# Does Social Capital Affect Farming Production?: A Case Study of *Pulu Mandoti Emas* Rice Farmers in South Sulawesi

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**Abstract.** The sustainability of traditional *Pulu Mandoti Emas* (PME) rice farming in Salukanan Village, South Sulawesi, Indonesia relies on the unique qualities and indigenous cultivation techniques of the farmer. Social capital of the farmers serves as a network of relationships, trust, and shared norms between PME farmers that is crucial for sustaining the cultivation of PME rice. The objectives of this article are to investigate social capital of PME paddy farmers in Salukanan Village and other factors affecting PME farming production. The structural and cognitive dimensions of social capital of 64 selected farmers were observed and analyzed using multiple regression which employs descriptive method to examine farmers' bonding and bridging social capital, social and institutional trust, and norms of reciprocity. The multiple regression analysis and the Cobb-Douglas production function revealed that, in addition to land use, bonding and bridging social capital, also institutional trust has a positive impact on PME rice production. The continuous exchange of information among farmers regarding cultivation outcomes and PME farming practices is essential for enhancing production and promoting sustainable farming practices. Furthermore, local governments' supports through subsidy policies, combined with effective communication, can significantly bolster these cultivation activities, ensuring the long-term success of PME farming.

## 1 Introduction

Rice, a vital staple for over two-thirds of the global population, plays a central role in addressing this goal. Notably, approximately 80% of the world's rice is cultivated from Asian rice (*Oryza sativa L.*), underlining its significance in the quest to combat hunger and poverty faced by people across the world [1,2]. The Green Revolution, while boosting yields, led to the decline of traditional rice varieties with a n arrow genetic base [3,4]. Farmers shifted to high-yielding but genetically limited rice, causing traditional varieties to fade. Recognizing the importance of climate resilience, it is now acknowledged that traditional rice varieties serve as a valuable gene pool, offering traits crucial for the adaptation of modern rice varieties to climate change [1].

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In Salukanan village, Baraka Region, Enrekang regency (Located at coordinates between 3º 14º 36º to 03º 50 '00" south latitude and 119º 40' 53" to 120º 06" 33" east longitude), the cultivation of traditional *Pulu Mandoti Emas* (PME) rice has been practiced since the 17th century [5,6]. PME rice is an endemic sticky red rice plant in Salukanan Village, Baraka District, Enrekang Regency. While PME rice can grow elsewhere, it won't produce rice of the same quality as that from Salukanan's soil, where it yields rice with a distinctive strong aroma, unlike elsewhere where it may produce red sticky rice but lacks the same strong, unique fragrance [7].

PME has become the staple food in Salukanan Village due to its perceived ability to endure hunger over extended periods compared to other rice varieties. Moreover, its long shelf life of up to five years when stored in barns enhances food security in rural communities. Additionally, the relatively high price of PME rice compared to other rice varieties contributes to economic improvement in Salukanan Village. The intricate role of social dynamics in shaping the livelihoods of PME rice farmers, fueled by high motivation within their social environment [7]. Despite its cultural significance as a traditional rice variety passed down through generations, cultivating PME rice requires meticulous six-month-long cultivation, presenting challenges for farmers in Salukanan Village, Enrekang Regency.

Agricultural farming involves utilizing production factors such as land, labor, and capital to achieve optimal results [8]. The Cobb-Douglas production function is an equation involving independent and dependent variables, where the aggregate capital in this index includes three types of capital: human capital, derived from productive consumption, and social capital, which is enhanced by the presence of human capital [9,10]. The Sustainable Livelihood Approach (SLA) views social capital-comprising social networks, norms, trust, and values—as crucial for promoting community sustainability by enabling effective collaboration [11]. This form of capital influences and is influenced by other capitals, making it a key asset in the pentagon framework of sustainable livelihood, which also includes human, financial, natural, and physical capital [12].

In this article, social capital, is divided into structural and cognitive dimensions. Structural social capital includes bonding and bridging relationships, while cognitive social capital encompasses social trust, institutional trust, and norms of reciprocity[13]. This intricate web of community relationships facilitates resource sharing, knowledge exchange, and support, which buffer against farming challenges[14]. Effective social capital structures significantly enhance farm productivity and promote collective action [15–17]. Trust, as an intangible foundation, underpins this productive environment, distinguishing it from the tangible aspects of physical capital and the less tangible nature of individual human capital [16,18].

Research on rice farming has extensively explored the influence of various production factors. previous studies seek to unravel how these factors impact rice farming productivity [8,19]. Utilized the Cobb-Douglas production function in a multiple regression model to examine the effects of production factors, costs, and returns on rice farming [20]. More recently, highlighted weather factors as critical variables influencing rice production [21]. Given these findings, PME rice farming in Salukanan Village should also be examined to identify the significant factors affecting its production. Understanding these factors is crucial not only for optimizing productivity but also for sustaining the cultural and economic significance of PME rice farming in the region.

In addition to these traditional factors, the impact of social capital on farm productivity and food security has been significant. Social capital positively affects farm productivity[17]. Further explored this by incorporating social capital measures into an extended Cobb-Douglas production function, showing that social capital drives Total Factor Productivity (TFP) by improving the efficiency and effectiveness of resource use[22]. These findings highlight the critical role that both social and material capital play in agricultural settings.

Moreover, capitals are essential not only for improving farm productivity but also for reducing income inequality among ethnic minorities, underscoring the broader socio-economic benefits of investing in social capital [23].

The farmers' reliance on a limited supply of PME rice seeds, exclusively sourced from within Salukakan village, the cultivation of PME that takes six months to be harvested, and many other challenges exemplifies the crucial need of social trust and the adherence to established reciprocity, reinforcing the collective commitment to preserving this agricultural heritage. This article is expected to answer the question of social capitals as contributing factors on the production of PME rice farming in Salukanan Village, South Sulawesi.

# 2 Research Methods

## 2.1 Study area and source of data

The selection of the research location was done purposively[24], based on the consideration that Salukanan Village, Baraka District, Enrekang Regency, is the center for traditional rice production of *Pulu Mandoti Emas* (PME) in South Sulawesi. The types and data used were secondary data obtained from village archives, libraries, research-related documents, and institutions such as the local agriculture officials, as well as from previous research on the subject. Primary data contained information obtained from interviews using questionnaires as instruments with research samples[25].

Using the Slovin sampling technique, a research sample of 64 out of 82 PME rice farmers [26] was obtained randomly (simple random sampling) from the population [24,27]. Interviews were conducted using a questionnaire instrument in October - November 2023. The questionnaire included structural social capital questions such as bonding social capital ($SC_1$), bridging social capital ($SC_2$), cognitive social capital such as Social Trust ($SC_3$), institutional trust ($SC_4$), norms of reciprocity ($SC_5$)[14], and other factors influencing the production and farming income of PME rice farmers. The interpretation of the results will be obtained by determining the score interval with the following formula:

$$\textit{Ideal score: } S \times n \tag{1}$$

*S* is the scale used in the interval scoring for measuring the variable while *n* is the number of respondent farmers interviewed for the research. The ordinal scale values will then be converted into intervals and interpreted as percentages using the following interval formula:

$$I = \frac{100}{\text{Total Score}} \tag{2}$$

The score interval for each respondent will be classified as very low (0% – 19,99%); low (20% - 39,99%); neutral (40% - 59,99%); high (60% - 79,99%); very high (80% - 100%). Accumulated rating method developed by Likert is the most commonly used method for measuring social attitudes [28].

## 2.2 Analytical techniques and model specification

To determine the validity and apply the necessary corrections, The responses from the farmers were tested for validity and reliability [29]. The validity of the instrument was tested using the product moment formula with the criteria that if the significance value (2-tailed) ≤ the alpha value (0.05), then the question item is considered valid, or $H_0$ is rejected, and if the significance value (2-tailed) > the alpha value (0.05), then the question item is considered invalid, or $H_0$ is not rejected and $H_1$ is accepted. To calculate the reliability factor of the measurement tools of the project, the Cronbach's Alfa was used by completion of 30 questionnaires (a=0.60). The criterion applied that if the Cronbach's Alpha value ≥ 0.6, then the variable is considered reliable, and if the Cronbach's Alpha value < 0.6, so the items in the variable are not reliable[30].

The data analysis model employed in this research is multiple regression analysis using the Ordinary Least Squares (OLS) method. This method is used to determine the magnitude of the influence that changes in an independent variable have on a dependent variable [31]. The functional relation of factors that affecting PME rice production is formulated in:

$$Y = f(X_1, X_2\ X_3, \ldots\ldots, X_5) \tag{3}$$

Then, descriptive analysis is used to explain findings related to the present and to determine the status of the phenomenon being investigated[28].

To make the coefficient *a* represents the elasticity of *Y* as the dependent variable with respect to *X* as the independent variable, indicating the percentage change in *Y* for a percentage change in *X*, used the Cobb Douglas production function model[32]. The production function for PME rice farming is assumed to have a Cobb-Douglas form transformed into a natural logarithmic linear as follows:

$$LnY = Ln\ a + a_1\ Ln\ X_1 + a_2\ Ln\ X_2 + a_3\ Ln\ X_3 + a_4\ Ln\ X_4 + a_5\ Ln\ X_5 + a_6\ Ln\ X_6 + + a_7\ Ln\ X_7 + a_8\ Ln\ X_8 + a_9\ Ln\ X_9 + a_{10}\ SC_1 + a_{11}\ SC_2 + a_{12}\ SC_3 + a_{13}\ SC_4 + a_{14}\ SC_5 + \varepsilon_i \tag{4}$$

Where: dependent variable $Y$ = PME rice production (kg), independent variables are $X_1$ = Land area (ha), $X_2$ = seeds (kg), $X_3$ = SP-36 fertilizer (kg), $X_4$ = KCL fertilizer (kg), $X_5$ = Urea fertilizer (kg), $X_6$ = organic fertilizer (kg), $X_7$ = labor (DOW), $X_8$ = Pesticide (kg), $X_9$ = Herbicide (kg) (Damayanti, 2013), and also structural and cognitive social capital elements also as independent variables, $\alpha_{1,..,14}$ = constant, while $\varepsilon_i$ = error term.

## 3 Results and Discussion

### 3.1 Social capital of the farmers

Validity testing was conducted using STATA16 software, and the results showed that the questionnaire items used to measure social capital, namely bonding social capital ($SC_1$), bridging social capital ($SC_2$), social trust ($SC_3$), institutional trust ($SC_4$), and norms of reciprocity ($SC_5$), were significant ($p < 0.05$). Therefore, it can be concluded that all questionnaire items validly measure the social capital of the respondent farmers. The reliability test results indicated Cronbach's alpha values of 0.7206 ($SC_1$), 0.7289 ($SC_2$), 0.7598 ($SC_3$), 0.6551 ($SC_4$), and 0.7216 ($SC_5$). Thus, Cronbach's Alpha is higher than the comparison *alpha* value of 0.60, meaning that the statements used in the social capital variable are reliable, or in other words, the measurement results can be trusted.

The social capital of respondent farmers is observed based on the dimensions of social capital possessed by the respondent farmers in Salukanan Village, Baraka District, Enrekang Regency. Social capital into two dimensions called structural and cognitive dimensions[13]. Structural social capital consists of the bonding and bridging social capital, while cognitive social capital consists of social trust, institutional trust, and norms of reciprocity. Statement instruments were then developed to measure the level of social capital of respondent farmers. More detailed information about the social capital of respondent farmers can be seen in Table 1.

**Table 1.** Social Capital Characteristic of Respondent Farmers in Salukanan Village, Enrekang Regency, 2023.

| Social Capital Dimensions | Social Capital Elements | Level | Total | % |
|---|---|---|---|---|
| Structural Social Capital | Bonding social capital | Very high | 23 | 35.94 |
| | | High | 22 | 34.38 |
| | | Medium | 18 | 28.13 |
| | | Low | 1 | 1.56 |
| | | Very low | 0 | 0.00 |
| | Bridging Social Capital | Very high | 24 | 37.50 |
| | | High | 36 | 56.25 |
| | | Medium | 4 | 6.25 |
| | | Low | 0 | 0.00 |
| | | Very low | 0 | 0.00 |
| Cognitive Social Capital | Social Trust | Very high | 31 | 48.44 |
| | | High | 27 | 42.19 |
| | | Medium | 5 | 7.81 |
| | | Low | 1 | 1.56 |
| | | Very low | 0 | 0.00 |
| | Institutional Trust | Very high | 38 | 59.38 |
| | | High | 19 | 29.69 |
| | | Medium | 6 | 9.38 |
| | | Low | 1 | 1.56 |
| | | Very low | 0 | 0.00 |
| | Norms of Reciprocity | Very high | 33 | 51.56 |
| | | High | 25 | 39.06 |
| | | Medium | 6 | 9.38 |
| | | Low | 0 | 0.00 |
| | | Very low | 0 | 0.00 |

The table highlights that *Pulu Mandoti Emas* (PME) rice farmers in Salukanan Village exhibit high levels of social capital, crucial for their agricultural practices and community cohesion. High bonding social capital reflects strong internal connections within the community, fostering mutual support among farmers. Simultaneously, very high bridging social capital indicates extensive relationships with external parties, opening up opportunities for growth, learning, and improved economic outcomes. This dual network enables access to new technologies and markets while preserving the PME rice cultivation, demonstrating their commitment to upholding their cultural heritage and ensuring sustainable farming practices.

Structural dimension of social capital involves leveraging personal contacts within social networks to access information or resources [33]. This dimension, characterized by external connections, includes interactions with entities like agricultural extension officers, village officials, and the local government of Enrekang Regency. Additionally, it encompasses corporate social capital, formed by professional associations like farmers' unions or agricultural cooperatives, which advocate for the interests of their members [34].

The distribution of cognitive social capital among PME rice farmers reveals an uneven landscape of shared beliefs, values, and norms. While norms of reciprocity (51.56%) and institutional trust (59.38%) exhibit strong levels of consensus, social trust lags slightly behind at 48.44%. This discrepancy indicates potential differences in shared values and norms, particularly between PME rice farmers and internal parties such as family, fellow farmers, and close neighbours. The high level of trust in institutional parties underscores their pivotal role in shaping and reinforcing these values, suggesting that external entities are crucial in fostering trust and guiding the community's traditional practices. This indicates the need for focused efforts to enhance social trust and unify shared beliefs among all stakeholders in the PME rice farming community.

Rural people form social bonds through cognitive social capital, leading to increased participation in collective action and public engagement [33,35]. However, the distribution of cognitive social capital may vary due to factors like diversity in backgrounds, experiences, and socioeconomic status within the community. Nonetheless, social capital remains a valuable resource for the communities in Salukanan Village, Enrekang Regency, facilitating progress and problem-solving.

### 3.2 *Pulu Mandoti Emas* (PME) farming analysis

The significant diversity in technology adoption among farmers persists as they tend to adopt technology partially rather than fully, largely due to the perceived technological risk in rural areas, leading to slow implementation [36,37]. Although traditional rice cultivation poses certain challenges, farmers in Salukanan Village are committed to preserving and perpetuating these varieties as integral components of their cultural heritage and local traditions. The average of input used and average PME rice production by farmers in Salukanan Village can be seen in the following table:

**Table 2.** The average input usage and average PME rice production by farmers in Salukanan Village, Enrekang Regency, 2023.

| Variables | Number of respondents | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Production (Kg/ha) | 64 | 4575,78 | 798,47 | 2774 | 6000 |
| Land area (ha) | 64 | 0,575 | 0,196598 | 0,2 | 1 |
| Seeds (Kg/ha) | 64 | 14,41 | 4,72 | 4,8 | 23,5 |
| Chemical fertilizer (Kg/ha) | 64 | 426,56 | 82,6 | 250 | 550 |
| Organic fertilizer (Kg/ha) | 64 | 106,71 | 76,25 | 0 | 300 |
| Numbers of labor (DOW/ha) | 64 | 21,01 | 6,41 | 14 | 48 |

Farmers in Salukanan Village faced challenges in PME rice farming, with limited land available for cultivation leading to small-scale operations, averaging 0,575 hectares per farmer. This limitation contributes to lower production levels of PME rice. Despite consistent seeding rates of 14,41 kilograms per hectare, farmers exhibit a reliance on chemical fertilizers such as SP-36, KCL, and Urea, is averaging 426,56 kilograms per hectare, alongside an awareness of organic benefits, with an average application of 106,71 kilograms per hectare. These practices reflect evolving farming methods influenced by traditional experiences, received information, economic factors, and environmental consciousness gained from social interaction from both internal and external parties.

The farming operations, averaging 21,01 laborers per hectare with a standard deviation of 6,41 laborers, indicate labor-intensive practices, which could be attributed to either the small-scale size of the farms or the particular crop type cultivated. The small-scale nature of many traditional farms in Salukanan village may necessitate a higher labor input per hectare compared to larger, more mechanized operations. Furthermore, the specific requirements of cultivating PME rice, which may involve intricate planting, tending, and harvesting techniques, could contribute to the labor-intensive nature of farming in this context.

### 3.3 The effect of social capital on PME production

The next step is to conduct an analysis of the impact of social capital on PME rice production using multiple linear regression analysis with the assistance of STATA 16.0 software. To obtain statistical properties that serve as the best, linear, and unbiased estimator (BLUE) and for the required conditions to be used effectively, classical assumption tests need to be conducted[31]. The classic assumption test covers normality test, multicollinearity detection and heteroscedasticity test[38].

The normality test using the Shapiro-Wilk test yielded a *p-value* of 0.85556 (greater than $\alpha$ = 0,05), indicating a normally distributed data set. Multicollinearity detection revealed correlation coefficients below 0,8 for some independent variables, except for land area and seed suggesting the existance of imperfect multicollinearity, however this case doesn't make the model used became biased[39,40]. Additionally, the Breusch-Pagan test resulted in a *p-value* of 0.6242, which is greater than $\alpha$ (0,05) indicating no heteroskedasticity. Thus, affirming the accuracy, unbiasedness, and consistency of the regression equation model used.

Multiple linear regression analysis was employed to test the factors influencing PME rice production, examining the coefficient of determination ($R^2$), t test, and *f test*. The $R^2$ value of 0,985 suggests that 98% of the dependent variable can be explained by the independent variables in the model. Furthermore, the *f test* yielded a *p-value* of 0.0000, indicating a significant collective influence of the independent variables on the dependent variable. More details on the multiple regression analysis are shown in the table below:

**Table 3.** Factors affecting PME rice production, 2023.

| **Variables** | **Expected Sign** | **Coefficient** | ***t*** | ***Sig. t*** |
|---|---|---|---|---|
| Constant | | 8.132412 | 19,07 | 0,000 |
| Land area ($X_1$) | + | 0,9131053*** | 13,24 | 0,000 |
| Seeds ($X_2$) | + | 0, 0339065$^{ns}$ | 0,59 | 0,559 |
| SP-36 fertilizer ($X_3$) | + | 0,035065$^{ns}$ | 0,87 | 0,391 |
| KCL fertilizer ($X_4$) | + | 0,040222$^{ns}$ | 1,31 | 0,271 |
| Urea Fertilizer ($X_5$) | + | -0,0072108$^{ns}$ | -0,32 | 0,749 |
| Organic fertilizer ($X_6$) | + | -0,0083223$^{ns}$ | -0,46 | 0,650 |
| Labor ($X_7$) | + | -0,0356854$^{ns}$ | - 0,97 | 0,339 |
| Pesticide ($X_8$) | + | 0,0132335$^{ns}$ | 0,64 | 0,525 |
| Herbicide ($X_9$) | + | 0,0159833$^{ns}$ | 0,69 | 0,495 |
| Bonding Social Capital ($SC_1$) | + | 0,0000157*** | 3,31 | 0,002 |
| Bridging Social Capital ($SC_2$) | + | 0,0286355*** | 2,79 | 0,008 |
| Social Trust ($SC_3$) | + | -0,0000136* | -1,85 | 0,073 |

| Variables | Expected Sign | Coefficient | *t* | *Sig. t* |
|---|---|---|---|---|
| Institutional Trust ($SC_4$) | + | 0,0000138* | 1,97 | 0,056 |
| Norma Kebajikan ($SC_5$) | + | -3, 59e-06$^{ns}$ | -0,49 | 0,628 |
| **Sig F** | | | | **0,000*** ** |
| **Adjusted $R^2$** | | | | **0,985** |

*,**, and *** significant 10%, 5%, 1% respectively, and $^{ns}$ not significant

The significance values of the variables for the amount of seeds, chemical fertilizers (SP-36, KCL, and Urea), and organic fertilizers show no significant impact on PME production, contrary to the studies [41] and [42] which indicate a significant impact of input variables like the amount of seeds on rice production. Respondent farmers rely on personal experience and advice from agricultural extension workers and fellow farmers to determine fertilizer doses, resulting in homogeneity in knowledge and cultivation practices in Salukanan Village.

Regression analysis results show that the frequency of internal and external communication and the social and institutional trust of farmers in Salukanan Village significantly affect PME production. The tradition of mutual help, stemming from trust among farmers, encourages them to maintain conventional practices, while external support enhances institutional trust, positively impacting PME rice production. Building relationships outside the agricultural circle supports farmers in adopting sustainable practices [43].

Social capital obtained from community involvement, such as the *"Makkombong"* activities in Salukanan Village, can promote sustainable farming practices, although strong internal traditions pose barriers. High trust among farmers and their internal networks can slow cultural and attitude changes, creating obstacles in adapting to climate change unbalanced exchanges of goodwill can cause tension and dissatisfaction within the community, although they persist in group selection and assortative matching [44].

## 4 Conclusion

Traditional *Pulu Mandoti Emas* (PME) rice farmers in Salukanan Village, Enrekang Regency, possess a strong sense of social capital, facilitating their access to resources, financial assistance, and subsidies, despite facing challenges that limit their land utilization to small-scale operations. Other than land area used, the factors influencing PME rice production include both the bridging and bonding social capital, social trust, and institutional trust of the farmers. Recognizing the importance of maintaining social connections both internally and externally within Salukanan village, policy interventions fostering such activities are crucial for bolstering the community's economic development.

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## References

1. J. Krishnankutty, M. Blakeney, R. K. Raju, and K. H. M. Siddique, Sustain. 13, 1 (2021)
2. A. K. Tyagi, J. P. Khurana, P. Khurana, S. Raghuvanshi, A. Gaur, A. Kapur, V. Gupta, D. Kumar, V. Ravi, and S. Vij, J. Genet. 83, 79 (2004)

3. K. Roy, A. Mukherjee, A. Maity, K. Shubha, and A. Nag, in Role Intellect. Prop. Rights Agric. Allied Sci. (Apple Academic Press, 2018), pp. 295–318
4. A. M. Ashraf and S. Lokanadan, Int J Curr Microbiol App Sci 6, 335 (2017)
5. A. Karim, Int. J. Innov. Sci. Res. Technol. 5, 793 (2020)
6. H. Hasmah, Walasuji J. Sej. Dan Budaya 11, 171 (2020)
7. J. Latif, N. Busthanul, and A. Amrullah, J. Sos. Ekon. Pertan. 16, 49 (2020)
8. A. G. Onibala and M. L. Sondakh, Agri-Sosioekonomi 13, 237 (2017)
9. A. Rahim, S. Supardi, and D. R. D. Hastuti, (2012)
10. S. Dinda, J. Socio. Econ. 37, 2020 (2008)
11. S. Morse and N. McNamara, Sustainable Livelihood Approach: A Critique of Theory and Practice (Springer Science & Business Media, 2013)
12. A. Abenakyo, P. Sanginga, J. M. Njuki, S. Kaaria, and R. J. Delve, (2008)
13. C. Grootaert and T. Van Bastelaer, (2002)
14. D. Belay and G. Fekadu, Clim. Dev. 13, 857 (2021)
15. E. Houshyar, B. Chen, and G. Q. Chen, Ecol. Indic. 105, 675 (2019)
16. G. Cofré-Bravo, L. Klerkx, and A. Engler, J. Rural Stud. 69, 53 (2019)
17. A. D. Kehinde, R. Adeyemo, and A. A. Ogundeji, Heliyon 7, (2021)
18. N. E. Ariessi and M. S. Utama, J. Piramida 13, 97 (2017)
19. L. Khakim, D. Hastuti, and A. Widiyani, Mediagro 9, (2013)
20. S. N. Ayambila, G. T. M. Kwadzo, and S. Asuming-Brempong, Ghana J. Dev. Stud. 5, 95 (2008)
21. R. Riaman, K. Parmikanti, B. Subartiny, and S. Supian, JTAM (Jurnal Teor. Dan Apl. Mat. 7, 924 (2023)
22. J. Oliver Huidobro, A. Antonioni, F. Lipari, and I. Tamarit, PLoS One 17, e0273066 (2022)
23. L. Liu, K. P. Paudel, G. Li, and M. Lei, Rev. Dev. Econ. 23, 528 (2019)
24. H. Fauza, I. Ferita, N. Putri, N. Nelly, and B. Rusman, Pros Sem Nas Masy Biodiv Indon 1, 23 (2015)
25. J. T. Sayuti, K. Sukiyono, and I. Irnad, AGRITEPA J. Ilmu Dan Teknol. Pertan. 9, 259 (2022)
26. M. Raufun, N. Nurdin, and A. Akbar, J. Sains Agribisnis 3, 37 (2023)
27. K. F. Purba, M. Yazid, M. Hasmeda, D. Adriani, and M. F. Tafarini, Potravinarstvo 14, (2020)
28. Y. K. Singh, Fundamental of Research Methodology and Statistics (New Age International, 2006)
29. T. Dalmiyatun, W. D. Prastiwi, and H. Setiyawan, Agric. Socio-Economics J. 18, 61 (2018)
30. P. P. Kuantitatif, Alf. Bandung (2016)
31. D. N. Gujarati, Essentials of Econometrics (Sage Publications, 2021)
32. A. Y. Fadwiwati and A. G. Tahir, J. Pengkaj. Dan Pengemb. Teknol. Pertan. 16, 92 (2013)
33. J. A. Gómez-Limón, E. Vera-Toscano, and F. E. Garrido-Fernández, Rural Sociol. 79, 380 (2014)
34. F. Sabatini, J. Socio. Econ. 38, 429 (2009)
35. M. M. Zain, H. Ibrahim, and M. Musdalifah, African J. Food, Agric. Nutr. Dev. 22, 21972 (2022)
36. S. P. Utama, I. Cahyadinata, and R. Junaria, J. AGRISEP Kaji. Masal. Sos. Ekon. Pertan. Dan Agribisnis 1 (2007)
37. C. H. Gladwin, Soc. Sci. Perspect. Manag. Agric. Technol. 127 (1989)
38. F. Purnamasari, S. H. Rosadi, and H. Hasnah, Agribus. J. 4, 29 (2021)
39. M. Kargbo, M. E. Theresia, E. Almekhlafi, and A. A. Kargbo, J. Bus. Financ. 3, 1

(2017)
40. L. M. Holland, (2014)
41. R. S. Singh and L. P. Gite, AMA-Agricultural Mech. Asia Africa Lat. Am. 43, 41 (2012)
42. A. Bashir and S. Yuliana, J. Ekon. Pembang. Kaji. Masal. Ekon. Dan Pembang. 19, 172 (2019)
43. D. Arnott, D. R. Chadwick, S. Wynne-Jones, N. Dandy, and D. L. Jones, J. Rural Stud. 83, 1 (2021)
44. R. Sethi and E. Somanathan, J. Econ. Theory 97, 273 (2001)