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Measuring Village Fund Efficiency on Socioeconomic Outcomes: A Dual-Method Approach

Azhari Azhari*
* Universitas Islam Kebangsaan Indonesia
Jl. Medan Banda Aceh, Bireuen, Aceh, Indonesia
Email*: azhari@uniki.ac.id

Abstract

Village fund management constitutes a strategic initiative aimed at addressing issues related to poverty and unemployment at the local level. Numerous villages continue to encounter difficulties in optimizing the efficiency of fund utilization, which is anticipated to yield significant socio-economic impacts. This study seeks to evaluate the efficiency of village funds and to analyze the correlation between various input variables and output indicators. The data used consists of village funds, poverty levels and unemployment in Aceh during 2015-2023. The methodological approach is Data Envelopment Analysis (DEA) to assess efficiency, and linear regression to investigate the relationships among the variables. The findings indicate a notable variation in the efficiency of village fund utilization, which positively contributes to the alleviation of poverty and unemployment. These results underscore the necessity for a participatory approach and the development of more adaptive policies in village fund management to achieve sustainable outcomes and enhance community welfare.

Keywords: Village fund, poverty, unemployment, efficiency

1. Introduction

In the past decade, the village fund program has emerged as a pivotal policy instrument aimed at accelerating economic development in rural areas, particularly in developing countries such as Indonesia. This program constitutes a government initiative focused on the advancement of village development (Ernawati et al., 2021; Kusumo et al., 2022; Manurung et al., 2022; Purba et al., 2022)Its design seeks to mitigate economic disparities and enhance the welfare of rural communities through the direct allocation of funds managed by village governments. In addition to serving as a catalyst for basic infrastructure development, village funds are also intended to support activities aimed at empowering local economies (Wahyuningrat et al., 2024). Nevertheless, despite its significant potential for contributing to poverty alleviation and unemployment reduction, the effectiveness and efficiency of village fund implementation frequently raise concerns, particularly regarding the variance in outcomes across different regions.

The efficiency of village fund utilization is a critical aspect warranting examination due to its significant potential impact on the socio-economic dynamics of village communities. Predominantly, prior research has concentrated on descriptive analyses regarding the impact of village funds on economic development, often neglecting comprehensive quantitative evaluations of the efficiency of their allocation, as demonstrated in studies (Azhari et al., 2022; Diansari, Othman, et al., 2023; Hartojo et al., 2022; Manurung et al., 2022; Wahyudi et al., 2022). Some of these investigations indicate that variations in village socio-economic conditions and the diversity of village fund management contribute to discrepancies in target achievements, particularly in efforts to alleviate poverty and unemployment. In this context, analyzing the efficiency of village funds not only elucidates their utilization but also offers deeper insights into the factors influencing the success of their implementation.

Given that the village fund program operates at a national scale, with a continuously increasing budget allocation, a better understanding of methods to optimize village funds for maximum outcomes is essential. This can be accomplished through the formulation of policies beneficial to the villages (Udjianto et al., 2021). Furthermore, the management of village funds should consider the capacity of village fund managers to prevent the misappropriation of funds (Ash-Shidiqqi & Wibisono, 2018; Diansari, Othman, et al., 2023; Setiyawati et al., 2023).

Despite the commendable objective of the village fund program to enhance the welfare of rural communities, the allocation of these funds has not been optimally employed in rural development (Ash-Shidiqqi & Wibisono, 2018). Various studies indicate that the utilization of village funds frequently fails to achieve optimal efficiency, particularly in the realms of poverty

alleviation and unemployment reduction, attributed in part to inadequate supervision of village assistants (Kusumo et al., 2022). Additionally, the development of human resources in rural areas remains insufficient (Arham & Hatu, 2020; Sijabat, 2018). In practice, although the allocated funds increase substantially each year, the resultant outcomes in the field reveal significant disparities.

This study introduces a novel contribution to the discourse on village fund efficiency by integrating Data Envelopment Analysis (DEA) with linear regression methodologies to evaluate the effectiveness of village fund utilization in alleviating poverty and unemployment. This synergistic approach, which has been infrequently employed in previous research, enables a dual focus on measuring fund allocation efficiency and identifying specific factors that influence the success or failure of village funds in achieving socio-economic objectives, as evidenced by the research conducted by Azhari et al., and Ernawati et al. (2022; 2021), who investigated the effects of village funds on poverty and unemployment through regression analysis. Similar studies by Abdullah (2022), Kamila (2021), Sabira et al (2021), Manurung et al (2022) further support this exploration.

While previous studies have assessed the impact of village funds on local welfare, most have not integrated an efficiency-based framework using robust empirical methods that account for cross-village variations. Thus, this study contributes to the literature by addressing both conceptual and methodological gaps in village-level policy evaluation. By integrating DEA and regression techniques, this research offers a comprehensive framework for assessing not only the outcomes but also the relative performance of fund utilization in promoting rural socioeconomic development.

This study is motivated by the need to gain a more systematic understanding of how efficiently village funds are being used to generate key development outcomes, particularly in reducing poverty and unemployment. Accordingly, the research focuses on measuring the relative efficiency of fund use across villages and identifying contextual factors such as education levels, infrastructure availability, and administrative capacity—that may influence those outcomes. The primary concern of this study lies in examining the relationship between fiscal inputs and socioeconomic outputs within a technical efficiency framework.

To this end, the study seeks to address two key research questions: (1) How efficiently are villages utilizing their allocated funds to reduce poverty and unemployment? and (2) What contextual factors influence variations in efficiency across villages? These questions are explored through a dual-method quantitative approach that combines Data Envelopment Analysis (DEA) for efficiency measurement and linear regression analysis to examine causal relationships among variables.

2. Method

This study employs a quantitative research design with a descriptive-analytical approach to assess the efficacy of village fund utilization in mitigating poverty and unemployment. The analysis utilizes secondary data encompassing economic and social indicators at the village level in Aceh, covering the period from 2015 to 2023. The methodological framework is structured to evaluate the relative efficiency of each village through the application of Data Envelopment Analysis and panel regression techniques.

The analysis adopts an output-oriented DEA model under the assumption of variable returns to scale (VRS), following the framework developed by Banker, Charnes, and Cooper (BCC). The output-oriented specification is appropriate because village governments generally have limited control over the level of fiscal transfers they receive, but they can influence how effectively these resources are translated into development outcomes. Therefore, the model evaluates the extent to which villages can maximize socioeconomic outcomes given the available fiscal resources.

In this study, village fund allocation is used as the primary input variable, reflecting the fiscal resources provided by the central government for rural development programs. Two key socioeconomic indicators poverty rate and unemployment rate are employed as output variables, representing fundamental dimensions of welfare improvement at the village level. Although rural development outcomes are inherently multidimensional, these indicators are selected because they directly capture the primary policy objectives of village fund programs and are consistently available across the study area.

Nevertheless, the analysis acknowledges that development performance may also be influenced by other outcomes such as infrastructure development, employment creation programs, or improvements in public services. Due to data constraints and the need for comparability across villages, the study focuses on core socioeconomic indicators while recognizing this limitation as an avenue for future research.

Operationalization of variables is conducted to identify the indicators employed in measuring efficiency and regression outcomes. Key variables assessed in this study include:

TABLE 1

INPUT AND OUTPUT VARIABLES

Variable	Definition	Input / Output
Village Fund	The total budget received by regency each year from the central government for village funds	Input
Poverty	Percentage of regency poverty rate annually (2015-2023)	Output
Unemployment	Percentage of Regency unemployment rate annually (2015-2023)	Output

Data Envelopment Analysis (DEA) Method

The DEA was first developed by Farrell (1957) to measure the technical efficiency of initial and outputs at additional entrances and multi-outputs. Additionally, we use relative efficiency value frames as the input ratio of the output (individual virtual inputs) (individual virtual outputs).

DEA is a non-parametric mathematical program that uses a number of inputs and outputs to assess an organization's efficiency known as a decision-making unit (DMU). Two efficiency measurement models based on the DEA are as follows:

1. CCR Model (Charners-Cooper-Rhodes, 1978).

They first discovered the DEA CCR (Charnes-Cooper-Rhodes) model in 1978 (Charnes, A., Cooper, W. W., & Rhodes, 1978). A Constant Return to Scale (CRS) is assumed by the model, which means that a proportionate change in the input level will cause a corresponding change in the output (for instance, adding 1% input will raise output by 1%).

2. Bankers, Charnes and Cooper (1984)

The DEA BCC model underwent additional development (Bankers, R.D., Charnes, A. and Cooper, 1984), A variable return to scale (VRS) is assumed. This implies that different output levels will result from measured units, and it is assumed that production size may have an impact on efficiency. This is what sets apart the CRS assumption, which holds that efficiency is unaffected by production scale.

This study was founded on findings from Koopmans (1951), Debreu (1951), and Farrell (1957), This set the groundwork for the literature on efficiency constraints. It was demonstrated that the company's efficiency measure can be determined with a variety of inputs. This study utilized the Data Envelopment Analysis (DEA) method created by Bankers, R.D., Charnes, A. and Cooper (1984). Furthermore, the resulting unit of output may increase, remain constant, or decrease in proportion to the input unit increase. Furthermore, the VRS model was adopted because it anticipated that the ratio of input to output addition is not constant. This indicates that adding input x times does not always result in an increase of x times in output, which could be less or higher than n times. Rising the proportion might take the form of rising returns to scale (IRS) or declining returns to scale (DRS). This model improves the convexity criterion for λ weight values by using the following constraint model:

$$\sum_{j=1}^{n} \lambda j = 1$$

The BCC model equation is as follows: λ Max π (DMU efficiency VRS Model).

Subject to:

$$\sum_{j=1}^{n} \lambda j \, xij \;\leq\; \theta xi0 = 1,2, \ldots . m \qquad (1)$$

$$\sum_{j=1}^{n} yrj\lambda j \;\geq\; yi0i = 1,2 \ldots . . s \qquad (2)$$

$$\sum_{j=1}^{n} \lambda j = 1 \quad (VRS) \qquad (3)$$

$$\sum_{j=1}^{n} \lambda j \geq \theta i = 1,2, \ldots . . n \qquad (4)$$

Where θ is the efficiency of the DMU, n is the number of DMUs, m is the number of inputs, s is the number of outputs, xij is the number of the i input DMU j, and yrj is the number of the r output of the DMU. The estimated DMU has a weight of j λj. Meanwhile, the study team employed the Malmquist Index and the following method to measure the degree of Village fund productivity:

$$M_o\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \frac{D_o^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_o^t\left(x^t, y^t\right)} \times \left[\left(\frac{D_o^t\left(x^{t+1}, y^{t+1}\right)}{D_o^{t+1}\left(x^{t+1}, y^{t+1}\right)}\right)\left(\frac{D_o^t\left(x^t, y^t\right)}{D_o^{t+1}\left(x^t, y^t\right)}\right)\right]^{\frac{1}{2}} \qquad (5)$$

where, is the distance from the period t + 1 observation to the technology t period. The starting ratio on the right side of Equation (3) represents the change in the relative efficiency between years t and t+1. Furthermore, the overall productivity of the factors will be evaluated by the following formula:

$$M_0\left(x^t,y^t,x^{t+1},y^{t+1}\right)=\left[\left(\frac{D_0^{t+1}\left(x^t,y^t\right)}{D_0^t\left(x^t,y^t\right)}\right)\left(\frac{D_0^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_0^t\left(x^{t+1},y^{t+1}\right)}\right)\right]^{\frac{1}{2}}\times\left(\frac{D_0^t\left(x^t,y^t\right)}{D_0^{t+1}\left(x^{t+1},y^{t+1}\right)}\right)\times\left(\frac{D_{oc}^{t+1}\left(x^t,y^t\right)}{D_0^{t+1}\left(x^t,y^t\right)}\frac{D_0^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_{oc}^{t+1}\left(x^{t+1},y^{t+1}\right)}\frac{D_{oc}^t\left(x^t,y^t\right)}{D_0^t\left(x^t,y^t\right)}\frac{D_0^t\left(x^{t+1},y^{t+1}\right)}{D_{oc}^t\left(x^{t+1},y^{t+1}\right)}\right)^{\frac{1}{2}} \quad (6)$$

where: $\left[\left(\frac{D_o^{t+1}\left(x^t,y^t\right)}{D_o^t\left(x^t,y^t\right)}\right)\left(\frac{D_o^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_o^t\left(x^{t+1},y^{t+1}\right)}\right)\right]^{\frac{1}{2}}$ = Technical Change (7)

$$\left(\frac{D_o^t\left(x^t,y^t\right)}{D_o^{t+1}\left(x^{t+1},y^{t+1}\right)}\right)$$

= Pure Efficiency Change (8)

$$\left(\frac{D_{oc}^{t+1}\left(x^t,y^t\right)}{D_o^{t+1}\left(x^t,y^t\right)}\frac{D_o^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_{oc}^{t+1}\left(x^{t+1},y^{t+1}\right)}\frac{D_{oc}^t\left(x^t,y^t\right)}{D_o^t\left(x^t,y^t\right)}\frac{D_o^t\left(x^{t+1},y^{t+1}\right)}{D_{oc}^t\left(x^{t+1},y^{t+1}\right)}\right)^{\frac{1}{2}}$$ = Scale Efficiency Change (9)

The raise in efficiency is a significant one, as measured by the Malmquist index. Additionally, a reduction in efficiency value occurs when it is less than 1. The same is true for change and technical efficiency when the TECHch value is greater than one. This signifies that the production process is becoming more technologically advanced, or that technical components are the primary driver for increased efficiency (TFP). Meanwhile, EFFch > 1 indicates that the process of converting input into output is efficient (frontier). This formula is expected to measure the productivity of village funds in a non-parametric manner.

Linear Regression Analysis

After obtaining the efficiency value from Data Envelopment Analysis (DEA), a linear regression analysis was conducted to examine the relationship between poverty and unemployment variables and the efficiency of village fund utilization.

The present study employs panel data to analyze the dataset, which integrates time series and cross-sectional data. Based on the panel data utilized, a total of 207 observations were included in this study. For data analysis, this study utilized the EViews program version 9 and Microsoft Excel, while the analytical method employed is panel data regression analysis, specifically pooling least squares (common effect), fixed effects approach, and random effects approach. The appropriateness of the models was assessed using the Chow test and the Hausman test. Hypothesis testing was conducted through the determination coefficient test, F-test, and t-test.

The Pooled Least Squares (Common Effect) Model Suitability Test combines cross-sectional data with time series and uses the Ordinary Least Squares (OLS) method to estimate the panel data model (Gujarati, 2021). The fixed effects model has a separate intercept for each subject (cross-section) and a steady slope for each subject throughout time (Gujarati, 2021). These diverse approaches are used to account for observed changes in values and relationships among random individuals, which are represented as residuals. The best model in panel data analysis is established via statistical testing using the Chow Test and the Hausman Test. The panel regression model for each response variable is as follows:

$$Pov = \beta0 + \beta DDit + eit \quad (10)$$

$$Un = \beta0 + \beta DDit + eit \quad (11)$$

Where pov is the percentage of poverty in each region, DD is the village fund obtained by each village, Un is the unemployment rate of each region, β1 and β2 is the regression coefficient, i is the unit cros section, t is the time period and e is the error term.

With this DEA and linear regression approach, the study can provide comprehensive insights into the effectiveness of village funds in supporting socio-economic development in rural areas as well as identify important factors that play a role in improving efficiency.

3. Result and Discussion

The study investigates the efficiency and correlation between village funds and the phenomena of poverty and unemployment. The data utilized, spanning from 2015 to 2023, is sourced from the Central Statistics Agency and the Ministry of Villages and Transmigration of the Republic of Indonesia. As an initial phase, this research presents a descriptive analysis for each variable employed. According to Table 2, the district with the highest poverty rate is Bener Meriah, registering at 23.79 percent, while the lowest rate is observed in Banda Aceh city, at 6.9 percent. Moreover, the district exhibiting the highest unemployment rate is North Aceh, with a rate of 17.05 percent, whereas Bener Meriah district displays the lowest unemployment rate at 1.03 percent. Lastly, the village fund input variable is reported to be the smallest in Sabang city, amounting to IDR 6.064 billion, while the highest is found in North Aceh district, totaling IDR 635.31 billion.

TABLE 2

STATISTIC DESCRIPTIF VARIABEL OF OUTPUT AND INPUT

	Output		**Input**
	Poverty (%)	Unemployment (%)	Village Fund (IDR)
Mean	16,07	6,28	189.575.809.357
Std Deviasi	3,63	2,77	153.992.513.685
Minimum	6,90	1,03	6.064.106.000
Maximum	23,79	17,05	635.314.441.000

Source: Data processed by eviews 12

Village Fund Efficiency with Data Envelopment Analysis

This study assesses the efficiency of village funds in relation to poverty and unemployment levels utilizing data envelopment analysis tools. The findings presented in Table 1 indicate that only one district in Aceh, Bener Meriah, achieved an efficiency index of one during the research period. However, several districts and cities demonstrated efficiency in specific years. For instance, Simelue district exhibited efficiency in 2016, 2018, 2019, 2021, and 2023. Additionally, Aceh Singkil maintained efficiency from 2017 to 2023, while West Aceh and Southwest Aceh were efficient in 2022 and 2020, respectively. Gayo Lues demonstrated efficiency in the years 2016, 2017, 2019, 2020, 2021, 2022, and 2023. Sabang city attained efficiency in 2020, and Bireuen and Lhoksemawe cities achieved efficiency in 2016. Central Aceh was efficient in 2018, Pidie Jaya in 2015, West Aceh again in 2022, Aceh Jaya in 2015 and 2023, and Sabang in 2020. Lastly, Subulussalam city achieved efficiency in 2022. Throughout the remainder of the period from 2015 to 2023, the remaining districts and cities did not attain an index value of one; in other words, nine districts and cities in Aceh were deemed inefficient, specifically South Aceh, Southeast Aceh, East Aceh, Greater Aceh, Pidie, North Aceh, Aceh Tamiang, Banda Aceh, and Langsa.

TABLE 3

THE EFFICIENCY VALUE OF VILLAGE FUND

No	Region	2015	2016	2017	2018	2019	2020	2021	2022	2023
1.	SIMEULUE	0.125	1.000	0.333	1.000	1.000	0.200	1.000	0.333	1.000
2.	ACEH SINGKIL	0.143	0.143	1.000	1.000	1.000	1.000	1.000	1.000	1.000
3.	ACEH SELATAN	0.100	0.159	0.143	0.167	0.167	0.167	0.167	0.500	0.500
4.	ACEH TENGGARA	0.419	0.267	0.250	0.452	0.333	0.200	0.167	0.400	0.400
5.	ACEH TIMUR	0.183	0.125	0.125	0.300	0.143	0.143	0.143	0.464	0.250
6.	ACEH TENGAH	0.333	0.372	0.333	1.000	0.500	0.333	0.500	0.500	0.500
7.	ACEH BARAT	0.167	0.167	0.167	0.206	0.143	0.143	0.429	1.000	0.533
8.	ACEH BESAR	0.282	0.142	0.125	0.251	0.381	0.143	0.143	0.250	0.250
9.	PIDIE	0.100	0.125	0.143	0.711	0.167	0.333	0.143	0.400	0.400
10.	BIREUEN	0.091	1.000	0.250	0.467	0.333	0.250	0.250	0.500	0.500
11.	ACEH UTARA	0.059	0.082	0.091	0.131	0.125	0.125	0.125	0.286	0.286
12.	ACEH BARAT DAYA	0.091	0.250	0.333	0.333	0.250	1.000	0.250	0.500	0.500

13.	GAYO LUES	0.500	1.000	1.000	0.500	1.000	1.000	1.000	1.000	1.000
14.	ACEH TAMIANG	0.071	0.132	0.200	0.196	0.167	0.143	0.200	0.286	0.286
15.	NAGAN RAYA	0.333	0.200	0.250	1.000	0.867	0.200	0.250	0.400	0.400
16.	ACEH JAYA	1.000	0.143	0.167	0.267	0.250	0.250	0.333	0.667	1.000
17.	BENER MERIAH	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
18.	PIDIE JAYA	1.000	0.167	0.250	0.294	0.250	0.333	0.333	0.500	0.500
19.	BANDA ACEH	0.083	0.111	0.143	0.181	0.167	0.111	0.125	0.250	0.250
20.	SABANG	0.143	0.250	0.333	0.350	0.250	1.000	0.333	0.500	0.667
21.	LANGSA	0.125	0.125	0.143	0.516	0.143	0.111	0.681	0.286	0.286
22.	LHOKSEUMAWE	0.077	1.000	0.100	0.314	0.091	0.091	0.091	0.222	0.250
23.	SUBULUSSALAM	0.125	0.221	0.250	0.400	0.524	0.167	0.186	1.000	0.400
	Mean	0.285	0.356	0.310	0.480	0.402	0.367	0.385	0.532	0.529

Source: Data processed with DEAP 2.1

Overall, the average efficiency of village fund allocation in Aceh province is 52.9 percent. Table 3 also shows that on average in the period 2015 to 2023, there is no efficiency in the allocation of village funds in Aceh. This proves that the level of efficiency in each district/city in Aceh has different efficiency in the allocation of village funds. However, there are eleven districts/cities in Aceh that have a level of efficiency in that period, although not consecutively, except for Bener Meriah.

Additionally, testing with DEAP 2.1 software revealed that the Malmquist Index of Total Factor Productivity Change (TFPch) for village finances across 23 city districts between 2015 and 2023 was discovered, as well as its constituent components. TFPch consists of two components: changes in technical efficiency (Tech) and changes in efficiency (EFch). The findings of EFch will then be divided into two categories: pure efficiency change (PECH) and scale efficiency change (Sech). It is vital to note that a TFP index less than 1.000 implies a decrease in productivity levels, whilst a TFP index more than 1.000 suggests stability or a rise in village funds' productivity levels.

Total factor productivity of the village fund

TABLE 4

TOTAL FACTOR PRODUCTIVITY MALMQUIST INDEX OF THE VILLAGE FUND

No	DMU's	TFPch	EFFch	TEch	PEch	SEch
1.	SIMEULUE	1.158	1.194	0.970	1.297	0.921
2.	ACEH SINGKIL	1.092	1.154	0.946	1.275	0.905
3.	ACEH SELATAN	1.100	1.248	0.881	1.223	1.021
4.	ACEH TENGGARA	0.994	1.096	0.906	0.994	1.102
5.	ACEH TIMUR	0.995	1.102	0.903	1.039	1.061
6.	ACEH TENGAH	0.908	1.059	0.858	1.052	1.006
7.	ACEH BARAT	1.046	1.103	0.948	1.156	0.954
8.	ACEH BESAR	0.895	1.005	0.891	0.985	1.021
9.	PIDIE	1.095	1.203	0.910	1.189	1.011
10.	BIREUEN	1.185	1.231	0.963	1.238	0.995
11.	ACEH UTARA	1.133	1.230	0.922	1.218	1.009
12.	ACEH BARAT DAYA	1.086	1.247	0.871	1.238	1.008
13.	GAYO LUES	1.063	1.103	0.964	1.091	1.011
14.	ACEH TAMIANG	1.068	1.180	0.905	1.189	0.992
15.	NAGAN RAYA	0.964	1.034	0.932	1.023	1.010
16.	ACEH JAYA	0.974	1.109	0.879	1.000	1.109
17.	BENER MERIAH	0.844	1.000	0.844	1.000	1.000
18.	PIDIE JAYA	1.022	1.182	0.865	0.917	1.290
19.	BANDA ACEH	0.931	1.031	0.903	1.147	0.899
20.	SABANG	1.008	1.197	0.842	1.212	0.987
21.	LANGSA	0.971	1.082	0.897	1.109	0.976
22.	LHOKSEUMAWE	1.136	1.239	0.917	1.159	1.069
23.	SUBULUSSALAM	1.110	1.160	0.957	1.156	1.003
	Mean	1.030	1.136	0.907	1.122	1.013

Source: Data processed with DEAP 2.1

The results of the observation in table 4, the average TFP in the 2015-2023 period is 1,030, meaning that there is a trend of increasing the performance of village fund allocation in Aceh by 3.3%. Bireuen Regency is the district that received the highest TFP of 1,185 (18.5) and Bener Meriah is the district that has a low TFP value of 0.844 (-8.4%). Furthermore, there are 12 districts/cities in Aceh that get a TFP value above the average, namely Simeulue, Singkil, South Aceh, West Aceh, Pidie, Bireuen, North Aceh, Southwest Aceh, Gayo Lues, Tamiang, Lhoksemawe and Subulussalam. Meanwhile, the TFP value is below the average of 11 districts/cities, namely Southeast Aceh, East Aceh, Central Aceh, Aceh Besar, Nagan Raya, Aceh Jaya, Bener Meriah, Pidie Jaya, Banda Aceh, Sabang and Langsa.

In order to identify which elements of the TFP contribute to changes in the overall performance of village fund allocation, calculate the rate of change in Efficiency (EFch) and Technical Change (TEch). The

test findings also show that all EFch in all districts are trending positively. The greatest EFch score was recorded in Lhoksemawe City at 1,239 (23.9%), while the lowest was in Bener Meriah Regency at 1,000 (0%), indicating that this district's efficiency did not change.

For more information on the EFch sub-components [i.e., Pure Efficiency Change (PEch) or Scale Efficiency Change (SEch)] that contribute most to efficiency change, the findings of change in both pure and scale efficiency changes are provided here. According to the study, PEch and SEch increased EFch in Aceh village fund allocation by 12.2% and 1.3%, respectively. However, some districts/cities have both negative and positive PEch and SEch. Southeast Aceh, Aceh Besar, and Pidie Jaya are specific examples of negative Pech. At this point, eight districts/cities have negative SEch values, including Simeulue, Aceh Singkil, West Aceh, Bireuen, Aceh Tamiang, Banda Aceh, Sabang, and Langsa.

On the other hand, Technical Efficiency changes (TEch), there is not a single district/city that has a positive trend. Overall, the average TEch level in Aceh has a negative value of -9.3%. This means that the allocation of village funds in Aceh has deteriorated with a negative trend owned by technical efficiency change. The inability of village fund management to use and combine good inputs to produce maximum output is the main cause of low management of village

fund allocation in Aceh. Simeulue is the district that has the lowest negative trend value of 0.970 (3%). While the highest is found in Bener Meriah district with a value of 0.844 (15.6).

The results of the study prove that overall the allocation of village funds is not efficient. This is in line with several previous studies (Sari H & Sari MP, 2020), which examined the efficiency of village funds in Kuta Makmur Aceh Utara, out of the ten villages studied, only five were efficient in village fund allocation. Likewise with the research conducted (Muna & Juliansyah, 2019), the results of several villages tested only one obtained a score of 100% (efficient). The latest study conducted by (Putra & Maulidasari, 2019), found that out of 26 villages, only 46% have an efficient value of 1, the remaining 54% of villages are not efficient.

The results of the DEA analysis reveal notable variations in technical efficiency across villages, indicating that the ability to transform fiscal inputs into socioeconomic outcomes differs substantially across local contexts. While some villages demonstrate relatively high efficiency in converting village fund allocations into reductions in poverty and unemployment, others remain significantly below the efficiency frontier. This variation suggests that differences in managerial capacity, institutional arrangements, and local governance practices may play an important role in determining how effectively village funds are utilized. In particular, villages with stronger administrative coordination and participatory planning mechanisms tend to achieve higher efficiency scores, even when operating with similar levels of financial resources.

An interesting pattern emerges when technical efficiency trends are compared with total factor productivity (TFP). The analysis indicates that although technical efficiency in several villages has declined slightly over time, overall productivity has continued to increase. From an economic perspective, this pattern suggests that productivity improvements may be driven by structural or technological changes such as infrastructure expansion, improved market access, or broader macroeconomic growth rather than improvements in the efficiency of local resource management. In other words, villages may be benefiting from broader development dynamics while still facing limitations in administrative capacity and governance quality. This finding is consistent with the theoretical perspective of public sector efficiency, which emphasizes that improvements in output performance do not necessarily imply improvements in managerial efficiency.

The Impact of Village Funds on Poverty and Unemployment

Poverty and unemployment are economic problems. Based on data from the Central Statistics Agency (2024), the percentage of Indonesia's population reaches 9.03% of the 281.6 million population. In other words, 25.4 million Indonesians are in the poor category. On the other hand, the unemployment rate

reached 4.82%. This means that 13.5 million Indonesians do not have jobs. Various efforts will be made by a country and region to overcome these two problems. At the regional level, Aceh province is the first ranked area in the poverty and unemployment category for the island of Sumatra. The poverty rate reaches 14.23 percent and unemployment is 5.75 percent of Aceh's 5.55 million population (Central Statistics Agency, 2024).

Several policies will be carried out by a country or region in terms of reducing the rate and poverty and unemployment. One of the policies that can be done is to provide transfer funds to the regions such as the allocation of village funds. The village fund is a policy carried out by Since 2014, the Indonesian government has focused on addressing regional social gaps, including poverty and unemployment. The amount of village funding distributed by the government between 2015 and 2024 reaches IDR 608.9 trillion (Ministry of Villages and Disadvantaged Regions of the Republic of Indonesia, 2024). Bridges, irrigation, drainage, BUMDes, village markets, and other projects were developed with these funds.

TABLE 5

RESULTS OF THE INFLUENCE OF VILLAGE FUNDS ON POVERTY AND UNEMPLOYMENT

	Poverty	**Unemployment**
Constant	2,4335	2,2324
Coefiecient	0,4433**	-1,1174***
T-Stats	2,3854	-5,6092
P-Value	0,0270	0,0000
Adjust-R	0,1825	0,5919
Prob (F-stat)	0,0270	0,0000

Note: *** and ** indicate significance at the 1% and 5% levels.

The results of the test prove that village funds affect poverty and unemployment both partially. Village funds are an instrument provided by the central government to reduce economic inequality, especially in rural areas. Village funds can have a positive impact on development in rural areas (Phoek et al., 2024). In terms of poverty reduction policies in rural areas, village funds can have a positive impact (Amin et al., 2024; Aslan et al., 2019; Azhari et al., 2022; Kamila et al., 2021; Muhammad Dafnis Fazlur Rahman & Kharisma Khalida Arifin, 2022; Sutikno et al., 2024; H. Wahyudi & Khotimah, 2022; Zitri et al., 2020). In addition, village funds can also have a positive impact on human resource development (Handra, 2022; Sijabat, 2018).

Statistically, village funds are not significant to poverty (Hardianto, 2022). The results of this study also contrast with Setianingsih (2017) which examined the influence of village funds in Melawi Regency. Village funds have not been able to have a positive impact on reducing poverty rates. Village funds have no effect on poverty at the district/city level in Indonesia (Handra, 2022). This is due to the slow pace of the local government in socializing the use of village funds, so that the village head uses the budget not on target.

Similar to poverty, village funds can also reduce the unemployment rate in villages. This is in line with research conducted by Handra (2022) village funds disbursed by the government have been proven to have a positive impact on unemployment. The results of the study also revealed that an increase in village funds per capita by 1% can reduce the unemployment rate in Indonesia. However, the unemployment rate in each region is not the same, so the village funds provided can produce different unemployment rates (Kamila et al., 2021).

The management of village funds is still in dire need of improvement, because the weak human resources in rural areas are a problem in itself, such as limited managerial skills and poor financial governance (Yulandari et al., 2023). In addition, accountability and transparency in management are also very necessary (Setiyawati et al., 2023; Yoppy, Mina, Risno Fality, 2021). So that village funds can be used according to needs in order to improve the welfare of the village community.

The allocation of village funds should not only focus on infrastructure, so that village funds can be used for other budget structures such as renewable energy (Marianti et al., 2023). In addition, village funds can be allocated to village-owned enterprises (BUMDes), so that the original income of the village can increase with the existence of business units carried out by the village which ultimately reduces poverty and unemployment.

The regression results further clarify the relationship between village fund allocation and socioeconomic outcomes. The estimated coefficients indicate that higher levels of village fund allocation are associated with reductions in poverty and unemployment, although the magnitude of this relationship varies depending on local contextual factors. In particular, villages with higher levels of education, better infrastructure availability, and stronger administrative capacity tend to translate fiscal resources into

socioeconomic improvements more effectively. These results suggest that financial transfers alone are insufficient to guarantee development outcomes; rather, the effectiveness of fiscal decentralization depends critically on local governance capacity and institutional quality.

The results of this study show that the level of efficiency in the use of village funds varies significantly between regions. These differences can not only be explained through quantitative aspects such as the amount of funds received or the number of programs implemented, but also reflect the quality of governance and social dynamics at the local level. Villages that demonstrate high efficiency generally have better coordination mechanisms and citizen participation, despite having relatively limited resources in some cases. This finding confirms that efficiency is not solely dependent on large inputs but also on how funds are managed intelligently and collaboratively by local actors.

The implications of these results are dualistic, both theoretically and practically. Conceptually, the findings enrich the public sector efficiency framework by placing institutional capacity as a key component in the technical efficiency model. Meanwhile, practically, this study provides important input for policymakers to prioritize non-physical interventions such as training on village financial management, strengthening monitoring systems, and developing participatory planning capacity. Thus, this study not only strengthens the empirical evidence but also broadens the horizon of more adaptive and contextualized village development policies.

The findings of this study have significant social implications, especially in the context of village fund management and its impact on poverty and unemployment. The efficiency of the use of village funds is not only related to the allocation of resources, but also related to efforts to empower the community. By improving the efficiency of village funds, the villages involved can be more effective in creating programs that support community welfare, such as skills training, infrastructure development, and better social services. This underscores the importance of investing in local capacities to encourage community participation and improve socio-economic outcomes.

From an ethical perspective, village fund management also demands high transparency and accountability. This study highlights that helplessness and lack of access to information can be inhibiting factors in effective fund management. Therefore, it is important for the government and stakeholders to ensure that information regarding the allocation and use of village funds is available and accessible to all members of the community. This will not only increase public trust in the government, but also encourage their active involvement in supervision and decision-making related to the use of village funds.

Furthermore, the ethical implications of the use of village funds are also related to social justice. In the context of poverty alleviation and unemployment reduction, it is important to ensure that all levels of society, including vulnerable groups, benefit equally from the allocation of village funds.

4. Conclusions

The current research was successful in identifying and analyzing the efficiency with which village funds are used, as well as their influence on poverty and unemployment. A dual-method approach combining Data Envelopment Analysis (DEA) and linear regression revealed that the efficacy of village funds varied greatly among the districts/cities analyzed, with a handful of villages demonstrating substantial success in reducing poverty and unemployment. Based on the study's findings, some recommendations for further research and practice can be made. First, broadening the research to include new variables that can influence the efficiency of village funds, such as community engagement in decision-making, can improve understanding of the components that underpin management efficiency. Additionally, continuous study that tracks changes in efficiency over time in different villages can provide more information about the dynamics of village fund management and its impact on community welfare. Third, measures aimed at boosting education, infrastructure, and administrative ability at the village level are critical for increasing the efficiency with which local monies are spent. The government must encourage community participation in program planning and implementation to guarantee that the community's needs and aspirations are satisfied. Finally, collaboration between the government, researchers, and village residents must be strengthened to establish more sustainable and inclusive solutions for village fund management.

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