

The Impact of Zakat, Agricultural Output, and Poverty on Indonesia's Food Security

Adzkia Amatullah Salsabila¹, Aas Nurasyiah^{2*}, Firmansyah³

^{1,2,3}Faculty of Economics and Business, Universitas Pendidikan Indonesia
E-mail: ¹adzkaaasalsabila@gmail.com, ²asnur.fna@upi.edu, ³firmansyah@upi.edu

*Corresponding author

JEL Classification:

Q18
I32
O13
Z12

Received: 04 February 2025

Revised: 29 July 2025

Accepted: 24 August 2025

Available online: October 2025

Published regularly: October 2025

ABSTRACT

Research Originality: The originality of this research lies in integrating zakat as an Islamic financial instrument into the analysis of food security in Indonesia, a topic that has rarely been explored. Furthermore, it links the concept of maqashid sharia with the Sustainable Development Goal 2 (Zero Hunger), thus offering a novel contribution both theoretically and practically to the food security literature.

Research Purpose: This study aims to assess the likelihood of food security across Indonesian provinces and investigate the role of zakat solutions.

Research Methods: Employing a quantitative methodology, panel data on zakat utilization, agricultural output, and poverty levels from 34 Indonesian provinces (2013-2022) were analyzed using EViews 9.

Empirical Results: The findings reveal that agricultural output and zakat utilization have a positive and significant impact on food security, whereas poverty has a negative effect.

Implications: More effective policies are necessary to manage zakat utilization, enhance food production, and alleviate poverty, thereby ensuring Indonesia has a more stable and sufficient food supply for all.

Keywords:

food security; zakat utilization; agricultural production; poverty

How to Cite:

Salsabila, A. A., Nurasyiah, A., & Firmansyah. (2025). The Impact of Zakat, Agricultural Output, and Poverty on Indonesia's Food Security. *Signifikan: Jurnal Ilmu Ekonomi*, 14(2), 549-562. <https://doi.org/10.15408/sjie.v14i2.44738>.

INTRODUCTION

One of the 17 Sustainable Development Goals (SDGs) is “Zero Hunger,” which emphasizes the global commitment to eradicating hunger and malnutrition. In many developing countries, including Indonesia, food and nutrition insecurity remain critical issues (Sekabira et al., 2022). The Economist Group (2022) ranks Indonesia 60th out of 113 countries in terms of food security. National data further reveal that 70 out of 416 Indonesian districts still fall within the low Food Security Index (FSI) category (Bapanas, 2023). Low FSI scores reflect inadequate access to safe, nutritious, and sufficient food, which contributes to health issues such as stunting, malnutrition, and non-communicable diseases. As emphasized by Sen (1981), food insecurity is not solely a supply issue but also relates to entitlement and access.

Indonesia faces significant gaps between food needs and actual consumption. According to Badan Ketahanan Pangan (2021), food availability, accessibility, and utilization are critical for a healthy and productive society. Inadequate food consumption can reduce work productivity and elevate poverty rates. This condition creates a vicious cycle that perpetuates food insecurity and undermines human development.

From a theoretical standpoint, this study is grounded in two major frameworks: Sen’s Entitlement Theory and the *Maqashid Shariah* framework. Sen’s (1981) entitlement approach argues that hunger arises not only from food shortages but also from individuals’ lack of access and purchasing power to obtain food. This view reframes food insecurity as an issue of socio-economic exclusion. In parallel, the *Maqashid Shariah* theory developed by Islamic scholars such as Al-Ghazali emphasizes the holistic fulfillment of human needs, particularly the protection of life (*nafs*) and wealth (*maal*), under which food security is categorized. From this perspective, *zakat* is not only a spiritual obligation but also an economic mechanism designed to address structural poverty and redistribute wealth, ensuring access to necessities such as food.

These theoretical lenses help explain why food security in Indonesia must be addressed through a combination of economic production, poverty alleviation, and Islamic social finance mechanisms such as *zakat*. However, existing literature tends to treat these dimensions in isolation. For example, studies by Appiah-Twumasi and Asale (2022) and Syakirotin et al. (2022) focus on agricultural productivity as a determinant of food security. Others, such as Kim and Choi (2023) and Ouoba and Sawadogo (2022), highlight the impact of poverty. While Dirie et al. (2023) and Shahid et al. (2023) examine the potential of *zakat* for achieving food-related SDGs, they do not empirically integrate *zakat* into regional food security models.

This study addresses the research gap by integrating the entitlement theory and Islamic economic principles to assess the impact of *zakat* utilization, agricultural production, and poverty levels on food security in Indonesia. While previous studies have investigated these variables separately, this research is among the first to combine them within a comprehensive empirical framework using provincial-level panel data from 2013 to 2022.

The novelty of this research lies in three main aspects. First, it offers a cross-paradigmatic theoretical integration of Sen's entitlement theory and the Maqashid Shariah framework to analyze food security from both socio-economic and spiritual perspectives. Second, it introduces zakat utilization as a formal economic variable that directly influences food access, an element that is often overlooked in conventional food security models. Third, this study utilizes a longitudinal panel dataset covering 34 provinces in Indonesia over ten years (2013–2022), enabling a comprehensive analysis of regional disparities and long-term trends in food security.

Therefore, this study aims to investigate the impact of zakat utilization, agricultural production, and poverty levels on food security across various provinces in Indonesia. By combining economic and faith-based perspectives within a unified analytical framework, this research aims not only to fill a gap in existing studies but also to offer meaningful insights for real-world solutions. The findings are expected to support the creation of food security policies that are not only effective and inclusive but also aligned with local values and spiritual principles, especially by recognizing the potential of Islamic social finance, such as zakat, to reduce structural poverty and improve access to food at the community level.

METHODS

This study employs balanced panel data from 34 provinces in Indonesia spanning the years 2013 to 2022. The dependent variable is the Food Security Index (FSI), which captures three core components: food availability, accessibility, and utilization. This index is sourced from the National Food Agency (Bapanas), which publishes annual data at the provincial level. The key independent variables include zakat utilization, agricultural output, and poverty rates. Zakat utilization data are collected from the National Zakat Board (BAZNAS), reflecting the amount of zakat distributed across provinces each year. Agricultural output is measured using provincial-level gross regional domestic product (GRDP) for the agricultural sector at constant prices, obtained from Statistics of Indonesia. Meanwhile, the poverty rate is defined as the percentage of people living below the national poverty line, which is also sourced from Statistics Indonesia. To ensure consistency, all monetary values are adjusted for inflation using constant prices.

To analyze the relationship between zakat, agriculture, poverty, and food security, this study applies panel data regression techniques. Panel analysis is chosen because it allows for the examination of both cross-sectional and time-series variations while controlling for unobserved heterogeneity across provinces. A series of diagnostic tests is conducted to determine the most appropriate model specification. The Chow test is used to compare the pooled ordinary least squares (OLS) model and the fixed effects model (FEM), while the Hausman test is applied to determine whether to use fixed effects or random effects. Based on the outcomes of these tests, the fixed effects model is selected as the most suitable method for this study. This approach helps isolate within-province changes over time, providing more accurate estimates of the relationships between the variables.

The mathematics of this research model are:

Basic model research (Pooled OLS)

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \beta_3 X_{3,it} + u_{it} \quad (1)$$

Fixed effect model

$$Y_{it} = \alpha_0 + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \beta_3 X_{3,it} + \varepsilon_{it} \quad (2)$$

Notation:

Y = Food security level

X_1 = Zakat utilization rate

X_2 = Agricultural production level

X_3 = Poverty rate

The empirical model includes the Food Security Index as the dependent variable, with zakat utilization, agricultural output, and poverty rates as explanatory variables. This methodological approach enables a comprehensive assessment of the structural and institutional factors that shape regional food security in Indonesia.

Figure 1. Conceptual Framework

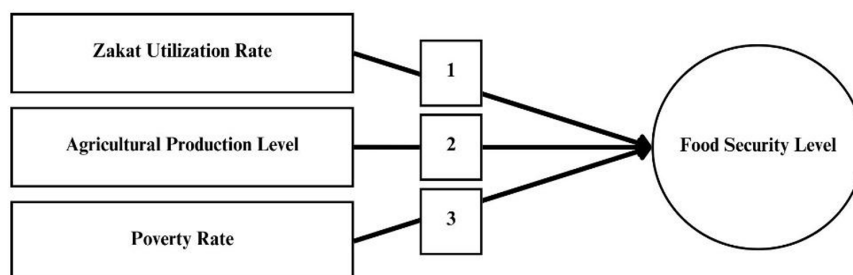


Figure 1 presents the conceptual framework of this study, showing how zakat utilization, agricultural output, and poverty are expected to influence food security in Indonesia. These three variables are chosen based on both economic theories and Islamic welfare principles. The arrows in the diagram reflect the direction of the relationships: zakat utilization and agricultural output are expected to improve food security, while poverty is expected to reduce it. By combining faith-based redistribution and economic development factors, this framework helps explain why food security levels may vary across regions.

RESULTS AND DISCUSSION

The Chow test was used to compare the Common Effect Model and the Fixed Effect Model. The result shows a p-value of $0.000 < 0.05$, suggesting that the Fixed Effect Model is preferable. This suggests that differences across provinces have a significant impact on the model, and these effects must be considered. The following are the results of the Chow test. Based on the Table 1 Chow test results above, it can be seen that the

cross-section chi-square probability value is 0.000, which is smaller than the alpha value of 0.05. This indicates that the test results reject H0 and accept Ha. This means that the Fixed Effect Model is a more appropriate model to use than the Common Effect Model.

Table 1. Result of the Chow test

Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	9.939206	(32,228)	0.0000
Cross-section Chi-square	230.570563	32	0.0000

Source: Author's compilation (2024).

The Hausman test was conducted to choose between the Fixed Effect and Random Effect models. Based on Table 2, it can be seen that the cross-section random probability value is 0.000 or smaller than 0.05, which is considered the significance value. This indicates that the test results reject H0 and accept Ha. This means that the Fixed Effect Model is the most appropriate model to use in this study.

Table 2. Result of the Hausman test

Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	48.326968	3	0.0000

Source: Author's compilation (2024).

To assess multicollinearity, a correlation matrix was used. Since all correlation coefficients were below 0.8, multicollinearity is not a concern in this model. This means the independent variables are sufficiently distinct to be included in the regression. Based on Table 3 and the multicollinearity test results, it is evident that all variables have coefficients below 0.8. Therefore, it can be concluded that the data in this study are not infected with multicollinearity.

Table 3. Result of the Multicollinearity test

	X1	X2	X3
X1	1	-0.00583	0.05824
X2	-0.00583	1	-0.71221
X3	0.05824	-0.71221	1

Source: Author's compilation (2024).

Heteroscedasticity was tested using the Glejser method. All variables showed p-values above 0.05, indicating homoscedasticity. Therefore, the variance of the residuals

is stable across observations, fulfilling one of the classical assumptions for panel regression (Baltagi, 2021). Based on Table 4, the results of the heteroscedasticity test indicate that the probability value for each variable is greater than 0.05. The probability of variable X1 is $0.5382 > 0.05$. The probability of the X2 variable is $0.7312 > 0.05$. The probability of variable X3 is $0.4712 > 0.05$. Thus, it can be concluded that the data in this study do not have heteroscedasticity problems.

Table 4. Result of the Heteroscedasticity test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	54.39138	10.99627	4.946347	0.0000
X1	-0.004586	0.007438	-0.616531	0.5382
X2	0.037143	0.108005	0.343897	0.7312
X3	-4.801918	0.780148	6.155134	0.4712

Source: Author's compilation (2024).

This model is estimated using the Fixed Effects Model (FEM), based on the results of the Chow and Hausman tests. The regression equation presented above summarizes the estimated relationship between zakat utilization, agricultural output, poverty rate, and food security in Indonesia. The statistical output from the panel regression analysis, as shown in Table 5, provides the detailed coefficients, standard errors, t-statistics, and significance levels used to interpret this model. These results are from the empirical basis for assessing the magnitude and direction of each variable's effect on food security across provinces during the 2013–2022 period.

Table 5. Panel Regression Output

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	255.5849	31.89627	8.013002	0.0000
X1	0.017059	0.021575	0.790682	0.0300
X2	0.079289	0.313285	0.253089	0.0004
X3	-18.54140	2.262933	-1.193529	0.0000
Cross-section fixed (dummy variables)				
R-squared	0.748491	Mean dependent var		67.86929
Adjusted R-squared	0.709882	S.D. dependent var		51.33653
S.E. of regression	3.492400	Akaike info criterion		7.847373
Sum squared resid	3.011315	Schwarz criterion		8.335002
Log likelihood	-2.85320	Hannan-Quinn criterion		8.043317
F-statistic	0.086550	Durbin-Watson stat		1.771623
Prob(F-statistic)	0.000000			

Source: Author's regression output using EVIEWS (2024).

Based on Table 5, the R-squared value of 0.748 indicates that nearly 75% of the variation in food security across provinces can be attributed to these three variables. The model is therefore quite strong—the remaining influence is due to other factors, such as education, infrastructure, food prices, or climate change. The empirical findings of this study identify three key factors that significantly affect food security across Indonesia: zakat utilization, agricultural production, and poverty levels. Using panel data from 34 provinces between 2013 and 2022, the regression analysis, based on a Fixed Effects Model selected through Chow and Hausman tests, shows that all three variables are statistically significant at the 5% level. Zakat utilization and agricultural output have positive coefficients, meaning that improvements in these areas are associated with better food security outcomes. On the other hand, poverty has a strong negative effect, indicating that higher poverty levels are consistently linked to reduced access to adequate and nutritious food.

These results confirm that the interaction between economic productivity, social equity, and faith-based redistribution mechanisms shapes food security in Indonesia. Strengthening public policies in these areas, particularly in the productive management of zakat and poverty alleviation, could substantially improve people's ability to meet their basic food needs (Sen, 1981; Hafandi & Helmy, 2021; Hsiao, 2022). In this context, zakat emerges not only as a spiritual obligation but also as a strategic tool for inclusive development and long-term food resilience.

To better understand how each of these factors contributes to food security, the following sections provide a more detailed interpretation of the empirical results. First, the regression results show that zakat utilization has a significant and positive impact on food security in Indonesia. A 1% increase in zakat utilization is associated with an improvement in the Food Security Index (FSI), indicating that zakat plays a significant role in enhancing access to adequate and nutritious food. This finding supports studies by Shahid et al. (2023) and Dirie et al. (2023), who demonstrate that productively distributed zakat can strengthen the purchasing power of mustahik (zakat recipients) and reduce vulnerability to hunger. Similarly, Amuda and Faizah (2020) emphasize that zakat-based empowerment programs help improve household food access, particularly in rural and agricultural communities. These outcomes are also consistent with the Maqashid Shariah framework, which places the protection of life (*nafs*) and wealth (*maal*) at the core of Islamic socioeconomic objectives (Dusuki & Abozaid, 2007).

Beyond its spiritual significance, zakat has tangible economic value. When well-managed, it not only offers short-term relief but also supports long-term improvements in household welfare, food access, and productivity (Hafandi & Helmy, 2021). By channeling resources from wealthier individuals (*muzakki*) to those in need (*mustahik*), zakat enhances access to food, education, and healthcare, which are fundamental components of human development. In this way, zakat can be seen not only as an instrument of faith but also as a strategic policy tool for inclusive development and food security. Its role becomes especially critical in Muslim-majority countries like Indonesia, where zakat management institutions have expanded significantly in recent years.

These results are consistent with previous studies. Sumarni et al. (2019) reported that productive zakat allocation significantly improves household food security in Indonesia. Similarly, Salim et al. (2024) highlighted that zakat-based urban farming programs in Malaysia successfully enhanced both food security and financial inclusion at the community level. Ibrahim et al. (2018) further emphasized that zakat aid is directly linked to achieving food security among beneficiaries in Malaysia. In addition, Ismail and Hasan (2019) argue that zakat expenditure can serve as a fiscal instrument to strengthen sustainable food systems.

This study contributes empirical evidence to a growing body of literature that advocates for zakat as a sustainable financing mechanism for social welfare. However, the effectiveness of zakat depends heavily on the quality of its governance. As noted by Nurjanah et al. (2019), zakat does not always lead to significant reductions in poverty or food insecurity, particularly in regions with poor distribution systems and weak institutional capacity. These differences may reflect local variations in transparency, targeting, and responsiveness to community needs.

By using provincial-level panel data from 2013 to 2022, this study captures broader structural patterns across time and geography, offering more generalizable insights. The findings reaffirm that zakat, when integrated into formal policy frameworks and implemented with accountability, can serve as both a religious duty and a powerful tool for economic justice. As such, policymakers should give greater attention to strengthening zakat governance and aligning it with regional food security strategies. As a policy implication, zakat institutions should prioritize productive-based programs, especially those targeting the agricultural sector and rural microenterprises, to create long-term improvements in food security rather than short-term consumptive assistance.

Second, the findings of this study confirm that agricultural production plays a central role in strengthening food security across Indonesian provinces. A positive and significant relationship was found between agricultural output and the Food Security Index (FSI), suggesting that increased agricultural productivity enhances the physical availability of food, one of the core pillars of food security defined by the FAO. This finding aligns with classical development economics (Todaro & Smith, 2011). It is supported by empirical studies, such as Appiah-Twumasi and Asale (2022) and Syakirotin et al. (2022), which emphasize the importance of agricultural growth in reducing hunger, particularly in rural communities.

Furthermore, recent studies emphasize the importance of innovation and efficiency in agricultural systems. Backer and Billing (2024) and Hasibuan (2023) argue that adopting new technologies can reduce production costs and increase access to affordable food. However, agricultural productivity alone is not always enough to guarantee food security. As Rosenzweig et al. (2021) and Chau & Scrimgeour (2023) caution, climate shocks such as floods, droughts, and unpredictable weather patterns can undermine productivity gains. Therefore, increasing resilience to environmental risks through improved irrigation systems, climate-smart practices, and early warning mechanisms is essential to maintaining food system stability.

The study also situates Indonesia's agricultural development within a broader international context, as noted by Finger (2024). Climate-oriented agricultural transitions in Europe could lead to increased food imports from countries like Indonesia. While this could create export opportunities, it also risks greater environmental pressure and unsustainable land use if not managed carefully. Cross-border cooperation and the adoption of ethical trade and environmental standards are therefore crucial to ensure that food production growth does not come at the cost of ecological degradation or public health.

Moreover, Todaro and Smith (2011) highlight that agricultural development must be approached holistically. Beyond increasing output, effective agricultural policy must also address institutional reforms, equitable pricing mechanisms, and access to local and global markets. Global disruptions, such as the COVID-19 pandemic (Raitt et al., 2022) and political instability (Adhikari et al., 2023), have demonstrated that even regions with high productivity are vulnerable if their supply chains and distribution systems are weak. Overall, this study underscores that while agriculture is a key engine of food security, its success depends on broader systems of economic, environmental, and institutional support.

This result aligns with Appiah-Twumasi and Asale (2022), who argue that agricultural performance is critical for national food security. Research in East Java revealed that technical efficiency in agriculture, enhanced through irrigation and government support, significantly strengthens household food security (Hakim et al., 2021). Globally, Dibba et al. (2019) demonstrated that the adoption of improved rice varieties (NERICA) in The Gambia improved food security outcomes. However, agricultural output is also vulnerable to climate shocks and market fluctuations (Herath, 2014; Kulkarni & Manogna, 2025), highlighting the need for sustainable farming systems and technological innovation. Policymakers should emphasize agricultural modernization, technological innovation, and climate-resilient farming practices to ensure sustainable productivity and food availability.

Third, the study confirms a significant and negative relationship between poverty and food security, aligning closely with Amartya Sen's Entitlement Theory (1981). According to this framework, hunger arises not only from food scarcity but also from the inability to access food due to lack of income or resources. The regression results in this study support this theory, indicating that a 1% increase in poverty is associated with a substantial decline in the Food Security Index. This finding aligns with previous studies by Kim and Choi (2023), Aguilera and Jatmiko (2022), and Ouoba and Sawadogo (2022), which emphasize that low-income households often struggle to meet their basic nutritional needs, regardless of the availability of food.

Moreover, the findings reveal structural inequalities in many parts of Indonesia, particularly in rural and remote regions, where poverty is multifaceted and multidimensional. As Wado et al. (2019) point out, poor communities often face overlapping disadvantages, limited access to clean water, sanitation, healthcare, and education, which deepen food insecurity. Poverty tends to reproduce itself through cycles of poor health, low productivity,

and unemployment (Sunde, 2024). Kamruzzaman (2021) adds that malnutrition and illness among the poor further reduce their capacity to work and escape poverty. These interrelated conditions make food insecurity not only more persistent but also more challenging to address with isolated interventions.

These findings are consistent with those of Wado et al. (2019) and Kim and Choi (2023), who also highlight poverty as a primary determinant of food insecurity in developing countries. Schneider et al. (2022) further emphasize that diet affordability remains a critical barrier to achieving nutritional adequacy among low-income households. Poverty alleviation strategies must be integrated with food security initiatives to achieve effective results. Programs such as conditional cash transfers, food vouchers, and zakat-based social protection schemes can enhance economic access to food and improve household resilience against food insecurity.

From a policy perspective, the study emphasizes the importance of adopting integrated and multi-sectoral approaches to poverty reduction. Braun and Hendriks (2023) suggest one potential path: internalizing social and environmental costs in food pricing to support sustainable production. However, they also caution that this could unintentionally raise food prices, making them less affordable for people experiencing poverty. More practical solutions include expanding targeted cash transfers, promoting zakat-based empowerment programs, and improving access to affordable local markets (Pasaribu & Adhikari, 2020; Adhikari et al., 2023). Such strategies can help break the cycle of poverty and ensure access to basic food, even in low-income settings.

In conclusion, this study provides strong empirical evidence that poverty is not just an economic issue but a significant barrier to achieving food security in Indonesia. It affects access to food through multiple channels: income, health, education, and employment. Policymakers should therefore prioritize comprehensive poverty alleviation strategies that address both structural inequalities and immediate needs. Doing so will not only improve food security outcomes but also promote long-term human development and social inclusion.

Building on these findings, the overall effectiveness of the regression model is assessed to determine how well these three key variables — poverty, zakat utilization, and agricultural production — collectively explain variations in food security across regions. The coefficient of determination (R^2) from the panel regression model is 0.748, indicating that approximately 74.8% of the variation in food security across Indonesia's provinces can be explained by the three main variables in this study: zakat utilization, agricultural production, and poverty. This level of explanatory power suggests that these factors are strongly associated with food security outcomes, reinforcing their relevance as policy targets. The adjusted R^2 , which accounts for the number of variables in the model, is slightly lower at 0.709, confirming that the model remains robust even after adjusting for complexity. These findings are consistent with other empirical studies that link multidimensional development factors, especially agricultural growth and poverty alleviation, to food access and availability (Appiah-Twumasi & Asale, 2022; Kim & Choi, 2023).

Prior research highlights that geographic disparities (Wado et al., 2019), inflation and food price volatility (Ouoba & Sawadogo, 2022), income distribution (Adhikari et al., 2023), and infrastructure quality (Rosenzweig et al., 2021) can all influence food security. Moreover, climate change, education levels, and market access are likely to interact with the variables studied. Future research should consider integrating these additional dimensions to provide a more holistic view of what drives food security across regions. Nevertheless, the current model provides strong empirical support for the notion that faith-based redistribution mechanisms, agricultural productivity, and poverty reduction are foundational pillars for achieving sustainable food security in Indonesia.

CONCLUSION

The findings of this study provide clear answers to the research objectives. By employing panel data regression across 34 Indonesian provinces from 2013 to 2022, this research demonstrates that zakat utilization and agricultural output significantly enhance food security, while poverty weakens it. These results confirm that food security is not only determined by agricultural productivity but also by effective resource redistribution through zakat and the socio-economic conditions of the population. Integrating zakat into the analysis offers a new perspective, showing that Islamic financial instruments can serve as strategic tools to support Sustainable Development Goal 2 (Zero Hunger).

This research proposes several policy recommendations. First, zakat management institutions should prioritize productive programs that directly enhance food availability and access, particularly in vulnerable regions. Second, the government needs to implement policies that promote agricultural innovation, ensure fair distribution channels, and improve resilience against climate risks. Third, poverty alleviation programs must be integrated with food security initiatives so that households not only receive social protection but also have the capacity to achieve long-term economic independence. Strengthening collaboration between zakat authorities, agricultural stakeholders, and policymakers will be crucial for achieving sustainable food security in Indonesia.

REFERENCES

- Adhikari, R., Suryana, A., & Yulida, E. (2023). Geopolitical Tensions and Food Supply Chain Disruptions: Evidence from Developing Countries. *Journal of Food Policy and Development*, 45(2), 155–170.
- Aguilera, R., & Jatmiko, H. (2022). Poverty and Nutritional Inequality in Southeast Asia: A Provincial Analysis. *Asian Journal of Development Studies*, 10(1), 75–92.
- Amuda, Y. J., & Faizah, M. N. (2020). Zakat-Based Empowerment Model and Its Role in Reducing Poverty and Hunger *International Journal of Zakat and Islamic Philanthropy*, 2(3), 44–58.

- Appiah-Twumasi, M., & Asale, M. S. (2022). Agricultural Productivity and Household Food Security in Sub-Saharan Africa: Evidence from Ghana. *African Journal of Agricultural Economics*, 11(1), 20–35.
- Backer, R., & Billing, A. (2024). Agricultural Innovation and Food Affordability in the Digital Age. *Global Agrifood Research*, 9(1), 11–29.
- Badan Ketahanan Pangan. (2021). *Food Security and Vulnerability Atlas of Indonesia*. Jakarta: Ministry of Agriculture.
- Badan Pangan Nasional. (2023). *Peta Ketahanan dan Kerentanan Pangan Indonesia*. Jakarta: Bapanas.
- Baltagi, B. H. (2021). *Econometric Analysis of Panel Data* (6th ed.). Cham: Springer.
- Braun, J. von, & Hendriks, S. (2023). Internalizing Externalities in Food Systems: Toward Sustainability and Inclusion. *Food Systems Transformation Journal*, 5(2), 62–79.
- Chau, D. H., & Scrimgeour, F. (2023). Climate Risk and Resilience in Pacific Agricultural Economies. *Journal of Environmental Economics*, 17(3), 211–230.
- Dirie, I. A., Shah, M., & Fata, I. A. (2023). Zakat, SDGs, and Food Security in Islamic Economies. *Journal of Islamic Social Finance*, 6(1), 88–104.
- Dusuki, A. W., & Abozaid, A. (2007). A Critical Appraisal of the Challenges of Realizing Maqasid al-Shari'ah in Islamic Banking and Finance. *IIUM Journal of Economics and Management*, 15(2), 143–165.
- Economist Intelligence Unit. (2022). *Global Food Security Index*. London: The Economist Group.
- Finger, R. (2024). Carbon footprints, environmental trade-offs, and global agricultural transitions. *European Journal of Environmental Policy*, 12(1), 55–71.
- Hafandi, M. R., & Helmy, I. M. (2021). Productive zakat management and socio-economic empowerment of mustahik. *Journal of Islamic Economics Perspectives*, 3(2), 100–118.
- Hakim, R., Haryanto, T., & Sari, D. W. (2021). Technical Efficiency among Agricultural Households and Determinants of Food Security in East Java, Indonesia. *Scientific Reports*, 11, 4141. <https://doi.org/10.1038/s41598-021-83670-7>.
- Hasibuan, R. (2023). Technological Modernization and Food Supply Chain Resilience in Indonesia. *Jurnal Pertanian Modern*, 8(3), 121–134.
- Herath, H. (2014). Impacts of Regional Trade Agreements on Food Security: Evidence from ASEAN. *Food Security*, 6(3), 257–268.
- Hsiao, C. (2022). *Analysis of Panel Data* (4th ed.). Cambridge: Cambridge University Press.
- Hsiao, Y. C. (2022). Exploring Structural Drivers of Food Insecurity in Southeast Asia. *Journal of Regional Development and Policy*, 14(2), 90–104.
- Ibrahim, N., Wahid, H., & Ahmad, S. (2018). The Relationship between Livelihood Assets, Zakat Aid, and Food Security Achievement among Zakat Recipients in Kedah, Malaysia. *Central Asia and the Caucasus*, 19(3), 89–100.

- Ismail, A. G., & Hasan, H. (2019). Zakat Expenditure on Food Security for Sustainable Development. *European Proceedings of Social and Behavioural Sciences*, 69, 219–227.
- Kamruzzaman, M. (2021). Poverty, Poor Health, and Food Insecurity: A Vicious Cycle in South Asia. *Development Studies Review*, 18(4), 45–61.
- Kim, D., & Choi, H. (2023). Does Poverty Still Matter in the Era of Food Surplus? New Evidence from Southeast Asia. *Journal of Development Research*, 31(1), 12–28.
- Kulkarni, R., & Manogna, R. L. (2025). Does the Financialization of Agricultural Commodities Impact Food Security? An Empirical Investigation. *arXiv preprint*. <https://arxiv.org/abs/2502.05560>.
- Nurjanah, S., Ramadhani, N., & Firmansyah, M. (2019). Evaluating the Effectiveness of Zakat Distribution on Poverty Reduction in Indonesia. *Journal of Islamic Philanthropy*, 4(2), 47–58.
- Ouoba, A., & Sawadogo, A. (2022). Inflation, Poverty, and Food Insecurity: Evidence from Burkina Faso. *West African Economic Review*, 16(1), 23–39.
- Pasaribu, R., & Adhikari, R. (2020). Food Access and Affordability in Rural Indonesia: The Role of Local Markets and Social Safety Nets. *Rural Development Insights*, 6(2), 33–49.
- Raitt, L., Nasution, H., & Tengku, R. (2022). The Impact of COVID-19 on Food Security in Southeast Asia: Lessons Learned and Policy Options. *Asian Development Journal*, 39(3), 98–117.
- Rosenzweig, C., Jones, J. W., & Tubiello, F. N. (2021). Climate Risk to Global Food Systems: Emerging Evidence and Policy Implications. *Nature Food*, 2(7), 404–415.
- Schneider, K. R., Christiaensen, L., Webb, P., & Masters, W. A. (2022). Assessing the Affordability of Nutrient-Adequate Diets. *arXiv preprint*. <https://doi.org/10.48550/arXiv.2207.07240>.
- Sekabira, H., Nalunga, S., & Kakuru, M. (2022). Household Food Insecurity and Income Shocks in Low-Income Economies. *Food Policy*, 107, 102213.
- Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. London: Oxford University Press.
- Shahid, M., Idris, F., & Zahari, Z. (2023). Zakat, Economic Justice, and Food Security: Toward a Framework of Inclusive Development. *Journal of Islamic Economic Integration*, 11(2), 65–83.
- Sumai, S., Mutmainnah, A. N., Nurhamdah, N., & Arsyad, M. (2019). The Role of Zakat in Poverty Reduction and Food Security. *IOP Conference Series: Earth and Environmental Science*, 343(1), 012254. <https://doi.org/10.1088/1755-1315/343/1/012254>.
- Sunde, T. (2024). The Poverty Trap and Its Consequences for Food Security in Sub-Saharan Africa. *Journal of Poverty Studies*, 9(1), 50–66.
- Syakirotin, N., Lestari, A. R., & Prasetyo, H. (2022). Agricultural Growth and Rural Food Security in Indonesia: A Provincial-Level Analysis. *Jurnal Ekonomi Pembangunan Indonesia*, 7(1), 88–101.

- Todaro, M. P., & Smith, S. C. (2011). *Economic Development* (11th ed.). New Jersey: Pearson.
- Wado, Y. D., Terefe, A., & Gebreyesus, H. (2019). Determinants of Household Food Insecurity in Rural Ethiopia. *African Journal of Food and Nutrition*, 13(4), 200–215.