

An Analysis of Smallholder Farmers' Economic Efficiency and The Role of Zakat Management Organizations in Achieving SDG 1 in Kediri

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ABSTRACT

This study aims to analyze the level of economic efficiency among smallholder farmers and the role of Zakat Management Organizations (ZMOs) in supporting the achievement of SDG 1: No Poverty, in Kediri Regency. The research employs a mixed-method approach combining quantitative and qualitative analyses. The quantitative analysis uses the Data Envelopment Analysis (DEA) method with the Banxia Frontier Analysis (BFA) to measure the farmers' economic efficiency based on farm input-output data. Meanwhile, the qualitative analysis conducted through in-depth interviews with several ZMOs to explore their roles and contributions in poverty alleviation. The findings reveal that there are noticeable disparities in resource utilization among them. The main sources of inefficiency founded in the harvesting stage and the management of production cost. The programs of ZMOs aligns with the principles of Islamic economics in wealth redistribution and empowerment of vulnerable groups, directly supporting the realization of SDG 1: No Poverty. However, ZMOs have not yet targeted many smallholder farmers. ZMOs can play a vital role in improving farmers' welfare through both consumptive and productive programs, training, and community-based empowerment. ZMOs are expected to design productive farmer empowerment programs based on technical assistance, equipment, and financial support to enhance smallholder farmers' efficiency.

INTRODUCTION

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Farmers play an important role in supporting the Sustainable Development Goals (SDGs), particularly Goal 2, Zero Hunger, as they serve as the primary providers of food for society. However, at the same time, many farmers still live below the poverty line, making this issue directly relevant to Goal 1, No Poverty. According to data from the Statistics Indonesia (BPS), 51.33% of poor households in Indonesia rely on the agricultural sector as their main source of income ¹. This highlights that improving the welfare of farmers in Indonesia remains a significant challenge that requires serious attention from various stakeholders.

Although Indonesia is widely recognized as an agrarian country due to its extensive agricultural land, the majority of its farmers are smallholder farmers, defined as those who operate less than 0.5 hectares (5,000 m²) of agricultural land. According to data from the Statistics Indonesia (BPS) of Kediri Regency, there were 220,545 farmers utilizing agricultural land, of whom 193,713 (87.83%) were classified as smallholder farmers ². The large proportion of smallholder farmers, combined with the high number of farmers living below the poverty line, raises important questions regarding the economic efficiency of their agricultural activities.

Economic efficiency among smallholder farmers refers to the extent to which farmers are able to optimize the use of their limited resources to achieve maximum output. Given their limited landholdings, an important question arises as to whether the farming activities carried out by smallholder farmers are economically efficient or whether inefficiencies persist, contributing to their continued existence below the poverty line. If smallholder farmers are able to manage their farming operations efficiently, it is expected that production output and income can be maximized while minimizing resource waste.

The agricultural sector plays a highly strategic role in national economic development, as it is not only directly related to meeting society's food needs but also contributes significantly to gross domestic product (GDP) and serves as a major source of employment. More targeted approaches and research are needed to identify the level of efficiency and the factors contributing to inefficiency among smallholder farmers. Given that a large proportion of smallholder farmers live below the poverty line, support from various stakeholders is essential to ensure the sustainability of their livelihoods and the continued management of agricultural land. Without adequate attention and intervention, farming may become an increasingly unattractive profession, leading to a continued decline in agricultural land use. Such conditions could hinder the achievement of food self-sufficiency targets and, in the long term, threaten price stability and national food security. In other words, ensuring a

¹ A Alta, A A Zahra, and A N Fauzi, "Membantu Petani Keluar Dari Perangkap Kemiskinan Melalui Penghidupan Berkelanjutan," *Center for Indonesian Policy Studies*, no. 15 (2023).

² Badan Pusat Statistik Indonesia, "Hasil Pencacahan Lengkap Sensus Pertanian 2023," *Sensus Pertanian*, 2023, 28.

stable food supply while managing natural resources efficiently has become an increasingly important priority ³.

On the other hand, financial and social support are important factors in improving the efficiency and welfare of smallholder farmers. However, many smallholder farmers face difficulties in accessing formal financial institutions, primarily due to limited financial literacy and the high risks associated with agricultural activities, such as crop failure. In this context, Zakat Management Organizations (ZMOs) have the potential to provide direct support to smallholder farmers. Zakat has been shown to reduce both the number and proportion of poor households, as well as alleviate the depth and severity of poverty ⁴.

Zakat Management Organizations (ZMOs) are institutions that manage zakat, infaq, and sadaqah funds with the objective of improving the welfare of the communities they serve. Unlike conventional financial institutions, ZMOs provide assistance in the form of donations that do not require repayment. Such support has the potential to enhance both the consumption capacity and productivity of smallholder farmers, as their limited resources can be allocated more efficiently toward productive agricultural activities. The presence of ZMOs within or near smallholder farming communities raises an important question regarding the extent to which these institutions have contributed to helping smallholder farmers escape poverty. The role of ZMOs is inherently aligned with the Sustainable Development Goals (SDGs), particularly Goal 1, No Poverty. The distribution and utilization of zakat, infaq, and sadaqah (ZIS) play an important role in achieving the objective of poverty reduction ⁵.

Zakat Management Organizations (ZMOs) in Kediri Regency are distributed across nearly all sub-districts, indicating their broad potential reach in supporting community empowerment and poverty alleviation efforts. Despite this potential, limited research has specifically examined the contribution of ZMOs to improving the economic efficiency of smallholder farmers and reducing poverty among this group. Previous studies have generally focused on only one of these aspects, either the economic efficiency of farmers or the role of ZMOs in broader community empowerment initiatives. Several previous studies investigating economic efficiency among farmers ^{6; 7; 8; 9; 10; 11; 12; 13; 14}. Several studies have examined the

³ A. F. Ahmed and M. N. Abed, "Estimating the Sustainable Efficiency and Economic Efficiency of Vegetable Crop Growers in Baghdad Governorate," *IOP Conference Series: Earth and Environmental Science* 1262, no. 10 (2023), <https://doi.org/10.1088/1755-1315/1262/10/102015>.

⁴ Irfan Syauqi Beik, "Analisis Peran Zakat Dalam Mengurangi Kemiskinan : Studi Kasus Dompot Dhuafa Republika Analisis Peran Zakat Dalam Mengurangi Kemiskinan : Studi Kasus Dompot Dhuafa Republika," no. August (2015).

⁵ M Jaenudin and Sri Herianingrum, "JEBIS: Jurnal Ekonomi Dan Bisnis Islam ZAKAT , INFAQ , SADAQAH ON MUSTAHIK INCOME TO REALIZE NO POVERTY IN INDONESIAN ZAKAT INSTITUTION" 8, no. 1 (2022): 134–52, <https://doi.org/10.20473/jebis.v8i1.36360>.

⁶ C. D., Ogisi O'raye; Chukwuji Christopher, O.; Okeke Daniel, "Efficiency of Resource Use by Rice Farmers in Ebonyi State, South East Nigeria: A Data Envelopment Analysis," *Asian Journal of Agriculture and Rural Development* 2, no. 2 (2012): 149–54.

⁷ M. Saeri et al., "Technical Efficiency Analysis of Maize Farming in Wajak District, Malang Regency with Data Envelopment Analysis Approach," *IOP Conference Series: Earth and Environmental Science* 1107, no. 1 (2022), <https://doi.org/10.1088/1755-1315/1107/1/012030>.

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relationship between zakat and SDGs¹⁵; ¹⁶. However, empirical evidence regarding the contribution of Zakat Management Organizations (ZMOs) to improving the economic efficiency and welfare of smallholder farmers remains limited.

Smallholder farmers face various constraints that may lead to inefficiencies in their farming operations. Low economic efficiency can lead into reduced productivity and lower income, ultimately increasing the risk of poverty. In this context, Zakat Management Organizations (ZMOs) serve not only as institutions that distribute consumptive zakat but also as agents of economic empowerment through productive zakat programs. Productive zakat programs have a large potential to reduce poverty and enhance community development¹⁷; ¹⁸; ¹⁹; ²⁰. Support in the form of financial assistance, provision of agricultural inputs, capacity-building training, business mentoring, and improved market access enables smallholder farmers to allocate their resources more efficiently, thereby enhancing the economic efficiency of their farming activities.

⁸ Michel Mivumbi and Xiaoling Yuan, "Sustainable Environmental Economics in Farmers' Production Factors via Irrigation Resources Utilization Using Technical Efficiency and Allocative Efficiency," *Sustainability (Switzerland)* 15, no. 5 (2023), <https://doi.org/10.3390/su15054101>.

⁹ Ahmed and Abed, "Estimating the Sustainable Efficiency and Economic Efficiency of Vegetable Crop Growers in Baghdad Governorate."

¹⁰ R. Burhansyah et al., "Income, Risks, Economic Efficiency of Rice Business and Economic Sustainability for Rice Farmers in Sambas District," *IOP Conference Series: Earth and Environmental Science* 1188, no. 1 (2023), <https://doi.org/10.1088/1755-1315/1188/1/012029>.

¹¹ Ria Herlina et al., "Efficiency Analysis of Aromatic Ginger Farming (Kaempferia Galangal L.) in Kudus Regency, Indonesia Efficiency Analysis of Aromatic Ginger Farming (Kaempferia Galangal L.) in Kudus Regency, Indonesia," 2023, <https://doi.org/10.1088/1755-1315/1246/1/012035>.

¹² G. Arun Balaji et al., "Assessment of Economic Efficiency and Its Determents for Mixed Crop Livestock Production under Dryland Agriculture System in the Western Zone of Tamil Nadu, India," *Sustainability (Switzerland)* 15, no. 10 (2023): 1–22, <https://doi.org/10.3390/su15108332>.

¹³ Aswan Abdel Qader Zaidan, Amna Abdel Elah Hamdoun, and Ahmed Abdel Aziz Younis, "Measuring the Economic Efficiency and Total Productivity of Effective Inputs for Wheat Farms in Nineveh Governorate for the Agricultural Season (2019-2020)," *IOP Conference Series: Earth and Environmental Science* 1158, no. 9 (2023), <https://doi.org/10.1088/1755-1315/1158/9/092008>.

¹⁴ Shamima Sultana, Moyazzem Hossain Id, and Nurul Haque, "Estimating the Potato Farming Efficiency : A Comparative Study between Stochastic Frontier Analysis and Data Envelopment Analysis," 2023, 1–15, <https://doi.org/10.1371/journal.pone.0284391>.

¹⁵ Nurhamdah and M Arsyad S Sumai, A N Mutmainnah, "Role of Zakat in Poverty Reduction and Food Security," 2019, <https://doi.org/10.1088/1755-1315/343/1/012254>.

¹⁶ Imas Rosi Nugrahani, "Peran Zakat Produktif Dalam Pemberdayaan Ekonomi Mustahiq (Studi Kasus Lembaga Amil Zakat Dompot Dhuafa Republika Yogyakarta 2017)," 2019.

¹⁷ Riki Maulana et al., "Utilization Of Productive Zakat Through The Indonesian Primary Agroative Producers Cooperative (KPAPI) In The Development Of Horticulture Agriculture," *ASAS Jurnal Hukum Ekonomi Syariah*, 1979.

¹⁸ Badrus Sholeh et al., "The Role of Productive Zakat in the Development of MSMEs in Ngronggot District, Nganjuk Regency (Study on LAZISNU MWCNU Ngronggot)," *Creative Economics and Tourism And Halal Ecosystem (CETHE)* 04, no. 01 (2026): 9–16.

¹⁹ Alfina Fitriani et al., "THE ROLE OF ZAKAT IN REDUCING POVERTY AND IMPROVING," *International Journal of Economics Education Research (IJEER)* 6, no. 2 (2025): 35–42.

²⁰ Universitas Islam and Negeri Sunan, "Optimize Productive Zakat to Eradicate Poverty Rafli Mahbubi," *Bulletin of Islamic Economics* 2, no. 1 (2023): 7–11.

Improved economic efficiency subsequently leads to higher productivity and increased farm income. When these interventions are implemented through ZMO-led productive zakat programs, their impact extends beyond improving the welfare of mustahik (zakat beneficiaries) to contributing to the achievement of Sustainable Development Goal 1 (No Poverty). It's because zakat has functioned not only as a mechanism for wealth redistribution but also as a sustainable instrument for economic empowerment that supports long-term poverty reduction.

Therefore, this study aims to examine the economic efficiency of smallholder farmers and the role of Zakat Management Organizations (ZMOs) in poverty alleviation in Kediri Regency within the framework of Sustainable Development Goal (SDG) 1, No Poverty. This approach is expected to contribute both theoretically and practically to the development of inclusive and sustainable agricultural development strategies that are aligned with the principles of Islamic economics. Based on the background discussed above, this study seeks to address the following research questions: (1) What is the level of economic efficiency of smallholder farming in Kediri Regency? (2) What role do Zakat Management Organizations play in poverty alleviation efforts in Kediri Regency? and (3) How do Zakat Management Organizations contribute to the achievement of Sustainable Development Goal especially (SDG) 1 No Poverty among smallholder farmers?.

METHODS

This study employed a mixed-methods approach. The quantitative method was used to obtain a measurable and objective assessment of the economic efficiency of smallholder farming. Meanwhile, the exploratory qualitative method was employed to gain an in-depth understanding of the conditions faced by smallholder farmers, the role of Zakat Management Organizations (ZMOs) in poverty alleviation, and their contribution to the achievement of Sustainable Development Goal (SDG) 1, No Poverty.

This study was conducted in Kediri Regency, East Java Province, through several stages, including preliminary observation, secondary data collection, primary data collection through interviews, data processing, data analysis, and report preparation. During the primary data collection process, in-depth interviews were conducted with smallholder farmers from several sub-districts in Kediri Regency, namely Pare, Wates, Kepung, Papar, Pagu, Plemahan, Semen, Ngadiluwih, Ringinrejo, Kayen Kidul, Kras, Gampengrejo, Kandat, Gurah, Grogol, Tarokan, Ngancar, Purwoasri, and Ngasem. As a result, a total of 14 smallholder farmers were selected as research participants. In-depth interviews were also conducted with representatives of Zakat Management Organizations (ZMOs) operating in Kediri Regency, including BAZNAS Kediri Regency, Lazismu Kediri Regency, LAZIS Al Haromain Kediri Regency, and Lembaga Manajemen Infaq (LMI) Kediri Regency.

Field observations and document analysis were conducted to obtain a direct understanding of the social and economic conditions of smallholder farmers. The combination of these techniques was intended to generate comprehensive and complementary data from both quantitative and qualitative perspectives, enabling a more

objective and in-depth analysis of the research problem. Economic efficiency was measured using Data Envelopment Analysis (DEA). The output variable in this study was the total value of agricultural production, calculated as the quantity of harvested output multiplied by its selling price. The input variable was the total production cost incurred throughout the farming cycle, from planting to harvesting. Efficiency analysis was performed using Banxia Frontier Analysis (BFA) software.

An input-oriented DEA model was employed because the selling price of agricultural products is largely determined by market conditions, limiting farmers' ability to influence output prices. In other words, farmers have greater control over the use of production inputs than over the prices of their outputs. Furthermore, all respondents were classified as smallholder farmers operating on a relatively small scale. Therefore, the efficiency analysis was conducted under the assumption of Constant Returns to Scale (CRS).

In this study, the sample was divided into two groups for the purpose of DEA analysis. The first group consisted of farmers who incurred costs for all input components. The second group consisted of farmers who reported zero expenditure on certain input components, such as labor during cultivation or harvesting activities, because these activities were carried out by family members or because harvesting costs were covered by produce collectors. This classification was necessary to facilitate data processing using Data Envelopment Analysis (DEA). For input variables that were reported as having zero cost, a minimum substitution value of IDR 1,000 was assigned to enable data processing in Banxia Frontier Analysis (BFA) software while minimizing distortions to the overall cost structure.

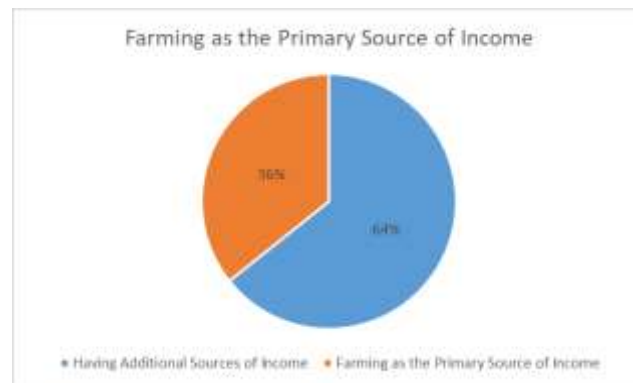
Qualitative descriptive analysis, consisting of data reduction, data display, and conclusion drawing, was employed to address the second and third research questions concerning the role of Zakat Management Organizations (ZMOs) in poverty alleviation and their contribution to the achievement of Sustainable Development Goal (SDG) 1, No Poverty. To enhance the validity of the findings, all data were analyzed using source triangulation. The results of the quantitative and qualitative analyses were subsequently integrated in the discussion section to provide a comprehensive understanding of the economic efficiency of smallholder farming, the role of Zakat Management Organizations in poverty alleviation efforts, and their contribution to achieving SDG 1 (No Poverty) among smallholder farmers.

RESULT AND DISCUSSION

Based on the interview results, most of the smallholder farmers included in this study were still within the productive age range and physically capable of managing agricultural land. Nevertheless, concerns regarding farmer regeneration remain, as only a limited number of respondents were young farmers. The size of landholdings varied considerably, ranging from 100 m² to 4,900 m². This distribution indicates that the majority of respondents belonged to the smallholder farmer category, which is generally characterized by limited production scale and restricted access to economies of scale. Furthermore, not all respondents relied on farming as their primary source of income. The characteristics of the respondents are presented in the following figure.

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Figure 1
Respondents' Main Sources of Income



Source: Interview Data (Processed by the Authors)

As shown in the figure above, 35.7% of the respondents relied on farming as their primary source of income, while the remaining 64.3% were engaged in other economic activities. These non-agricultural occupations varied considerably, including trade-related activities (such as operating small retail shops, selling vegetables, and running small businesses), service activities (such as electrical and water pump installation), handicraft production (such as palm sugar production), and livestock farming (including cattle, poultry, and goat raising). These supplementary activities were generally small-scale and household-based. This finding indicates that most smallholder farmers in the study area depend on multiple sources of income to sustain their household livelihoods and maintain economic resilience.

The respondents' farming experience varied considerably, ranging from 10 years to more than 30 years. Interestingly, several respondents reported that they had been involved in farming since childhood or had inherited farming activities from previous generations, even though farming was no longer their primary source of income. This finding reflects a shift in the occupational orientation of smallholder farmers, from a traditional reliance on agriculture toward a more diversified livelihood strategy in response to available economic opportunities.

None of the respondents maintained written financial records of their farming activities. However, with the assistance of a structured interview guide provided by the researcher, they were able to recall and describe the input and output components of their farming operations in considerable detail. This finding highlights an important challenge related to financial literacy and farm record-keeping practices among smallholder farmers.

Efficiency Analysis Results

The results of the efficiency analysis for Group I and Group II are presented as follows:

a. Group I

Figure 2

Efficiency Scores of Group I

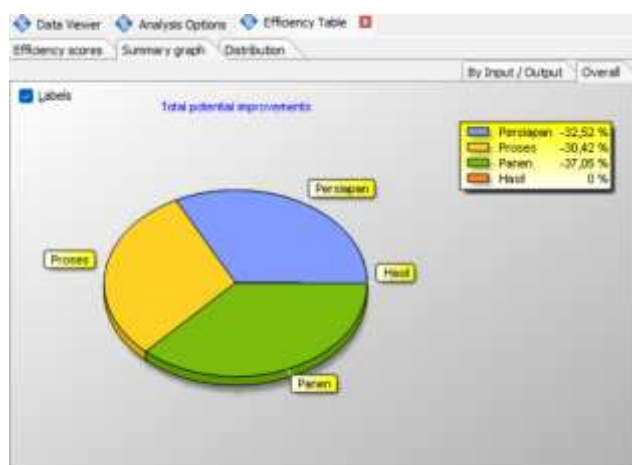
Unit name	Score	Efficient	Condition
Petani BT Guruh	90.7%		
Petani D Kandat	78.4%		
Petani IM Tarolan	38.5%		
Petani JS Senen	100.0%	✓	
Petani J Purwohari	100.0%	✓	
Petani Ju Kandat	76.9%		
Petani MH Wates	100.0%	✓	
Petani N Grogol	100.0%	✓	
Petani Sun Ngadluh	72.7%		

Source: Interview Data (Processed by the Authors)

The efficiency score indicates the extent to which farmers utilize production inputs (preparation, cultivation, and harvesting costs) to generate output, measured by the value of harvested crops. As shown in Figure 2, only four farmers achieved full efficiency (100%). The lowest efficiency score was 38.5%, while the highest score among the inefficient farmers was 90.7%, indicating substantial variation in resource utilization across farmers.

From an economic efficiency perspective, improvement efforts for inefficient farmers should focus on reducing unnecessary costs during the preparation, cultivation, and harvesting stages without compromising output levels. This would enable farmers to achieve a more optimal allocation of resources while maintaining agricultural productivity.

Figure 3
Total Potential Improvement of Group I



Source: Interview Data (Processed by the Authors)

The Total Potential Improvements diagram presented in Figure 3 illustrates the proportion of potential cost savings across the three main input components of farming activities: preparation, cultivation, and harvesting. The percentage associated with each component represents the average potential cost reduction that farmers could achieve in order to reach full efficiency (100%) without reducing output levels.

The results indicate that:

1. Harvesting has the greatest improvement potential, accounting for 37.05% of total inefficiency. This suggests that harvesting-related costs, including labor, transportation, and post-harvest handling, offer the largest opportunity for cost reduction and efficiency enhancement.
2. Preparation ranks second, with a potential cost reduction of 32.52%. This stage includes activities such as land preparation, seed procurement, and the application of basic fertilizers.
3. Cultivation has a potential improvement of 30.42%. This component includes crop maintenance activities such as fertilizer application, pest control, and irrigation.
4. Output shows 0% potential improvement, which is consistent with the input-oriented DEA model employed in this study. Under this approach, output levels are held constant while efficiency gains are achieved through reductions in input use.

These findings suggest that the harvesting stage should be prioritized in efforts to improve farming efficiency for group I, as it contributes the largest share of inefficiency relative to the preparation and cultivation stages. Interventions such as optimizing harvest labor utilization, adopting more efficient harvesting equipment, and improving transportation planning for harvested products may generate substantial efficiency gains

Figure 4
Distribution of Scores of Group 1



Source: Interview Data (Processed by the Authors)

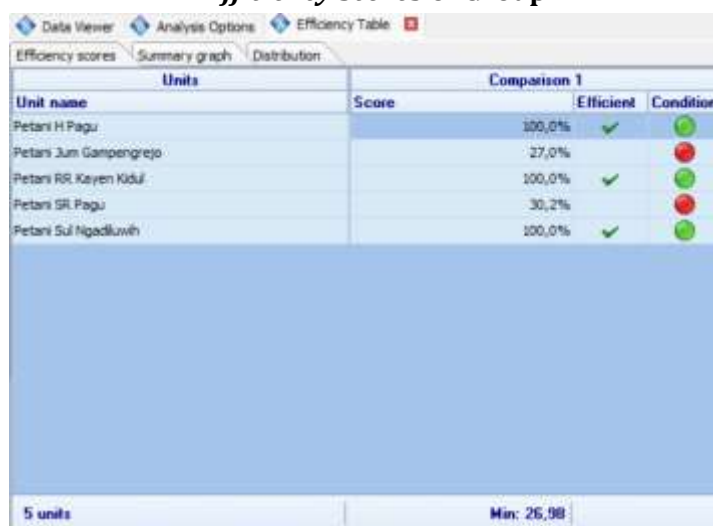
The distribution of efficiency scores for farmers in Group I is presented in Figure 4. In general, the results show that (1) Four farmers (40% of the total sample) achieved efficiency scores within the range of 91–99.9 (green category), indicating that they were operating close to full efficiency. (2) One farmer (10%) obtained an efficiency score within the range of 81–90 (yellow category), suggesting a relatively high level of efficiency with some room for improvement. (3) Three farmers (30%) fell within the range of 71–80 (red category), indicating a moderate level of efficiency and the need for significant improvement efforts. (4) One farmer (10%) recorded an efficiency score within the range of 31–40 (red category), reflecting a low level of efficiency and the greatest potential for improvement. (5) No farmers were found within the efficiency ranges of 0–30 or 51–70.

Overall, the findings indicate that a substantial proportion of farmers have already achieved relatively high levels of efficiency. However, a significant number remain in the lower efficiency categories and require further attention. Interventions such as technical assistance, cost-management training, and the adoption of more efficient farming technologies may help reduce input use without compromising output levels. Farmers with the lowest efficiency scores should be prioritized in future improvement programs due to their greater potential for efficiency gains.

b. Group II

Figure 5 illustrates the relative efficiency scores of the five sampled farmers. Efficiency is measured as a percentage, where a score of 100% represents full efficiency. As shown in Figure 5, three farmers achieved full economic efficiency, indicating that they utilized their production inputs optimally relative to the observed output.

Figure 5
Efficiency Scores of Group II



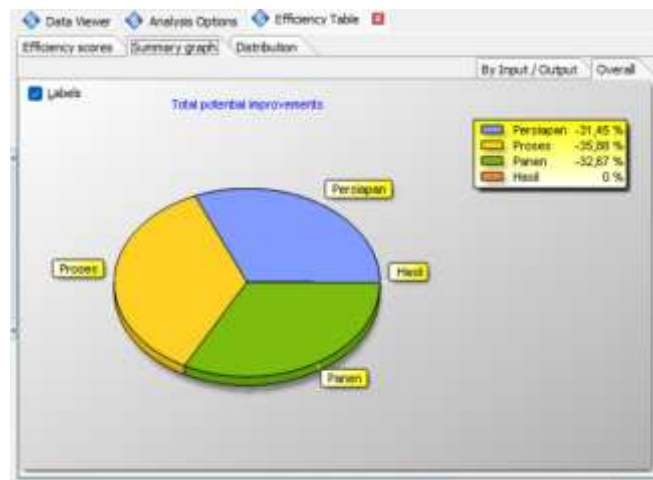
Unit name	Score	Comparison 1	Efficient	Condition
Petani H Pagu	100,0%		✓	●
Petani Jum Gampengrejo	27,0%			●
Petani RR Kayen Kidul	100,0%		✓	●
Petani SR Pagu	30,2%			●
Petani Sul Ngadluwih	100,0%		✓	●

5 units Min: 26,98

Source: Interview Data (Processed by the Authors)

In contrast, two farmers recorded efficiency scores substantially below 100% (26.98% and 30.2%), suggesting considerable potential for improvement through more efficient input utilization, the adoption of appropriate technologies, and improvements in production practices. The lowest efficiency score observed was 26.98%, highlighting a substantial efficiency gap among the sampled farmers. This variation suggests that while some farmers have successfully optimized their resource allocation, others still face significant inefficiencies in their farming operations.

Figure 6
Total Potential Improvements of Group II



Source: Interview Data (Processed by the Authors)

Figure 6 illustrates the proportion of potential improvements across the different stages of the farming production process. The results indicate the following:

1. **Cultivation Process:** This stage has the highest potential for improvement, accounting for 35.88% of total inefficiency. This finding suggests that activities related to crop management, such as fertilization, pest control, irrigation, and general crop maintenance, may involve inefficient input utilization and therefore offer substantial opportunities for efficiency gains.
2. **Harvesting:** The harvesting stage shows a potential improvement of 32.67%. This stage includes labor use, harvesting equipment, and harvesting methods that could be optimized to reduce costs without compromising output quality.
3. **Preparation:** The preparation stage accounts for 31.45% of potential improvement. This component includes activities such as land preparation, seed procurement, and the preparation of production inputs. More efficient management at this stage could contribute to reducing unnecessary input use.
4. **Output:** No potential improvement was identified for output (0%), indicating that output levels were already optimal relative to the inputs utilized.

These findings suggest that economic efficiency in smallholder farming is primarily influenced by the optimization of input use during the cultivation, harvesting, and

preparation stages. The DEA results indicate that inefficiencies originate mainly from excessive input utilization rather than insufficient output production. Therefore, for group II strategies aimed at improving efficiency should focus on reducing unnecessary input use across these three production stages especially in cultivation process while maintaining existing output levels. This finding is consistent with the research data, which indicate that 80% of the farmers in Group II did not incur harvesting costs because harvesting activities were managed by produce collectors, who also covered the associated harvesting expenses.

Figure 7
Distribution of Scores of Group II



Source: Interview Data (Processed by the Authors)

Figure 7 presents the distribution of efficiency scores among farmers in Group II. The results indicate that:

- 1) Three farmers (60%) achieved efficiency scores within the range of 91–99.9 (green category). This finding suggests that the majority of farmers in Group II were operating close to full efficiency.
- 2) Two farmers (40%) recorded efficiency scores within the range of 31–40 (red category). This indicates a relatively low level of efficiency and suggests that substantial improvements are needed in input management and resource allocation. These farmers may benefit from targeted interventions aimed at reducing input inefficiencies while maintaining or improving output levels.
- 3) No farmers were found within the efficiency ranges of 0–30, 41–90, or 100.

The distribution reveals a considerable disparity in efficiency levels within the group. While the majority of farmers were operating near the efficiency frontier, a smaller group remained substantially less efficient. Consequently, targeted intervention strategies are required to address these differences. Farmers with lower efficiency scores should be prioritized for support programs, including technical training, farm cost management assistance, access to appropriate technologies, and more intensive extension services.

The results of the Data Envelopment Analysis (DEA) indicate that, although all respondents were classified as smallholder farmers, there were notable differences in their ability to manage agricultural land and production resources efficiently. This finding is particularly concerning because smallholder farmers, who already face constraints in terms of land ownership and production scale, are more vulnerable to economic losses when resources are not utilized efficiently. Therefore, it is important to further examine the factors that contribute to inefficiency among certain smallholder farmers.

The results of the potential improvement analysis reveal that the preparation, cultivation, and harvesting stages contributed relatively similar proportions to overall inefficiency. This suggests that inefficiencies are not concentrated in a single stage of the farming process but are distributed throughout the production cycle. Consequently, efforts to improve the economic efficiency of smallholder farmers should adopt a comprehensive approach that addresses all stages of farming activities, from land preparation and crop management to harvesting practices.

Farmers with relatively larger plots of land have the potential for greater output, but they are not always more efficient if input costs are not well managed. When looking at land area, it can be seen that the entire sample consists of small-scale farmers, but efficiency levels show varying results. This means that small-scale farmers with larger plots of land are not always more efficient than small-scale farmers with smaller plots. This aligns with research.²¹ that found that farm size is negatively related and has no significant effect on resource efficiency. The study also stated that education level, farming experience, and extension worker visits had a significant influence on the level of efficiency of rice farmers.²² also showed that the level of farmer education has a positive and significant effect on the level of technical efficiency.

In this study, farming experience did not show significant differences. The smallholder farmers sampled in this study all had more than ten years of farming experience. Further research should incorporate education and extension variables to provide a more comprehensive picture. Furthermore, these results provide input for the local government and related institutions, highlighting the urgent need for extension services and capacity building for smallholder farmers in Kediri Regency. Improving extension services and farmer awareness can reduce waste of productive resources used in farming.²³

Differences in efficiency levels between farmers can be influenced by several factors, such as land area, capital and production costs, experience, financial literacy, and job diversification. Larger plots are more economical because farmers can more easily implement

²¹ D., Ogisi O'raye; Chukwuji Christopher, O.; Okeke Daniel, "Efficiency of Resource Use by Rice Farmers in Ebonyi State, South East Nigeria: A Data Envelopment Analysis."

²² Saeri et al., "Technical Efficiency Analysis of Maize Farming in Wajak District, Malang Regency with Data Envelopment Analysis Approach."

²³ Zaidan, Hamdoun, and Younis, "Measuring the Economic Efficiency and Total Productivity of Effective Inputs for Wheat Farms in Nineveh Governorate for the Agricultural Season (2019-2020)."

modern technologies such as tractors and better irrigation management ²⁴. Farmers with relatively larger plots of land have the potential for greater output, but they are not necessarily more efficient if input costs are not well managed. As previously explained, land size has been shown not to be a significant factor in differentiating efficiency between farmers, as the entire sample in this study consisted of smallholder farmers and exhibited varying levels of efficiency.

²⁵ found that capital input, farmer education level, marketing channels, brand registration, and access to financial credit positively impacted the efficiency of family farming businesses. The DEA test results showed that the greatest waste occurred during the harvest and processing stages, particularly labor costs and harvest transportation. This is unfortunate for smallholder farmers with limited capital who, if inefficient in running their farming businesses, could potentially incur losses instead of profit. Farmer education level was not examined in this study, so it is a note for future research to examine farmer education levels.

On the other hand, this study found that 85% of the farmers sampled in this study sell their crops directly to collectors. Of the 14 farmers, 12 sell their crops to collectors, one partnered with a seed supplier, and one sold through both collectors and his own grocery store. This indicates that smallholder farmers have very low bargaining power.

When smallholder farmers sell their crops directly to collectors, their potential profits can be reduced. Smallholder farmers' decisions to sell their crops directly to collectors can be driven by limited capital and a desire to reduce harvesting and distribution costs. However, this situation actually gives collectors a stronger bargaining position because they lack alternative marketing channels.

This can be worse if farmers' dependence on collectors often stems from the need for business capital, where farmers borrow funds from middlemen who also become buyers of their harvest ²⁶. Although this study did not examine deeply in the capital aspect, the findings strengthen the suspicion that limited capital and weak access to formal financial institutions weaken the bargaining position of smallholder farmers in the agricultural product marketing chain.

Thus, improving marketing channels for smallholder farmers is urgently needed. Both conventional and digital marketing training should be provided to smallholder farmers to improve their bargaining position in the market. However, if cost is the reason they sell to middlemen, access to capital that favors smallholder farmers is necessary. Further research can be directed at improving marketing skills and access to capital for smallholder farmers.

²⁴ Sultana, Id, and Haque, "Estimating the Potato Farming Efficiency: A Comparative Study between Stochastic Frontier Analysis and Data Envelopment Analysis."

²⁵ Zhigang Chen et al., "The Analysis of Family Farm Efficiency and Its Influencing Factors: Evidence from Rural China," *Land* 11, no. 4 (2022): 1–20, <https://doi.org/10.3390/land11040487>.

²⁶ Vina Septiana Permatasari, "Enhancing Farmer's Independence by Baitul Maal Wat Tamwil Concept" 98, no. Icpsuas 2017 (2018): 281–84, <https://doi.org/10.2991/icpsuas-17.2018.59>.

Furthermore,^{27 28} also stated that fertilizer use has a positive effect on the efficiency of family farming businesses. Based on interviews with smallholder farmers in this study, fertilizer is one of the main obstacles in their farming operations. 42% of the sample reported difficulty accessing subsidized fertilizer, which increased their production costs. 42% of the sampled farmers also stated that they experienced difficulties dealing with pests. 64% of the sample also expressed the hope that the government would provide easier access to fertilizer assistance. Of the various important agricultural inputs, the contribution of fertilizer to agricultural production cannot be ignored²⁹.

Fertilizer assistance is expected to reduce the burden of production costs borne by farmers. Therefore, increasing economic efficiency can be achieved through improved management and more appropriate input allocation, taking into account input prices, to minimize production costs³⁰. With these steps, government support in providing fertilizer remains an important factor in maintaining the sustainability of farmers' businesses.

Longer farming experience can improve farmers' practical knowledge in land management, fertilizer use, and pest control. However, research shows that farming experience does not always correlate with economic efficiency. Some farmers with 20–33 years of experience have not yet achieved optimal efficiency, while farmers with 10–16 years of experience are classified as efficient or nearly efficient.

These findings indicate that length of farming experience is not the sole factor determining efficiency. Experience that is not accompanied by innovation and knowledge updates has the potential to lead to stagnation in cultivation practices. Furthermore, age can influence adaptability to technology and changes in the farming environment.

Conversely, farmers with 10–20 years of experience, who are generally of productive age, tend to be more open to innovation, have easier access to modern agricultural information, and have better managerial skills in managing production costs. Therefore, economic efficiency is determined more by farmers' ability to adaptively utilize experience than by length of experience itself.

These research results indicate that farming experience will have a positive impact on efficiency when accompanied by continuous learning and adaptability. Thus, efforts to increase efficiency need to be focused on strengthening the capacity for adaptation and innovation, both for young and senior farmers.

Financial literacy plays a significant role in the economic efficiency of farmers. Field findings indicate that all respondents lack written financial records for their farming activities. As a result, farmers find it difficult to evaluate their cost structure and profits. This often leads to irrational allocation of funds, such as excessive input purchases or unplanned

²⁷ Chen et al., "The Analysis of Family Farm Efficiency and Its Influencing Factors: Evidence from Rural China."

²⁸ Chen et al.

²⁹ Balaji et al., "Assessment of Economic Efficiency and Its Determents for Mixed Crop Livestock Production under Dryland Agriculture System in the Western Zone of Tamil Nadu, India."

³⁰ Burhansyah et al., "Income, Risks, Economic Efficiency of Rice Business and Economic Sustainability for Rice Farmers in Sambas District."

expenses. Farmers with better financial awareness, even through simple record-keeping, can utilize capital more efficiently. Training to improve financial literacy among smallholder farmers is essential to support economic efficiency and farm sustainability.

More specifically, improving farmers' financial literacy can bolster their financial management skills, such as cash flow recording, budget planning, and production cost control. Furthermore, improved financial literacy can support more rational economic decision-making, provide access to safe and risk-adjusted financial institutions, and enhance farmers' economic resilience.

Job diversification is a common adaptive strategy employed by smallholder farmers in this study to address uncertainty and high risks in the agricultural sector. This strategy aims to maintain economic stability when agricultural yields decline due to external factors such as fertilizer scarcity and high costs, pest attacks, water or irrigation difficulties, increased dependence on water pumps, excessive rainfall, and extreme weather conditions such as strong winds. Furthermore, fluctuating market prices and limited access to subsidized fertilizer exacerbate farmers' income uncertainty.

This situation makes agriculture a high-risk sector and offers little guarantee of economic sustainability for smallholder farming families. In this context, job diversification presents a structural dilemma. On the one hand, non-agricultural activities such as trading, raising livestock, or running a grocery store provide an economic safety net. However, they simultaneously divert farmers' attention and energy from farming activities, reducing their economic efficiency. This phenomenon was evident in one respondent who owned a grocery store. He did have additional distribution channels beyond collectors, but the DEA test results showed low farm efficiency. On the other hand, farmers with other activities, such as livestock farming, achieved 100% efficiency. This aligns with research ³¹ which found that family farming (breeding) had the highest efficiency.

The diversification strategy employed is not actually a sign of farmers' lack of commitment to farming, but rather a reflection of economic rationality in the face of risk and an effort to maintain the sustainability of family income through alternative sources. Thus, income diversification can be seen as a form of risk management by farming households, not a direct cause of low efficiency, but rather a consequence of structural uncertainty in the agricultural sector.

The findings of this study align with ³² and ³³, which explain that rural households tend to diversify their income as an adaptive strategy to address economic uncertainty, resource constraints, and environmental risks. In the long term, improving the efficiency of smallholder farmers requires external support. Access to subsidized fertilizer, integrated pest

³¹ Chen et al., "The Analysis of Family Farm Efficiency and Its Influencing Factors: Evidence from Rural China."

³² Frank Ellis, "The Determinants of Rural Livelihood Diversification in Developing Countries," *Journal of Agricultural Economics* 51, no. 2 (2008): 289–302.

³³ C.B Barrett and P Webb , T Reardon, "Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications," *Food Policy* 26, no. 4 (2001): 315–31.

control, improved irrigation systems, and guaranteed crop prices can reduce the pressure of agricultural risks. If these conditions are met, diversification can shift from a survival strategy to a household economic strengthening strategy that complements the agricultural and non-agricultural sectors.

The results of this study have important implications for efforts to improve the efficiency of smallholder farming. Technical and managerial assistance, as well as more in-depth research, are needed, particularly in the farming process, including harvesting, which is the source of the greatest waste. The preparation process also exhibits similar levels of waste. Simple marketing and financial literacy training, such as input-output recording, can help farmers identify inefficient sources of costs and improve their bargaining power in the market. Furthermore, access to cost-effective agricultural technology and the use of modern harvesting tools can increase productivity while reducing expenses. Developing farmer groups is also an effective strategy for farmers to share best practices and strengthen their bargaining position.

The government needs to ensure more equitable access to subsidized fertilizer and irrigation channels, as research shows these are the main obstacles faced by many smallholder farmers. This is crucial because productivity is influenced by the use of water resources ³⁴.

On the other hand, programs in zakat management organizations can be directed to assist smallholder farmers who are struggling to run their businesses, for example through agricultural capital assistance, agricultural tools and technology that can be used collectively in farmer groups, mentoring, and training that supports Sustainable Development Goals (No Poverty) for smallholder farmers. Sustainable efficiency needs to be a concern for various parties because it is a good and effective tool not only for evaluating the performance of farming businesses, but also for increasing the sustainability of input use and improving the added value or value of agricultural production ³⁵.

Zakat Management Organizations in Kediri Regency run various programs that, although not specifically mentioned, strongly support the realization of the SDGs. BAZNAS Kediri Regency operates five program pillars. Lazismu Kediri Regency runs three program segments. Lazis Al Haromain focuses on seven main programs. Lembaga Manajemen Infaq (LMI) of Kediri Regency has four main programs. A comprehensive list of these programs and their support for the SDGs can be found in Appendix 1.

Interviews revealed that Lembaga Manajemen Infaq (LMI) is a zakat management organization that has a program that specifically targets farmers. The assistance provided included the free provision of plant seedlings and catfish fingerlings. However, limited collaboration with local governments and educational institutions has limited the scale of its

³⁴ Mivumbi and Yuan, "Sustainable Environmental Economics in Farmers' Production Factors via Irrigation Resources Utilization Using Technical Efficiency and Allocative Efficiency."

³⁵ Ahmed and Abed, "Estimating the Sustainable Efficiency and Economic Efficiency of Vegetable Crop Growers in Baghdad Governorate."

impact. For smallholder farmers, assistance in the form of seeds, fertilizer, or basic agricultural equipment can be a starting point for maintaining business sustainability.

This program is aligned with Sustainable Development Goal (SDG) 1 (No Poverty), which emphasizes the importance of eradicating poverty in all its forms through the economic empowerment of vulnerable groups. Therefore, the initiative undertaken by LMI Kediri Regency can be regarded as an example of Islamic philanthropy oriented toward enhancing farmers' economic self-reliance, while also demonstrating that even simple social interventions can contribute directly to the achievement of sustainable development goals.

Overall, the role of zakat management organizations in Kediri Regency in contributing to the achievement of Sustainable Development Goal (SDG) 1 (No Poverty) can be categorized into three dimensions: (1) a consumptive role, through food assistance, educational scholarships, and healthcare support; (2) a productive role, through programs focused on micro, small, and medium enterprises (MSMEs), agriculture, and livestock farming; and (3) a transformative role, aimed at enabling mustahik (zakat beneficiaries) to eventually become muzakki (zakat payers). However, the specific contribution to smallholder farmers remains relatively limited compared to other community groups. Therefore, targeted strategies are needed to ensure that smallholder farmers are more effectively integrated into empowerment programs.

Consumptive assistance given by zakat management organizations (ZMOs) serves as a social safety net. At the same time, ZMOs are supporting long-term economic independence. If implemented consistently, this program can drive the transformation of mustahik into muzakki, which is the ideal purpose of Islamic philanthropy. Collaboration between ZMOs and institutions such as local governments, local communities, and sharia financial institutions is an important factor in supporting the achievement of SDGs.

Thus, this study shows that the agricultural efficiency of smallholder farmers in Kediri Regency still faces significant challenges, especially regarding land management, cost, and the low financial literacy. On the other hand, zakat management organizations (ZMOs) play a significant role in social and economic support, even though their direct contribution to smallholder farmers is still limited. Zakat management organizations' programs are proven relevant to SDGs achievement, especially SDG 1 (No Poverty), but they remain predominantly focused on short-term approaches (charity) rather than long-term ones (empowerment). Therefore, a stronger synergy is needed between enhancing smallholder farming efficiency and the use of productive zakat, infaq, and shadaqah, so that the goals of poverty alleviation can be sustainably achieved.

CONCLUSION

The DEA analysis shows that the economic efficiency of smallholder farmers in Kediri Regency still varies due to differences in managerial abilities, technical skills, cost management, input access, financial literacy, and dependence on middlemen. The farming stage with the greatest potential for improvement is harvesting, processing, and preparation, offering cost-saving opportunities of over 30%. Zakat management organizations have contributed to SDG 1 through consumptive aid and productive programs; however, their

direct involvement with smallholder farmers remains limited, necessitating collaborative strategies to reach the agricultural sector more broadly and sustainably.

Capacity building for farmers needs to focus on business management, financial record-keeping, agricultural extension, cultivation training, marketing, and business diversification that continues to support the agricultural sector. Local governments should strengthen access to fertilizer, irrigation, capital, financial literacy, and partnerships with Islamic financial institutions, as well as reinforce farmer group institutions. Zakat management organizations can expand productive zakat for farmers through capital assistance, shared agricultural tools, training, and long-term mentoring to drive the transformation of mustahik (zakat recipients) into muzakki (zakat payers). Collaboration among zakat management organizations, government, universities, and Islamic financial institutions must be strengthened to create integrated empowerment programs.

Future research could expand the scope of farmers, focus on specific commodities, and examine the role of zakat management organizations alongside the relationship between productive zakat and farmers' economic efficiency. Community participation as donors and volunteers is also crucial to strengthening the sustainability of zakat-based empowerment programs for smallholder farmers.

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