Agriekonomika

Volume 15, Issue 2 – October 2026
ISSN (Print): 2301-9948 | ISSN (Online): 2407-6260
Page: 267-276

OPEN ACCESS

Article

Farmers' Perception of Sustainable Coffee Innovation Based on Climate Smart Agriculture (CSA)

*[1, A-E]Dara Latifa, [1, C-E]Maulia Usni, [2, C, D]Melani Anisa Putri, [1, E, F]Friskia Hanatul Qolby

[1]Politeknik Pertanian Negeri Payakumbuh, Indonesia
[2] Universitas Bengkulu, Indonesia

A – Research Concept and Design, B – Collection and/or Assembly of Data, C – Data Analysis and Interpretation, D – Writing The Article, E – Critical Revision of The Article, F – Final Approval of Article

ARTICLE INFO

Article History
Received: May 2026
Accepted: July 2026
Published: October 2026

Keywords
Coffee;
CSA;
Innovation;
Perception;
Sustainability

DOI:
10.21107/agriekonomika.v15i2.34370

© 2026 by the authors.
This is an open access article under the CC-BY license.

ABSTRACT

The Climate Smart Agriculture (CSA) approach has become one of the innovations in implementing sustainable coffee cultivation in West Sumatra, particularly in Situjuah Limo Nagari District. This study aims to describe the characteristics of the coffee farmers and understand their perception regarding the adoption of sustainable coffee innovation based on CSA in Situjuah Limo Nagari District. The research was conducted from August to September 2025 by applying a survey method. The sample consisted of 156 Situjuah coffee farmers Data analysis employed the Spearman Rank correlation. The results show the characteristics of coffee farmers in Situjuah Limo Nagari District depicted based on age, gender, residence, education, farming experience, number of dependents, land size, type of sales, land ownership status, and coffee variety. The second results of this study on the perception level of coffee farmers in implementing sustainable coffee based on CSA in Situjuah Limo Nagari District show that, in general, farmers have a relatively high perception, with an average score of 68.74% of the maximum score. Moreover, farmers' perceptions of CSA implementation are more strongly influenced by economic factors (income) and external institutional factors (farmer groups and extension workers), followed by innovation characteristics.

How to Cite:
Latifa, D., Usni, M., Putri, M. A., Qolby, F. H. (2026). Farmers' Perception of Sustainable Coffee Innovation Based on Climate Smart Agriculture (CSA). *AGRIEKONOMIKA*, *15*(2), 267-276. https://doi.org/10.21107/agriekonomika.v15i2.34370.

***Corresponding author:**
Email : dara.latifa@politanipyk.ac.id
Address : Jl. Raya Tanjung Pati Km 7, Koto Tuo, Kec. Harau, Kabupaten Lima Puluh Kota, Sumatera Barat

INTRODUCTION

Indonesia's coffee production faces increasing threats from weather variability and climate change, which affect productivity, plant pests and diseases, as well as coffee bean quality. The Climate Smart Agriculture (CSA) approach has been recommended as one of the strategies to improve resilience, productivity, and emission mitigation in small- and medium-scale coffee production systems. CSA includes a range of technical and managerial practices such as crop rotation, shade management, soil conservation, varietal diversification, and water management. These practices are adapted to the local context to achieve the three main goals of CSA: production, adaptation, and mitigation (Djufry et al., 2022). Studies by Prasetyo et al. (2017), Angka. (2021) and Leo et al. (2023) have shown that temperature changes significantly affect coffee productivity. Suboptimal environmental temperatures can lead to flower and young fruit drop, resulting in lower yields.

Situjuah Limo Nagari District, Lima Puluh Kota Regency, West Sumatra, is one of the areas with strong economic dependence on plantation crops, including coffee. Research by Latifa et al. (2025) revealed that Robusta coffee is a leading plantation commodity in Lima Puluh Kota Regency and possesses competitive and comparative advantages in Situjuah Limo Nagari District. This indicates that the area has the potential to become a coffee development center.

However, studies on CSA-based coffee production systems and farmers' perceptions of sustainable innovations, both at the District and nagari (village) levels, remain very limited. Generally, national studies show that the adoption of CSA practices is still low due to socio-economic factors such as knowledge, access to technology, and institutional support. Therefore, contextual studies are needed to describe the characteristics of local coffee farming systems as well as farmers' understanding and attitudes toward CSA innovations as the basis for policy recommendations (Hidayat, 2023).

In addition, studies on farmers' perceptions of coffee innovations, such as organic coffee or new cultivation techniques, indicate that demographic factors, experience, sources of information, and economic benefits influence farmers' attitudes and adoption decisions. This is relevant for designing effective extension strategies and policies at the local level. Perception studies like this provide a methodological framework that can be adapted to the context of Situjuah Limo Nagari District (Rohma et al., 2023). Azel et al. (2024) stated that the adoption rate of sustainable coffee farming reached 71%, indicating that farmers are quite responsive to new technologies.

Coffee production in Situjuah has not yet reached its full potential. In 2022, production was 22.62 tons, but it declined by 3.47 tons in 2023. This significant decline occurred over the last two years (BPS Kabupaten Lima Puluh Kota, 2024). One of the causes is farmers' limited knowledge, particularly in utilizing local resources (Mangunsong & Wahyudi, 2018). Thus, CSA implementation becomes increasingly relevant for improving productivity while maintaining environmental sustainability (Schroth et al., 2015; Mulyono et al., 2022).

Situjuah Limo Nagari District still applies traditional agricultural management models, where practices are based on inherited knowledge passed on from previous farmers' generation, such as the use of chemical fertilizers, minimal coffee crop care, and waste disposal. In fact, there is considerable potential to improve production through better management practices. Therefore, the adoption of CSA is considered necessary. However, CSA implementation in Situjuah still faces challenges such as uneven dissemination of technology, limited innovation adoption, and the marginalization of local knowledge-based technologies. These issues are partly due to differences in understanding between farmers and extension workers, as well as the rapid flow of modern technology transfer. Modern technologies are often considered more dynamic compared to local/traditional technologies (Craparo et al., 2017; Kirungi et al., 2023).

The objective of this study is to describe the characteristics of coffee farmers and understand their perception regarding the implementation of sustainable coffee innovation based on CSA in Situjuah Limo Nagari District, Lima Puluh Kota Regency.

RESEARCH METHOD

This research was conducted in Situjuah Limo Nagari District (Figure 1), Lima Puluh Kota Regency, West Sumatra. It consists of five Nagari (villages). The study was implemented from August to September 2025. The data collection method used was survey. The research design employed a mixed-method approach, combining qualitative and quantitative descriptive research.

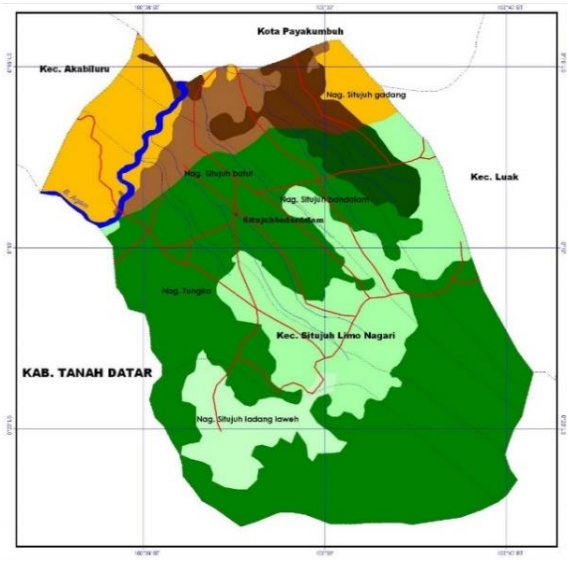


Figure 1
Map of Situjuah Limo Nagari District
Source: GIS Data Proceed, 2025

The data used in this study consisted of primary and secondary data. In this research, the index variables were measured using a Likert scale ranging from 1 to 5. Secondary data were obtained through literature studies to support, complement, and refine primary data, both from internal and external sources, including reports and other published data such as from BPS, the Department of Food Crops, Horticulture, and Plantation of Lima Puluh Kota Regency.

The population consisted of 256 coffee farmers spread across five nagari in Situjuah Limo Nagari District. The sample was determined using Slovin's formula by using 5% margin of error, which then result in 156 coffee farmers. This number is consistent with the minimum sample size required for survey research, which ranges from 100 to 300 samples (Kusnandar et al., 2022; Munandar et al., 2023). Sampling was conducted using the simple random sampling method (Kumalasari et al., 2019; Sumargo, 2020).

Data analysis applied qualitative descriptive approach to describe the characteristics of coffee farmers in Situjuah Limo Nagari District using data tabulation and mean values. To determine the perception level of coffee farmers regarding the implementation of sustainable coffee innovation based on CSA, the following formula was used (Sugiyono, 2022). Perception Level, Interpretation Criteria of Scores Riduwan & Kuncoro (2015): (a) 0% – 20%: Very low perception level of farmers in implementing sustainable coffee innovation based on CSA in Situjuah Limo Nagari District, (b) 21% – 40%: Low perception level of farmers in implementing sustainable coffee innovation based on CSA in Situjuah Limo Nagari District, (c) 41% – 60%: Moderate perception level of farmers in implementing sustainable coffee innovation based on CSA in Situjuah Limo Nagari District, (d) 61% – 80%: High perception level of farmers in implementing sustainable coffee innovation based on CSA in Situjuah Limo Nagari District, and (e) 81% – 100%: Very high perception level of farmers in implementing sustainable coffee innovation based on CSA in Situjuah Limo Nagari District

To analyze the relationship between internal factors (age, education, experience, income, land area, access to information) and external factors (role of extension workers, role of farmer groups, innovation characteristics) with farmers' perceptions of sustainable coffee innovation based on CSA, the Spearman Rank correlation analysis was used with the aid of IBM SPSS Statistics 24 software at a 5% significance level.

The hypotheses of this research are formulated as follows: H0 = There is no relationship between internal and external factors and farmers' perceptions of implementing sustainable coffee innovation based on CSA. H1 = There is a relationship between internal and external factors and farmers' perceptions of implementing sustainable coffee innovation based on CSA. A positive or negative sign indicates the direction of the relationship. A positive sign (+) indicates a direct relationship, meaning that if one variable increases, the other variable also increases. Conversely, a negative sign (–) indicates an inverse relationship, meaning that if one variable increases, the other decreases. The criteria for interpreting Spearman Rank correlation coefficients are as follows (Fitria et al., 2021): (1) 0.00 – 0.20: No correlation, (2) 0.21 – 0.40: Low correlation, (3) 0.41 – 0.60: Moderate correlation, (4) 0.61 – 0.80: High correlation and (5) 0.81 – 1.00: Perfect correlation.

Table 1
Characteristics of Coffee Farmers in Situjuah Limo Nagari District

Characteristics	Indicators	Number	Percentage
Age	< 30	6	4%
	30–40	12	8%
	41–50	27	17%
	51–60	77	49%
	> 60	34	22%
Nagari	Situjuah Gadang	10	6%
	Situjuah Ladang Laweh	111	71%
	Situjuah Batuah	4	3%
	Situjuah Banda Dalam	20	13%
	Tungkar	11	7%
Education	Elementary School	80	51%
	Junior High School	35	22%
	Senior High School	35	22%
	Undergraduate	6	5%
Gender	Male	106	69%
	Female	48	31%
Experience	1–10 years	47	30%
	11–20 years	20	13%
	21–30 years	39	25%
	31–40 years	38	24%
	> 40 years	12	8%
Dependents	< 1	11	7%
	1–2	98	63%
	3–4	42	27%
	> 4	5	3%
Land Size	< 1 ha	139	89%
	1–2 ha	12	8%
	> 2 ha	5	3%
Type of Sales	Cherry	113	72%
	Green bean	25	16%
	Not yet harvested	18	12%
Land Ownership	Own	146	94%
	Rent	5	3%
	Sharecropping	5	3%
Coffee Variety	Robusta	139	89%
	Arabica	12	8%
	Arabica & Robusta	5	3%

Source: Primary Data Processed, 2025

RESULTS AND DISCUSSION

Farmers' Characteristics

The research results on the characteristics of coffee farmers in Situjuah Limo Nagari District include age, gender, residence, education, farming experience, number of dependents, land size, type of sales, land ownership status, and coffee variety, is presented in Table 1.

Farmers' characteristics are important factors in understanding the socio-economic context and patterns of agricultural innovation adoption. Based on the survey results, several interesting findings emerged that reflect the actual condition of coffee farmers in Situjuah Limo Nagari District.

Dealing with the age perspective, the majority of farmers are in the productive age group of 51–60 years (49%), followed by those over 60 years old (22%). Meanwhile, young farmers (<30 years) account for only 4%. This dominance of elderly farmers is consistent with the findings of (Susilowati, 2016), who observed that the number of young farmers in Indonesia continues to decline, while the proportion of older farmers

increases. The distribution of farmers by nagari shows that the largest concentration is in Situjuah Ladang Laweh (71%), while the other nagari have relatively fewer farmers. It indicates that Ladang Laweh is the main coffee-producing center in the district. Nagari Tungkar has a long history of Robusta coffee dating back to the Dutch colonial period, though it receives little maintenance and is only harvested twice a year.

In terms of education, more than half of the respondents (51%) only completed elementary school, while around 5% had higher education degrees. It indicates that the formal education level of coffee farmers in Situjuah Limo Nagari District is relatively low, which may limit their capacity to understand and adopt agricultural innovations. Regarding gender, the majority are men (69%), though women also play a significant role (31%) in coffee management, both at the upstream level and during post-harvest processes.

To discuss the perspective of farming experience, the researchers discover that most farmers have long time experience, while 30% of the respondents having 1–10 years of experience and 25% of the having 21–30 years. Regarding family dependents, the majority of farmers have 1–2 dependents (63%), reflecting a moderate household economic burden. Land size characteristics show that most farmers (89%) cultivate small plots of field which is less than 1 hectare. It reflects the smallholder nature of coffee farming in Indonesia (Susilowati, 2016).

In terms of sales type, most farmers (72%) sell their products in form of cherry, while only 16% sell green beans, and 12% had not yet harvested. It shows the low value-added obtained by farmers since most of them sell merely primary products. Land ownership is dominated by self-owned land (94%), with only a small proportion engaged in rented or sharecropped arrangements. It indicates relatively secure access to land. Finally, Robusta dominates the coffee variety, which is (89%), while Arabica was only 8% and mixed Arabica-Robusta 3%. This data aligns with the agroclimatic conditions of the area, which are more suitable for Robusta. Furthermore, market demand for Robusta is higher than Arabica.

Farmers' Perception Level of CSA

The results of this study on the perception level of coffee farmers in implementing sustainable coffee based on CSA in Situjuah Limo Nagari District shows that, in general, farmers have a relatively high perception, average in 68.74% of the maximum score. It supports the research conducted by Ginting et al. (2019) and Imani et al. (2024) which discovered that farmers' perceptions of innovations in coffee cultivation were relatively high in North Sumatra and West Lampung Regency. However, the result of research conducted by the researchers here in Situjuah District was relatively higher compared to the similar research conducted by Irwansyah (2019) which studied about farmers' perceptions on organic coffee cultivation in Simalungun Regency, which was only 51%. It indicates that most coffee farmers understand the importance of sustainable farming practices and are eagerly prepare to adopt innovations related to CSA. Details are shown in Table 2 below.

According to the measured variables, the role of farmer groups obtained the highest score at 74.32%. It shows that farmer groups function as an important platform for knowledge transfer, solidarity building, and access to agricultural innovations. The income variable also scored relatively high (74.19%). It indicates that farmers are aware of the potential welfare benefits from sustainable coffee practices. Meanwhile, innovation characteristics obtained 73.38% score, showing that farmers perceive CSA innovations as having clear benefits. This is consistent with the principle of relative advantage in the theory of innovation diffusion. The more obvious the benefits, the higher the level of farmer acceptance.

Other high variables include farming experience (69.53%) and the role of extension workers (68.63%). Farmers who have more experience tend to have a better understanding of innovation benefits, while extension workers act as agents of change bridging technology and farmers. Access to information scored 65.13%, showing that although farmers have sufficient understanding of CSA-related information, limitations remain in utilizing modern sources of information such as digital platforms.

Education level (65.98%) and age (66.79%) also scored high, showing that both older farmers and those with lower education still have awareness of sustainable farming practices, although different communication strategies were required to deliver information effectively. The lowest score came from land area (60.73%), indicating that farmers' perceptions of CSA adoption are still influenced by limited land ownership. Farmers with smaller plots tend to be more cautious in adopting new innovations due to production risk concerns.

Table 2
Farmers' Perception Level in Implementing Sustainable Coffee Practices Based on CSA

No	Variable	Obtained Score	Maximum Score	Percentage (%)	Criteria
1	Age	1,563	2,340	66.79%	High
2	Education	1,544	2,340	65.98%	High
3	Experience	1,627	2,340	69.53%	High
4	Income	1,736	2,340	74.19%	High
5	Land Area	1,421	2,340	60.73%	High
6	Access to Information	1,524	2,340	65.13%	High
7	Role of Extension	1,606	2,340	68.63%	High
8	Role of Farmer Groups	1,739	2,340	74.32%	High
9	Innovation Characteristics	1,717	2,340	73.38%	High

Source: Primary Data Processed, 2025

Table 3
Results of Spearman Rank Correlation Analysis

No	Variables (X) – Y	Correlation (r)	Sig. (2-tailed)	Criteria
1	Age (X1) – Perception (Y)	-0.132	0.100	No Correlation
2	Education (X2) – Perception (Y)	-0.255	0.001	No Correlation
3	Experience (X3) – Perception (Y)	0.056	0.487	No Correlation
4	Income (X4) – Perception (Y)	0.569	0.000	Moderate Correlation
5	Land Area (X5) – Perception (Y)	-0.194	0.015	No Correlation
6	Access to Information (X6) – Perception (Y)	0.168	0.036	No Correlation
7	Role of Extension (X7) – Perception (Y)	0.237	0.003	Low Correlation
8	Role of Farmer Groups (X8) – Perception (Y)	0.393	0.000	Low Correlation
9	Innovation Characteristics (X9) – Perception (Y)	0.498	0.000	Moderate Correlation

Source: Primary Data Processed, 2025

Correlation of Internal and External Factors with Farmers' Perception

The results of the Spearman Rank correlation test showed variations in the relationships between internal and external factors (X1 to X9) and coffee farmers' perceptions (Y) of the implementation of sustainable coffee based on CSA in Situjuah Limo Nagari District, as presented in Table 3.

In general, several variables showed significant relationships to farmers' perceptions (Y). Income (X4) showed a moderate, positive correlation and was the strongest among all variables (r = 0.569; sig. 0.000). It indicates that higher income is associated with more positive perceptions on sustainable coffee adoption (H0 rejected, H1 accepted). This finding is consistent with Sutiknjo (2017), who stated that income is an economic factor influencing perception, attitude, and participation of farmers in agricultural programs.

Innovation characteristics (X9) also showed a moderate, positive, and significant correlation with perception (r = 0.498; sig. 0.000). It indicates that positive perceptions are formed when farmers view CSA innovations could provide advantages (H0 rejected, H1 accepted). This finding aligns with (Ritonga, 2019), who emphasized innovation characteristics as a key factor in shaping farmers' perceptions.

Role of farmer groups (X8) showed a low, positive correlation (r = 0.393; sig. 0.000). It implies that farmers' perceptions of CSA adoption improve when they are part of farmer groups. Suharyanto (2017) and Latifa et al. (2023) highlights the importance of farmer groups in influencing farmers' decisions. While (Putra et al., 2020) confirms that external support from groups significantly affects farmers' perceptions. Role of extension workers (X7) also had a low, positive correlation (r = 0.237; sig. 0.003). Effective extension services enhance farmers' understanding and willingness to adopt sustainable agricultural technologies (H0 rejected, H1 accepted). Padillah (2017) finds that the intensity of communication between farmers and extension workers significantly influences perception, while Santyari et al. (2022) confirmed that extension workers affect adoption decisions.

Access to information (X6) shows a weak but significant positive correlation (r = 0.168; sig. 0.036). This result suggests that better access to information, whether conveyed by extension agents or media, improves farmers' understanding of CSA (H0 rejected, H1 accepted). However, the relatively weak correlation reflects persistent challenges in digital literacy, as supported by Putri et al. (2024), who finds a significant relationship between digital literacy and farmers' use of the internet as an information source.

On the other hand, age (X1), education (X2), experience (X3), and land area (X5) did not show significant correlations with farmers' perceptions. It indicates that differences in age, formal education level, and farming experience do not directly affect farmers' views on CSA (H0 accepted, H1 rejected). Similar findings were reported by Kurniati (2019) and Fitria et al. (2021), whose observation indicates no significant correlations between these variables and farmers' perceptions of technological innovation adoption. Ramadhani & Suciati (2024) also confirm that land area has no significant effect on farmers' acceptance of agricultural innovations.

CONCLUSION

Coffee farmers in Situjuah Limo Nagari District are still dominated by elderly age groups, low education levels, small landholdings, and the tendency to sell coffee cherry. These characteristics are an important foundation for formulating strategies for developing sustainable coffee innovations based on CSA, not only to increase productivity but also to strengthen farmers' capacity in facing climate change and market challenges. Coffee farmers in Situjuah Limo Nagari District have a high level of perception in supporting sustainable coffee practices based on CSA. However, farmers remain facing challenges, particularly regarding with digital information access and limited land ownership. Therefore, policy interventions need to focus on strengthening farmer groups, optimizing the role of extension workers, and improving farmers' digital literacy so that CSA implementation can be more effective and inclusive. Farmers' perceptions of CSA implementation are more strongly influenced by economic factors (income) and external institutional factors (farmer groups and extension workers), followed by innovation characteristics, rather than internal factors such as age, education, or farming experience. Thus, strategies to increase CSA adoption should be prioritized in improving the added value of harvests, strengthening farmer organizations, enhancing extension services, and expanding access to information.

AI DISCLOSURE STATEMENT

During the preparation of this manuscript, the authors used Grammarly to assist with grammar checking, language editing, translation, and improving academic English writing. All outputs generated by these tools were carefully reviewed, verified, and revised by the authors to ensure the accuracy, clarity, and appropriateness of the content. The authors take full responsibility for the integrity, originality, and final content of this manuscript.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENT

The authors gratefully acknowledge that this research was financially supported by the BIMA Kemendiktisaintek Replublic of Indonesia, in the fiscal year 2025, under research contract numbers No. 195/C3/DT.05.00/PL-BATCH II/2025 July, 14 2025 and 3168/AL.04/2025 July, 16 2025. The authors also extend their appreciation to Politeknik Pertanian Negeri Payakumbuh, local goverment of Lima Puluh Kota Regency, Agricultural Extension Officers and Coffee Farmers of Situjuah Limo Nagary District for their valuable participation and insights during the data collection process. The support and contributions of all staeholders were instrumental in the successful completion of this study.

REFERENCES

Angka, A. W. A. (2021). Dampak Perubahan Iklim Terhadap Produktivitas Kopi Robusta Di Desa Kurrak Kecamatan Tapango Kabupaten Polewali Mandar. *Media Agribisnis*, *5*(2), 133–139. https://doi.org/10.35326/agribisnis.v5i2.1594.

Azel, F., Khairad, F., Latifa, D., & Sidqi, M. S. (2024). Perubahan Perilaku Petani dalam Usahatani Tanaman Kopi dengan Implementasi Sistem Pertanian Berkelanjutan. *Pucuk : Jurnal Ilmu Tanaman*, *4*(2), 41–48. https://doi.org/10.58222/pucuk.v4i2.278.

BPS Kabupaten Lima Puluh Kota. (2024). *Luas Lahan dan Produksi Kopi di Kabupaten Lima Puluh Kota Tahun 2020-2023*. BPS Kabupaten Lima Puluh Kota.

Craparo, A. C. W., Steppe, K., Van Asten, P. J. A., Läderach, P., Jassogne, L. T. P., & Grab, S. W. (2017). Application of Thermography for Monitoring Stomatal Conductance of Coffea Arabica Under Different Shading Systems. *Science of The Total Environment*, *609*, 755–763. https://doi.org/10.1016/j.scitotenv.2017.07.158.

Djufry, F., Wulandari, S., & Villano, R. (2022). Climate Smart Agriculture Implementation on Coffee Smallholders in Indonesia and Strategy to Accelerate. *Land*, *11*(7), 1-21. https://doi.org/10.3390/land11071112.

Fitria, N., Hindarti, S., & Maula, L. R. (2021). Hubungan Antara Karakteristik Petani Jeruk Dengan Persepsi Pertanian Berkelanjutan Di Desa Karangwidoro Kecamatan Dau Kabupaten Malang. *SEAGRI Jurnal Sosial Ekonomi Pertanian dan Agribisnis*, *9*(3), 1–11.

Ginting, A., Purba, E., Chalil, D., & Diana, N. (2019). Persepsi Petani tentang Lingkungan Internal dan Eksternal Usahatani dalam Pemberdayaan Petani Integrasi Kopi Kambing di Sumatera Utara. *Prosiding Seminar Nasional Hasil Penelitian Agribisnis*, *1*, 24–32.

Perubahan Rencana Kerja Perangkat Daerah. (2023). *Rencana Kerja Perangkat Daerah Kecamatan Situjuah Limo Nagari Tahun 2023*. Perubahan Rencana Kerja Perangkat Daerah Bupati Lima Puluh Kota.

Imani, S. N., Sukaryana, Y., & Dulbari. (2024). Persepsi Petani Terhadap Inovasi Budidaya Kopi Robusta Organik di Kabupaten Lampung Barat. *Mimbar Agribisnis : Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, *10*(2), 3601–3608. https://doi.org/https://doi.org/10.37149/jia.v8i2.591.

Irwansyah, B. (2019). Persepsi Petani Dalam Budidaya Kopi Organik Di Kecamatan Pematang Sidamanik Kabupaten Simalungun. *Skrips*i. Politeknik Pembangunan Pertanian Medan. http://202.162.198.147:1111/repo/detail/sp62902d9236a39.

Kirungi, D., Senyange, B., Wesana, J., Sseguya, H., Gellynck, X., & De Steur, H. (2023). Entrepreneurial and Attitudinal Determinants for Adoption of Climate-smart Agriculture Technologies in Uganda. *Cogent Food and Agriculture*, *9*(2), 1-25. https://doi.org/10.1080/23311932.2023.2282236.

Kumalasari, A. D., Budiraharjo, K., & Setiadi, A. (2019). Komparasi Produksi Dan Pendapatan Petani Tebu Mitra Dan Non Mitra Pabrik Gula Rendeng Di Kabupaten Kudus. *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*, *3*(1), 28–38. https://doi.org/10.14710/agrisocionomics.v3i1.4021.

Kurniati, S. A. (2019). Sustainable of Shallot Farming Sungai Geringging Village Kampar Kiri Subdistrict Kampar District Riau Province. *Jurnal Dinamika Pertanian Edisi Khusus Nomor 3 Desember*, *Edisi Khusus*(3), 101–110. https://doi.org/10.25299/dp.2019.vol35(3).4570.

Kusnandar, D. L., Sari, D. P., & Sahroni, N. (2022). Pengaruh Literasi Digital dan Persepsi Return dan Risiko dalam Meningkatkan Minat Investasi Generasi Z di Pasar Modal pada Era New Normal. *Valid Jurnal Ilmiah*, *20*(1), 97–104. https://doi.org/DOI.10.53512/valid.v20i1.266.

Latifa, D., Ispinimiartriani, Novfirman, & Sidqi, M. S. (2025). Analisis Komoditi Unggulan Subsektor Perkebunan di Kabupaten Lima Puluh Kota Provinsi Sumatera Barat. *Agrifo*, *10*(1), 12–22. https://doi.org/10.29103/ag.v10i1.19627.

Latifa, D., Karmaita, Y., Yefriwati, Agustamar, & Yubniati. (2023). Financial Analysis of Corn Farming on The Post-Gold Mine Land Reclamation Technology Package in Palaluar Nagari Sijunjung Regency. *IOP Conference Series: Earth and Environmental Science*, *1160*(1), 1–7. https://doi.org/10.1088/1755-1315/1160/1/012060.

Leo, G. A. P., Wirianata, H., & Santosa, T. N. B. (2023). Analisis Pengaruh Curah Hujan terhadap Produktivitas Kopi (Coffea Sp.) Kec. Gemawang, Kab. Temanggung, Jawa Tengah. *Agroforetech*, *1*(1), 95–102.

Mangunsong, A. S., & Wahyudi, M. (2018). Peranan Kompos Tithonia dan Mikroorganisme terhadap Sifat Kimia Tanah dan Tanaman serta Produksi Kopi Arabika di Kebun Petani Situjuh Kabupaten Lima Puluh Kota Propinsi Sumatera Barat. *Seminar Nasional Peranan Teknologi Pembenihan Berbasis Sumberdaya Lokal Dalam Mendukung Ketahanan Pangan Di Era Industri 4.0*, 353.

Mulyono, A. E., Apnitami, P., Wangi, I. S., Wicaksono, K. N. P., & Apriono, C. (2022). The Potential of Smart Farming IoT Implementation for Coffee farming in Indonesia: A Systematic Review. *Green Intelligent Systems and Applications*, *2*(2), 53–70. https://doi.org/10.53623/gisa.v2i2.95.

Munandar, F. A., Krisnamurthi, B., & Burhanuddin, B. (2023). Persepsi Generasi Muda Tentang Pertanian Organik dan Pengaruhnya Terhadap Minat Berwirausaha. *Forum Agribisnis*, *13*(1), 110–120. https://doi.org/10.29244/fagb.13.1.110-120.

Padillah. (2017). Peranan Penyuluh dan Partisipasi Petani dalam Peningkatan Produksi Padi di Kecamatan Tabir Kabupaten Merangin Provinsi Jambi. *Skripsi*. Institut Pertanian Bogor. https://repository.ipb.ac.id/handle/123456789/91507.

Prasetyo, S. B., Aini, N., & Maghfoer, M. D. (2017). Dampak Perubahan Iklim Terhadap Produktivitas Kopi Robusta (Coffea Robusta) di Kabupaten Malang. *Jurnal Produksi Tanaman*, *5*(5), 805–811.

Putra, C. P., Sadono, D., & Susanto, D. (2020). Perceptions of Smallholders Farmers on Oil Palm Plantation Cooperative in Kongbeng, East Kutai. *Jurnal Penyuluhan*, *16*(1), 134–146. https://doi.org/10.25015/16202028295

Putri, A. S. D., Lubis, D. P., & Aulia, T. (2024). Literasi Digital Anggota Kelompok Wanita Tani dan Pemanfaatannya sebagai Akses Informasi Pertanian. *Jurnal Sains Komunikasi Dan Pengembangan Masyarakat [JSKPM]*, *8*(03), 55–66. https://doi.org/10.29244/jskpm.v8i03.1408.

Ramadhani, M. W., & Suciati, L. P. (2024). Karakteristik Sistem Pertanian Kopi Rakyat Berbasis CSA (Climate Smart Agriculture) dan Faktor–Faktor yang Mempengaruhi di Kabupaten Jember. *Jurnal Ekonomi Pertanian dan Agribisnis*, *8*(3), 1112–1118.

Riduwan, & Kuncoro, E. A. (2015). *Cara Menggunakan dan Memaknai Analisis Jalur (Path Analysis)*. Alfabeta.

Ritonga, M. F. A. (2019). Persepsi Petani Dalam Penerapan Sistem Pertanian Organik Pada Budidaya Kakao di Kecamatan Gebang, Kabupaten Langkat. *Skripsi*. Politeknik Pembangunan Pertanian Medan. http://202.162.198.147:1111/repo/detail/sp629047c76a51d.

Rohma, C. N., Nikmatullah, D., Soepratikno, S. S., & Hasanuddin, T. (2023). Persepsi Petani Terhadap Inovasi Kopi Robusta Organik di Kabupaten Lampung Barat. *JIA (Jurnal Ilmiah Agribisnis) : Jurnal Agribisnis Dan Ilmu Sosial Ekonomi Pertanian*, *8*(2), 142–150. https://doi.org/10.37149/jia.v8i2.591.

Santyari, W. S., Lestari, E., & Permatasari, P. (2022). Farmers' Perceptions of the Integrated Participatory Development and Management Irrigation Program (IPDMIP). *Jurnal Sosial Ekonomi Pertanian*, *18*(3), 187–199.

Schroth, G., Läderach, P., Blackburn Cuero, D. S., Neilson, J., & Bunn, C. (2015). Winner or Loser of Climate Change? A Modeling Study of Current and Future Climatic Suitability of Arabica Coffee in Indonesia. *Regional Environmental Change*, *15*(7), 1473–1482. https://doi.org/10.1007/s10113-014-0713-x.

Sugiyono. (2022). *Metode Penelitian Kualitatif, Kuantitatif dan R & D*. Alfabeta.

Suharyanto, N. (2017). Faktor-Faktor yang Mempengaruhi Persepsi Petani Terhadap Kebijakan Perlindungan Lahan Pertanian Pangan Berkelanjutan di Provinsi Bali. *Jurnal Pengkajian Dan Pengembangan Teknologi Pertanian*, *20*(2), 111–124. https://doi.org/10.21082/jpptp.v20n2.2017.p111-124.

Sumargo, B. (2020). *Teknik Sampling*. UNJ Press.

Susilowati, S. H. (2016). Kebijakan Insentif untuk Petani Muda: Pembelajaran dari Berbagai Negara dan Implikasinya bagi Kebijakan di Indonesia. *Forum Penelitian Agro Ekonomi*, *2*(34), 103–123. https://doi.org/10.21082/fae.v34n2.2016.103-123.

Sutiknjo, T. D. (2017). Studi Persepsi, Sikap Dan Tingkat Partisipasi Anggota Kelompok Tani Terkait Program Asuransi Usahatani Padi (AUTP). *Jurnal Agrinika : Jurnal Agroteknologi Dan Agribisnis*, *1*(2), 168–189. https://doi.org/10.30737/agrinika.v1i2.325.