the impact of fiscal policy on access to basic education. While Widodo (2019) chooses research objects in regions with special autonomy. However, these studies were done in the national context, not in the village context or the efficiency of the village fund expenditure. Therefore, the issue of the efficiency of the use of village funds in Indonesia is still interesting to study in more depth.

Budget efficiency is greatly influenced by various interrelated factors, both internal and external, such as resource utilization, human resource capacity, transparent and accountable financial system, use of information technology, and economic and political stability. To achieve optimal budget efficiency, it is necessary to create a good system, effective supervision, and budget policies that are responsive to change.

Qiu et al. (2023) examined the connection between listed Chinese medical manufacturing companies' (CMMLF) technological innovation efficiency (TIE) and internal governance, taking into account how environmental factors affect innovation performance. The findings indicate that competition in the industrial sector and investment in education drive efficiency in innovation. In comparison, government assistance and spending in the health sector produce repetition in the innovation aspect. Moreover, significant TIE for firms emerges as a result of several mechanisms within them, with two main stable arrangements for achieving optimal technical efficiency and five possible pathways supporting TIE enhancement.

This study offers policy alternatives for policymakers to enhance effective innovation of medical manufacturing businesses by methodically analyzing internal organizational elements and external organizational elements as two situational aspects for CG.

Fachrun et al. (2020) examined the elements that affect Kalahunde Village's village fund management and discussed community involvement. The goal of community involvement is to improve the efficacy and efficiency of village fund management. The findings demonstrate that community participation in the planning stage can be observed in the form of suggestions made during the planning stage, as well as in attendance at all meetings and deliberations, including those at the village and hamlet levels. During the implementation phase, community members contribute labor, tools, food, and beverages. The mutual cooperation of the still-strong Kalahunde village community has an impact on this phase. For everyone's benefit, the community members who took part in the evaluation stage gave the village fund budget manager recommendations and helpful critiques. In Kalahunde Village, Middle Pakue District, North Kolaka Regency, internal characteristics such as age, education, and job have an impact on community involvement in the management of the village fund.

Adit and Qibthiyyah (2022) studied the impact of village spending and social capital on rural industry. They focused on determining the correlation between village spending and social capital with rural industry. The findings demonstrate that community empowerment spending and social capital have a positive and significant relationship with rural industry. In addition, the allocation of spending specifically for village industry needs also increases the number of rural micro and small businesses in the village.

The progress of rural industry can be encouraged through adjustments to spending areas, spending efficiency, and special allocations for industrial needs. On the other hand, the village government must work together with entrepreneurs to develop and empower industrial actors in the village and develop cooperation and cooperatives in their area. Further studies are recommended to use the amount or ratio of spending for the benefit of rural industry.

Mohi et al. (2019) studied the ability of apparatus to manage village fund (ADD) in Monano Village, North Gorontalo Regency. The results show that, in managing the allocation of village funds, the apparatus does not yet have quality skills, skills, sincerity, effectiveness, and efficiency. The apparatus still needs to learn a lot of knowledge, communicate well, be creative, adapt to new tasks, work together, be loyal and responsible for the tasks assigned to them, and always be self-motivated, enthusiastic, and passionate in working. As public servants, village officials have not paid maximum attention to the fate of people with low incomes, have not succeeded in formulating development programs related to the interests of people experiencing poverty, and have not brought maximum results for the welfare of the people.

Pasolo et al. (2024) discovered that community involvement and governance framework positively and notably influence the fiscal responsibility of village resources in Mamberamo Raya Regency, which indirectly affects the efficiency of village fund expenditures. Likewise, Ayem et al. (2023) analyzed the impact of community involvement, organizational dedication, internal control procedures, and apparatus proficiency on accountability in village budget administration.

Based on this literature review, it can be generalized that fiscal decentralization has the potential to increase efficiency and have a positive impact on economic growth and community welfare. The efficiency level is highly dependent on the internal management method, community participation, and the appropriate managerial use of decentralized funds.

Since fiscal decentralization is not able to increase efficiency and depends on community participation, governance processes, and the managerial capacity of managers, the purpose of this study is to evaluate the level of efficiency of village fund use and analyze the variables that influence it.

This understanding is the basis for selecting independent variables and testing hypotheses on the level of efficiency. Thus, this analysis aims to examine the following hypotheses:

H1: Collaborative cooperation that reflects community involvement will positively and considerably influence the effectiveness of managing the village fund.

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H2: A good financial system, which represents the internal management method, will greatly enhance the efficiency of managing the village fund.

H3: The level of education of the village head, which represents the ability to manage the village fund, will have a meaningful and beneficial impact on the efficiency of managing the village fund.

2. METHOD

This study has two main objectives, namely identifying the level of efficiency of the use of the village fund in Indonesia and analyzing internal and external variables on the efficiency of the use of the village fund. This descriptive research employs a quantitative approach (Adani et al., 2023; Febriani et al., 2023), where this study calculates village fund transfer data in 33 provinces in Indonesia to solve existing problems per the research objectives.

2.1. Data envelopment analysis (DEA)

This study uses a quantitative research method to analyze the level of efficiency of village fund use using the non-parametric data envelopment analysis (DEA) approach. The input variables used are the amount of the village fund in 33 provinces, while the output variables are the infrastructure built in villages that use the village fund. The data source is the Village Potential Report (Pokdes), periodically published by the Central Statistics Agency (BPS) of Indonesia in 2018 and 2021, which covers all village governments in Indonesia. Table 1 shows the input and output variables used in this study.

Table 1. Input and output variables in the data envelopment analysis (DEA) model

Type	Variable	Unit
Input	Village Fund	Billion Rupiah
Output	Irrigation Channel	Kilometer
	Community Reading Park	Unit
	Integrated Construction Post (Posbindu)	Unit
	Open Public Space	Unit
	Paved Road	Kilometer

The efficiency value results show a scale of zero to one; if the efficiency result shows 0, then the unit being tested is inefficient; if the value is 1, then the unit is efficient. The efficiency value is relative (not absolute), and the value produced is by comparing each unit in the data set to be analyzed (Tanjung & Devi, 2018). In other words, an Operationalization of Process Z (OPZ) or Organization/Observation Unit Z, which is tested for efficiency is said to be very efficient if its value reaches 100%. The further away from 100% or the closer to 0%, the less efficient the OPZ is.

2.2. Binary logistic regression

Binary logistic regression was used to analyze the factors that influence the efficiency of village funds, both internal and external factors. Binary logistic regression is a statistical analysis technique that aims to understand the relationship between a binary dependent variable and a correlative predictor variable. The dependent variable has two categories, which means that the variable can have two possibilities, for example, 0 or 1 (Hosmer & Lemeshow, 2000). The logistic regression model is as follows:

$$\pi(x) = \frac{\sigma(\beta 0 + \beta 1 x 1 + \ldots + \beta \rho x \rho)}{1 + e}, \qquad (1)$$

where $\pi(x)$ is a predictive function or probability of an event occurring. In the context of logistic regression, this is the probability that an event will occur, the probability of "yes" or "no". σ (Sigmoid Function): The sigmoid function converts the input value (z) into a number between 0 and 1, which can be interpreted as a probability. In the given equation, this function is applied to ($\beta 0 + \beta 1 x 1 + \ldots + \beta \rho x \rho$). β0 (Intercept): is the intercept parameter or constant in the logistic regression model. It is the base value of the probability when all independent variables ($x1, x2, \ldots, x\rho$) are 0. β1, β2, ..., βρ (Coefficient) This coefficient is a model parameter that shows how much influence each independent variable ($x1, x2, \ldots, x\rho$) has on the probability of the outcome. Each β multiplies the value of the independent variable concerned. $x1, x2, \ldots, x\rho$ (Independent Variables) are input variables (or predictors) used to predict the probability of an outcome. The number can be more than one (ρ indicates the total number of independent vari-

ables). *e* (Euler Number): e is a mathematical constant that is approximately 2.71828. It is used in the logistic function to create an S-shaped curve that approaches 0 when the input value is very negative and approaches 1 when the input value is very positive.

By using the logit transformation of $\pi(x)$ to facilitate the estimation of the regression parameters, it is formulated as follows.

$$\begin{aligned}&\{\pi(x)\}\{1+e\beta 0+\beta 1x1+\ldots+\beta pxp\}\\&=\{e\beta 0+\beta 1x1+\ldots+\beta pxp\}\\&=\{\pi(x)\}\{\pi(xx)e\beta 0+\beta 1x1+\ldots+\beta pxp\}\\&=e\beta 0+\beta 1x1+\ldots+\beta pxp\},\end{aligned} \tag{2}$$

$$\begin{aligned}&\{\pi(x)\}=e\beta 0+\beta 1x1+\ldots+\beta pxp\}\\&-\pi(x)e\beta 0+\beta 1x1+\ldots+\beta pxp\},\end{aligned} \tag{3}$$

$$\begin{aligned}&\{\pi(x)\}=e\beta 0+\beta 1x1+\ldots+\beta pxp\}\\&-\pi(x)e\beta 0+\beta 1x1+\ldots+\beta pxp\},\end{aligned} \tag{4}$$

$$\pi(x)=\{1+\pi(x)\}e\beta 0+\beta 1x1+\ldots+\beta pxp\}, \tag{5}$$

$$\frac{\pi(x)}{1-\pi(x)}=e\beta 0+\beta 1x1+\ldots+\beta pxp\}, \tag{6}$$

$$\int n\frac{\pi(x)}{1-\pi(x)}=\int n\beta 0+\beta 1x1+\ldots+\beta pxp\}, \tag{7}$$

$$\int n\frac{\pi(x)}{1-\pi(x)}=\beta 0+\beta 1x1+\ldots+\beta pxp. \tag{8}$$

So the following equation is obtained:

$$\begin{aligned}g(x)&=\int n\left[\frac{\pi(n)}{-\pi(x)}\right]=\beta 0\\&+\beta 1x1+\ldots+\beta pxp,\end{aligned} \tag{9}$$

where $g(x)$ is called the logit function of the binary logistic regression model with p predictor variables, equation 10 is the equation model formula:

$$\pi(x)=\frac{\exp(g(x))}{1+\exp(g(x))}, \tag{10}$$

where $\pi(k)$ = Event level opportunities; exp = 2.71828183; Determine the values of x; and x = Logit function of the logistic regression model.

2.3. Overall parameter test

This overall parameter test is useful to determine beforehand if all independent variables affect the model (Misna et al., 2018), with the following approach:

H0: $\beta 1 = \beta 2 = \ldots = 0$ *(No influence).*

H1: $\beta 1 = \beta 2 \neq 0$ *with = 1, 2, ... (There is at least one).*

The result of the submission is that H0 can be rejected if the result is a g ≥ x2 (p) value.

2.4. Individual test parameters

This test can be done if there is at least one variable that affects the model in the overall parameter test so that testing can be done to find out which variables have this influence, through the results of the Wald test (Haloho et al., 2013), with the following approach:

H0: $\beta = 0$ *(There is no model significance on the logit coefficients).*

H1: $\beta \neq 0$ *(The significance of the model is found in the logit coefficients).*

2.5. Model fit test

This examination aims to assess the practicality of the derived logistic regression model. The instrument utilized for this test is the Hosmer and Lemeshow test (Hosmer & Lemeshow, 2000). The hypotheses used are:

H0: The model fits the observation data.

H1: The model does not fit the observation data.

Rejection of H0 can occur if $\hat{C}$ > x2 (α, db) with degrees of freedom (db) = g – 2.

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2.6. Interpretation of parameter coefficients

In explaining the parameter coefficient, the odds ratio (ψ) is used. At the value of x = 1, it is defined as π(1) / [1 – π(1)]. If x = 0, then the odds ratio value will be made as follows: π(0) / [1 – π(0)] (Agresti, 1990). The odds ratio is calculated using the equation:

$$\psi = \frac{odds\ A}{odds\ B} = \frac{\frac{\pi_A}{1-\pi_A}}{\frac{\pi_B}{1-\pi_B}}. \quad (11)$$

The odds ratio is often referred to as a measure of the average tendency of the dependent variable to value x = 1 rather than x = 0 (Hosmer & Lemshow, 2000).

2.7. Classification accuracy

This classification accuracy procedure aims to confirm the possibility of misclassification made by a classification function (Johnson & Wichern, 2007). The measure used is the Apparent Error Rate (APER). The APER value is the percentage of samples classified by the classification function (see Table 2).

Table 2. Classification accuracy calculation

Observation Results	Estimated Classification	
	v1	v2
y1	n11	n12
y2	121	n22

Note: n_11 = Number of Subjects y_1 that are categorized correctly v_1; n_12 = Number of Subjects y_1 that are categorized correctly v_2; n_21 = Number of Subjects y_2 that are categorized correctly v_1; n_22 = Number of Subjects y_2 that are categorized correctly v_1; The APER formula used is: APER = (n_21+ n_12)/n ×100%. n = Number of Observations.

3. RESULTS AND DISCUSSION

The fiscal decentralization policy at the village level in Indonesia began in 2025, marked by the implementation of the Village Fund Transfer Program. The village fund is included in the allocation of resources to rural areas obtained from the state budget (APBN). The fund is allocated for village-based development programs to realize equitable and just development down to the village level. Figure 1 outlines the total village funds allocated by the central government to every village, categorized by the 33 provinces in Indonesia for the years 2018 and 2021.

The province that received the most village fund transfers in 2021 was Central Java, while the prov-

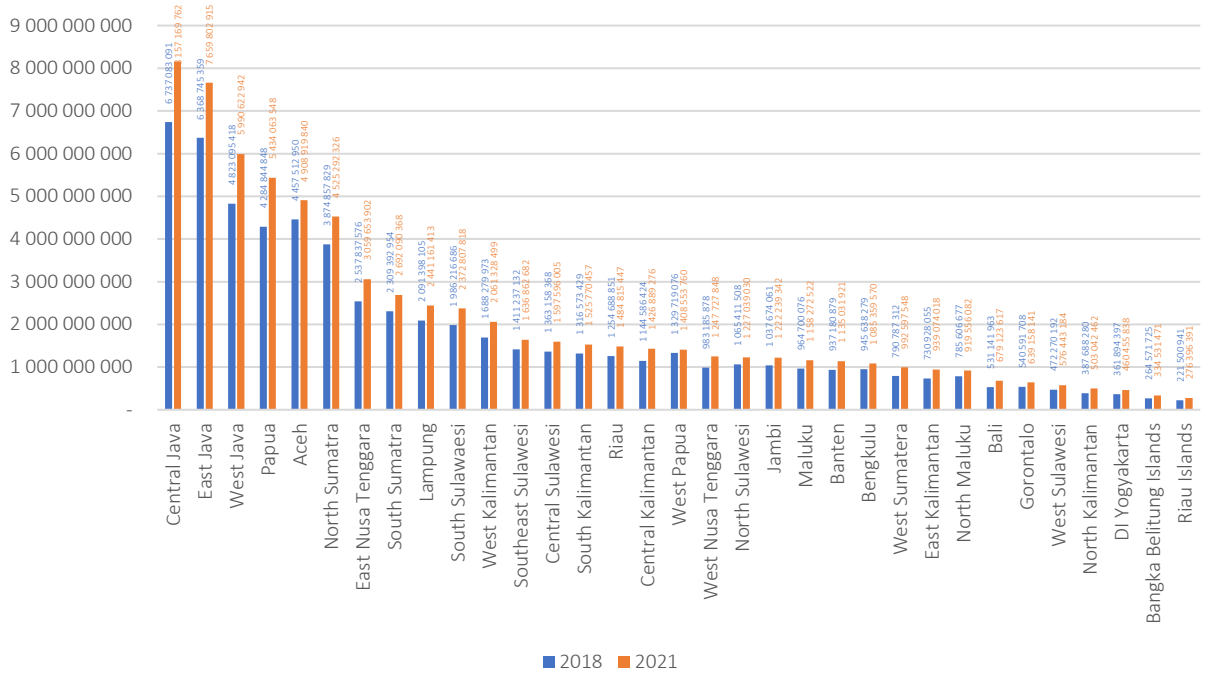

Figure 1. Amount of village funds by province in Indonesia in 2018 and 2021 (in thousand Rupiah)

ince that received the least village fund transfers in 2021 was Riau Islands. The amount of village funds allocated to a province is determined by the number of villages in that province. Central Java Province should indeed receive the most village fund transfers because has the largest number of villages in Indonesia, namely 8,563 villages. On the other hand, the number of villages in Riau Islands Province is only 275 villages.

During the analysis period, village fund transfers to all villages in 33 provinces in Indonesia increased on average by 20.48%. The highest increase occurred in North Kalimantan, at 29.75%, while the lowest increase occurred in West Papua, at only 5.93%.

This study analyzed the level of efficiency of village fund use in 33 provinces in Indonesia, using the periods 2018 and 2021. In this analysis, the village fund was used as the decision-making unit (DMU). Based on the results of calculations carried out using the data envelopment analysis (DEA) 2.1 software, the distribution of technical efficiency values of village funds in 33 provinces in Indonesia was obtained as in Table 3.

The results of data processing using the Constant Return to Scale (CRS) method of the output-oriented DEA model show (see Table 3) that in 2021, out of 33 provinces analyzed, 10 provinces were declared efficient with a score of 1 or 100%. The remaining 23 are inefficient because their scores are

Table 3. Technical efficiency analysis

Province	2018		2021	
	Constant Returns to Scale (CRS)	Information	Constant Returns to Scale (CRS)	Information
Aceh	0.739	inefficient	0.885	inefficient
North Sumatra	0.699	inefficient	0.813	inefficient
West Sumatra	1.000	efficient	1.000	efficient
Riau	0.657	inefficient	0.715	inefficient
Jambi	0.729	inefficient	0.800	inefficient
South Sumatra	0.677	inefficient	0.790	inefficient
Bengkulu	0.921	inefficient	1.000	efficient
Lampung	0.616	inefficient	0.773	inefficient
Bangka Belitung Islands	1.000	efficient	1.000	efficient
Riau Islands	1.000	efficient	1.000	efficient
West Java	0.895	inefficient	0.864	inefficient
Central Java	0.954	inefficient	1.000	efficient
DI Yogyakarta	1.000	efficient	1.000	efficient
East Java	0.916	inefficient	1.000	efficient
Banten	0.974	inefficient	1.000	efficient
Bali	1.000	efficient	1.000	efficient
West Nusa Tenggara	0.890	inefficient	0.879	inefficient
East Nusa Tenggara	0.560	inefficient	0.652	inefficient
West Kalimantan	0.3822	inefficient	0.609	inefficient
Central Kalimantan	0.578	inefficient	0.725	inefficient
South Kalimantan	0.950	inefficient	1.000	efficient
East Kalimantan	0.958	inefficient	1.000	efficient
North Kalimantan	0.556	inefficient	0.595	inefficient
North Sulawesi	1.000	efficient	1.000	efficient
Central Sulawesi	1.000	efficient	0.855	inefficient
South Sulawesi	1.000	efficient	1.000	efficient
Southeast Sulawesi	1.000	efficient	0.980	inefficient
Gorontalo	1.000	efficient	1.000	efficient
West Sulawesi	0.823	inefficient	0.837	inefficient
Maluku	0.589	inefficient	0.674	inefficient
North Maluku	0.775	inefficient	0.807	inefficient
West Papua	0.359	inefficient	0.542	inefficient
Papua	0.284	inefficient	0.270	inefficient

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less than 1 or 100%. The results in 2021 show that 14 provinces are declared efficient with a score of 1 or 100%. Meanwhile, the remaining 19 are inefficient because their scores were less than 1 or 100%. It can be concluded that the level of use of village funds in Indonesia is still relatively inefficient, although improvements have been seen over time. In 2021, the number of provinces declared efficient was greater than in 2018. However, overall, both in 2018 and 2021, the number of provinces that are inefficient in the use of village funds was still higher.

The findings confirm Wildani et al. (2022), who assessed how well regional incentive funds, nonphysical special allocation funds, and the village fund were managed, particularly focusing on the distribution of the village fund across all provinces in Indonesia during the 2019–2021 fiscal years, in connection with village well-being as indicated by the Village Development Index (IDM). The study indicated that only eight provinces showed efficiency in the use of village fund input variables, while the effectiveness of village funds was the least favorable when assessed alongside regional incentive funds and special allocation funds.

Likewise, Chalil (2020) examined the effectiveness of independent sub-municipal government expenditures and described how bureaucratic factors and lump sum grants affect spending efficiency. This study examined the 2014 Indonesian Village Government data set using the meta-cost frontier to quantify village expenditure efficiency. It then looked into the causal relationship between the efficiency attained and the fiscal transfers that were awarded as well as bureaucratic issues. The findings indicate that the inefficiencies of autonomous village expenditure will worsen if direct transfers are made. Spending inefficiency is positively impacted by administrative issues, including the village government's extensive bureaucracy and lack of bureaucratic capability. The results of empirical analysis show that, overall, the use of village funds in Indonesia still needs to be improved in terms of efficiency. The main challenges include inefficiency in the distribution and use of funds, as well as the influence of a large bureaucracy. To increase the effectiveness of village fund use, it is vital to evaluate existing policies and strengthen the capacity of village organizations to manage these funds.

Efficiency can be shown through a comparison between output and input. Mubyarto and Hamid (1987) in Ria et al. (2022) define efficiency as a benchmark used for various purposes, a comparison between input and output. In other words, efficiency is carried out by minimizing the cost of using resources to achieve a predetermined output.

The method used to examine the factors that affect the effectiveness of village fund expenditures across 33 provinces in Indonesia was binary logistic regression. This examination was conducted to identify the connection between dependent binary variables and qualitative predictor variables. The dependent variable in the equation model of this study is the result of technical efficiency calculations based on data envelopment analysis (DEA) in Table 1, where efficient provinces receive a score of 1 (one), while inefficient provinces receive a score of 0 (zero). The independent variables in this equation model are mutual cooperation, a good financial system, and the village head's education level. The analysis process using binary logistic regression in this study was carried out in six stages, namely:

1. Model feasibility testing (Hommer test);
2. Termination coefficient analysis (*R* square);
3. Model accuracy test;
4. Model accuracy test;
5. Simultaneous test; and
6. Partial test.

3.1. Model feasibility testing (Hommer test)

The Hosmer-Lemeshow goodness of fit test is used to evaluate the fit or suitability of a model in logistic regression. This test is intended to evaluate the ability of the logistic regression model created to predict data accurately by comparing the model's prediction results with the actual data. If the *P*-value > 0.05, the logistic regression model does not show significant inconsistency with the data. This indicates that the model can predict well and does not need to be revised. Whereas if the *P*-value ≤ 0.05, the model shows inconsistency with the data. This indicates that the model lacks sufficient capability to explain the connection between the independent and dependent variables; therefore, it

needs to be adjusted or improved. Table 4 presents the result of the Hosmer test on the logistic regression model of this study.

Table 4. Hosmer test

H-L Statistics	5.7694	Prob. Chi-Sq(8)	0.6730
Andrews Statistics	24.1891	Prob. Chi-Sq(10)	0.0071

The Hosmer test result shows that the probability value or *P*-value is 0.6730 > alpha (0.5), thus indicating suitability with the data, suggesting that the model is declared fit or feasible for logistic regression modeling.

3.2. Termination coefficient (R square)

After the logistic regression model is declared fit or feasible to be used for logistic regression modeling, the next step is to test the termination coefficient (*R* square). *R* square in logistic regression is used to assess the extent to which the model can explain data variability. The *R* square test model employed is McFadden R^2, with the following formula,

$$R^2 McFadden = 1 - \frac{Lmodel}{Lnull}, \qquad (12)$$

where Lmodel is the likelihood of the logarithmized model, and Lnull is the likelihood of the null model. McFadden R^2 is used to measure the fit of the model in logistic regression. The McFadden R^2 value is usually smaller than the R^2 in linear regression. A good value for McFadden R^2 is between 0.2 and 0.4, although this depends on the context and complexity of the model. Table 5 shows the results of the McFadden R^2 test.

Table 5. R square test

Metric	Value
McFadden *R*-squared	0.533677
S.D. dependent var	0.496198
Akaike info criteria	0.867742
Schwarz criterion	1.049137
Hannan-Quinn criterion	0.928776
Restr. Deviance	44.25152
LR statistic	23.61603
Prob (LR statistic)	0.000030

Based on the analysis using the McFadden R^2 test in Table 5, the McFadden *R* square value reached 0.533677. This shows that independent variables such as cooperation, a good financial system, and village apparatus education can predict dependent variables by 53%, while the rest is explained by other variables not included in the study. These results indicate that the selection of independent variables is considered good because more than 50% can predict the dependent variable in the model.

3.3. Model accuracy test

After the independent variables are declared good in predicting the dependent variable, the third step in testing the logistic regression model is the model accuracy test. In logistic regression, the purpose of the model accuracy evaluation is to determine how effectively the constructed model can forecast the right outcomes (category 1 or 0) based on the existing data. Accuracy measures the extent to which the model predictions match the values observed in the data. The accuracy matrix is used to evaluate the accuracy of the logistic regression model. Matrix accuracy measures the percentage of correct predictions from the total observations tested. In the context of logistic regression, this measures how many correct classifications (both positive and negative) are produced by the model compared to the total amount of data tested. Table 6 shows the outcomes of the accuracy assessment for the model, along with the matrix accuracy of this research model.

Table 6. Model accuracy test

Estimation Criteria	Dep = 0	Estimated Equation	Total
		Dep = 1	
E (# of Dep = 0)	16.71	3.29	20.00
E (# of Dep = 1)	3.29	9.71	13.00
Total	20.00	13.00	33.00
Correct	16.71	9.71	26.43
% Correct	83.57	74.73	80.09
% Incorrect	16.43	25.27	19.91
Total Gain*	22.97	35.34	27.84
Percent Gain**	58,31	58.31	58.31

Note: * nominal gain estimate, **percent gain estimate.

The results of the model accuracy test obtained a percentage of 83.57% of the correctness test, suggesting that the tested model can predict correctly by 83.57%.

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3.4. Simultaneous test

After going through the model accuracy test, the next step taken in the logistic regression test is to conduct a simultaneous test. In the examination of logistic regression, concurrent evaluation is utilized to determine the combined effect of multiple independent variables on a two-category dependent variable. This assessment aims to evaluate if a group of independent factors has a noteworthy impact on the dependent variable together or whether the model is better than a model containing only an intercept or a model without independent variables.

The simultaneous logistic regression test in this study refers to the value of the likelihood ratio test, which is applied to assess the overall significance of the model. Table 5 presents the result of the simultaneous test of the logistic regression model in this study. The outcomes of the concurrent assessment indicated that the probability value of the likelihood ratio (LR statistic) is 0.000030, and the result is < 0.05; thus, the model can be stated as fit, or at least an independent variable affects the dependent variable. The likelihood ratio (LR statistic) value of 0.000030 < 0.05 indicates that the results of the simultaneous test predict that an X variable will affect the Y variable in the logistic regression model being tested.

3.5. Partial test

Following the execution of a concurrent examination and declaring that an independent factor is capable of forecasting the dependent factor, the last step in the logistic regression test is to conduct a partial test. In logistic regression, a partial test is used to assess the impact of independent variables on dependent variables by holding other variables in the model. The benefit of this test is to determine whether the independent variables provide a significant contribution to the model individually and to test the coefficients of the variables. Table 7 shows the results of partial tests on the logistic regression model in this study.

Based on the partial test results, the variable of village apparatus with a bachelor's/diploma education affects the variable of efficiency or inefficiency in the use of village funds. If the coefficient value is negative, the probability is 0; if positive, the probability is 1. Meanwhile, the odds ratio value obtained from the coefficient results is raised to the power of an exponential value of 2.72 as follows:

1. The coefficient value of X1 is 0.066482 positive, with an OODS ratio value of 1.36. This shows that if there is an increase in cooperation activities, the opportunity to have efficient village status is 1.36 times greater.

2. The coefficient value of X2 is 0.256060 positive, with an OODS ratio value of 6.13. This shows that if there is an improvement in the village financial system and an update is carried out, the opportunity for the village to have an efficient status is 6.13 times greater.

3. The coefficient value of X3 is 0.179629 positive, with an OODS ratio value of 2.67. This means that if there is an increase in the number of village heads with diploma/bachelor's degrees, the opportunity to achieve village efficiency will be 2.67 times greater.

The results of the partial test show that the village head education variable affects the efficiency/inefficiency of village fund spending in Indonesia. In addition, when viewed from the coefficient based on the OODS ratio value, the largest value is obtained by the good village financial system variable. Thus, the village financial management system is the most influential factor in the efficiency of the use of village funds in Indonesia. These results are in line with the results of Chalil's study

Table 7. Partial test results

Variable	Coefficient	Std. Error	Z.Statistic	Prob.
C	–34.16156	15.96011	–2.140433	0.0323
Cooperation (Gotong Royong)	0.066482	0.039398	1.687451	0.0915
Good Financial System	0.256060	0.145877	1.755315	0.0792
Village Head with Bachelor/Diploma education	0.179629	0.077754	2.310231	0.0209

(2020), which discovered that elements related to administration, such as extensive bureaucracy and insufficient bureaucratic ability within the village administration, positively influence inefficient spending. Chalil (2020) recommends the need for an evaluation of village governance policies to improve expenditure efficiency, especially with a focus on the adequacy of village institutions in handling fund transfers. The study suggests that accountability in village fund administration is influenced by apparatus competency, internal control mechanisms, organizational commitment, and community involvement. The findings of this study have implications for promoting responsible village fund management through improved community involvement, organizational commitment of the village administration, and the proficiency of the village fund management apparatus.

The findings of this study indicate that all independent variables tested in the logit model have a positive effect on the efficiency of village fund use, thus in accordance with the proposed hypothesis. However, of the three independent variables tested, only one variable has a significant effect on the efficiency of village fund use, namely the number of village heads with diploma/bachelor's degrees variable.

CONCLUSION

The purpose of this study is to evaluate the level of efficiency of village fund use and analyze the variables that influence it. Understanding the level of efficiency and factors that influence the efficiency of the village fund is critical for the central government that distributes the funds to villages and local governments (village level) in assessing the extent to which they manage the funds wisely. In the Indonesian context, although the central government provides the funds to villages, they have full autonomy to make their spending decisions at the village level. The findings of this study can be summarized into two aspects. First, Indonesia experienced an increase in the degree of efficiency in the use of village funds during the study period, but during the study period, 57.58%, or 19 out of 33 provinces, were still operating village funds inefficiently. Second, this study also found that the key elements that influence the efficiency of village fund use are the education level of the village head, a strong village financial system, and community collaboration.

The policy implications of these findings can be summarized into four aspects that reflect the increase in the efficiency of village funds in the future through good management and governance quality. First, the central government needs to closely monitor village budgeting to ensure that funds are spent appropriately for village community development. This can be done through monitoring the budgeting process and holding frequent meetings with village heads and communities for further advice and discussion. Second, strengthening the capacity and capabilities of human resources at the village level is also needed because they are the main actors who will implement projects in the village. Improving human resource capabilities can be done through formal education or providing further training for village officials and supporting officials to improve their knowledge and skills in budget management, preparing good financial reports, and monitoring village fund expenditures. Third, increasing local involvement in the organization and supervision of village financial resources is also important. Local communities must take a more active role in determining how village funds are used, including during the monitoring phase of village fund expenditures. Finally, improving the village financial management system through technology is essential to improve transparency and governance of village fund use. This effort can be implemented by adopting a digital-based financial system that allows local communities and other interest groups to track the use of village finances in real time.

AUTHOR CONTRIBUTIONS

Conceptualization: Sutikno, Zulkefly Abdul Karim, Alifah Rokhmah Idialis.
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Supervision: Sutikno.
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Visualization: Sutikno, Alifah Rokhmah Idealis.
Writing – original draft: Sutikno, Zulkefly Abdul Karim, Alifah Rokhmah Idialis.
Writing – review & editing: Sutikno, Zulkefly Abdul Karim, Alifah Rokhmah Idialis.

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