Agro Bali : Agricultural Journal
Vol. 9 No. 1: 167-181, March 2026

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

Performance and Determinants of Organic Rice Agribusiness Systems: Evidence from Lampung Province Using PLS-SEM

Sri Handayani[1♥], Wan Abbas Zakaria[2], Novi Rosanti[2], Hamim Sudarsono[3], and Dwi Haryono[2]

[1]Agribusiness Management Study Program, Politeknik Negeri Lampung, Bandar Lampung, Indonesia
[2]Agribusiness Study Program, Lampung University, Bandar Lampung, Indonesia
[3]Plan Protection Study Program, Lampung University, Bandar Lampung, Indonesia
♥Corresponding author email: sri.handayani84@polinela.ac.id

Article history: submitted: December 5, 2025; accepted: March 19, 2026; available online: April 10, 2026

Abstract. The performance of agribusiness is linked to the sustainability of organic rice agribusinesses in Lampung Province. This study enriches agribusiness system theory by validating the integration model of subsystems as the main determinant for optimizing the performance of organic rice agribusiness. This study aims to analyze the performance of the organic rice agribusiness system and the factors that determine organic rice agribusiness in Lampung Province. The research was conducted in four districts that implement organic rice farming: South Lampung, East Lampung, Central Lampung, and Pringsewu. The number of respondents was 50 organic rice farmers. Agribusiness performance analysis was measured using a performance index with a percentage ratio calculation between the total actual score and the maximum score to be classified into five categories of performance assessment interval scale. The determinants of agribusiness performance were analyzed using *partial least squares structural equation modeling* (PLS-SEM). The results show that the organic rice agribusiness system showed good performance. Meanwhile, the marketing subsystem is fair, with a performance score of 2.96. Overall, the organic rice agribusiness system showed good performance, with a score of 3.63 or 72.7%. The results of the second analysis indicate that the agribusiness subsystems consisting of the production inputs, farming, post-harvest, marketing, and supporting element subsystems affect the sustainability of organic rice agribusiness. Strengthening market institutions into business units (cooperatives) can serve as aggregators that consolidate harvests in terms of both quantity and quality. This will create economies of scale and improve farmers' bargaining power.

Keywords: agribusiness; institutional; organic rice; performance; sustainability

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1. Introduction

Conventional farming systems applied in Indonesia aim to increase food production through agricultural management with high and massive chemical inputs. This leads to farmers' dependence on synthetic chemical fertilizers and pesticides. In the long term, this will become an issue of environmental damage and the problem of farming due to the degradation of soil fertility and the risk of environmental damage, which will impact production decline (Sudarsono, 2016). The negative impacts of chemical fertilizers and pesticides include damage to agroecosystems (Haque et al., 2019), barren or severely damaged agricultural land, pest resistance, pesticide residues in plants, water, and soil, as well as risks to human safety and health (Handayani, 2022).

In contrast, organic farming has emerged as a superior alternative. The development of organic farming is very significant due to the increasing public awareness of healthy lifestyles. People want healthy and safe food (Ando et al., 2014). Organic farming offers enhanced carbon sequestration, climate resilience, and the production of high-quality safe food (Heryadi et al., 2018; Karki et al., 2011; Widiarta et al., 2011). Organic farming is better because farmers are using the local resources and technologies, and they have better independence (Rani et al., 2013). Organic farming goes beyond simply eliminating the use of synthetic inputs; it also involves the sustainable utilization of natural resources, the production of healthy food, and energy efficiency (Hamakonda & Mau, 2023).

Organic products are considered to be better in quality than inorganic products (Rani et al., 2013). In Indonesia, despite a burgeoning public demand for healthy lifestyles, the transition to organic systems remains paradoxically sluggish (Mayrowani,

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

2016). This stagnation is particularly evident in Lampung Province, where, despite government initiatives since 2014 such as the provision of organic fertilizer production tools, the sector continues to struggle with fragmented land ownership and a significant "productivity gap", with organic yields averaging 4–5 tonnes/ha compared to the 6–7 tonnes/ha achieved by conventional methods (Handayani et al., 2023). The development of organic rice agribusiness in Lampung Province is still constrained by scattered planting areas in small spots (less than 0.5 hectares), and some areas are still used for non-organic rice farming and other commodities (Handayani, 2022).

A critical synthesis of this research reveals a mismatch between upstream support and downstream market integration. While local government interventions have focused on inputs related to technical aspects of production, they largely overlook institutional barriers that weaken the agribusiness value chain. Specifically, there is a striking deficiency in the role of institutions in regulating the organic supply chain, irrigation management, and price stabilisation. Moreover, the combination of poor infrastructure and high transportation costs creates an inefficient agribusiness system that weakens farmers' bargaining position (Noer et al., 2025). Current literature is still limited to the biophysical benefits of organic farming, but it has not yet explained the structural and institutional inefficiencies that impact the performance of organic rice agribusiness.

However, previous studies have not analyzed the performance of organic rice agribusiness in an integrated manner between agribusiness subsystems, and the determinants of agribusiness performance have not used a structural equation modeling (SEM) approach. SEM provides higher statistical power, which aligns with determining agribusiness performance (Hair et al., 2019). Agribusiness performance is a holistic concept that integrates upstream, on-farm, and downstream systems (Nursidiq et al., 2020). Through the implementation of good agribusiness performance, it is hoped that farmers' incomes can be increased. The performance of organic rice agribusiness can be measured in areas that implement organic rice cultivation, namely the districts of South Lampung, Central Lampung, East Lampung, and Pringsewu, which are considered necessary to be further researched based on the current development conditions of organic rice agribusiness in Lampung Province.

Therefore, the research question that arises is how is the performance of organic rice agribusiness? and whether this research can address the gap by examining the holistic performance of organic rice agribusiness in Lampung. The urgency of this research lies in the analysis of agribusiness performance and the analysis of structural factors that influence the performance of organic rice agribusiness to become a sustainable, efficient, and institutionally supported agribusiness. Therefore, this study aims to analyze the performance of organic rice agribusiness and the determinants of organic rice agribusiness performance in Lampung Province. Based on the research objectives and the identified problems, the proposed hypothesis is: The determinant of organic rice agribusiness performance in Lampung Province is significantly influenced by the input, farming, post-harvest, marketing, and supporting service subsystems.

2. Materials and Methods

Location and time of research

The survey method was used in this study to collect factual information from a region and learn about current symptoms (Nazir, 2011). The research was conducted in four districts in Lampung Province that cultivate organic rice: Central Lampung, East Lampung, South Lampung, and Pringsewu (Figure 1). The research location was chosen intentionally (purposive) because it was the first certified organic rice farming operation. The research respondents were 50 organic rice farmers. The research was conducted from January to October 2025.

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Figure 1. Research location, A. South Lampung District, B. East Lampung District, C. Central Lampung District, D. Pringsewu District, Lampung, Indonesia. Source: (BPS Provinsi Lampung, 2023)

Data analysis

This research uses primary and secondary data. Primary data was obtained through field surveys, questionnaires, and interviews with organic and non-organic rice farmers. Secondary data was obtained through research results, literature studies, reports, and documents from various institutions related to the research field. The data collection methods used in this study are interviews and observation.

This study uses a nonprobability sampling design, which means that elements in the population do not have an inherent probability of being selected as subjects (Rogers, 2003). (Sugiyono, 2018) explains that purposive sampling can be used in social research with specific criteria. According to Hair et al. (2019), the minimum sample size that should be used is 10 times the number of variables. This study has 5 agribusiness subsystem variables, so the number of respondents used is 50. This is also supported by the limited number of organic rice farmers because not all regions practice organic farming.

This research aligns with the existing theory of Agribusiness System (Davis & Goldberg, 1957) in Saragih (2010). This theory views agribusiness not as a separate sector, but rather as an integrated system consisting of several interdependent subsystems: Upstream, On-farm, Downstream, and Supporting Services. The development of sustainable theory is the development of downstream agribusiness subsystems into post-harvest and marketing, which are two different activities. In this research five agribusiness subsystems are used.

Measurement of variables

Analysis method for agribusiness performance uses an agribusiness system consisting of an organic rice agribusiness subsystem (Nainggolan, Setiawan, Noor, Simarmata, et al., 2022; Saragi et al., 2021). To measure the performance of organic rice agribusiness, it is not only based on nominal figures but also involves other qualitative variables quantified using a Likert scale. The Likert scale can transform subjective perceptions into quantitative data that can be statistically processed. The questionnaire is outlined as simply as possible so that the respondents can understand the relationship of those factors and easily rate their influence (Ntiamoah et al., 2019). The questions were asked on a 5-point Likert scale from “1 = very low” to “5 = very high” to guide the

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

respondents to offer feedback regarding different levels of impact (Durdyev et al., 2018).

A performance matrix is the establishment of the content and component parts of a broad-based performance measure (Kennerley & Neely, 2002). The performance measurement preparation stage begins with the determination of indicators. Agribusiness performance indicators can be seen in Table 1.

Table 1. Agribusiness performance indicators

Interval	Performance Indicator
1.00 – 1.80	Poor
1.81 – 2.60	Low
2.61 – 3.40	Fair
3,41 – 4,20	Good
4,21 – 5,00	Excellent

Source: (Nainggolan, et al., 2022)

In this study, the variables influencing the performance of sustainable organic rice agribusiness are based on the results of previous research, considering the suitability of the study area. Karki et al. (2011) explaining that although many indicators have been developed, they do not yet cover all aspects of agribusiness performance. Additionally, due to variations in socioeconomic conditions, indicators used in one country may not be suitable for another. Production/farming subsystem indicators include: varieties, land, technology, and labor. Post-harvest and processing subsystem indicators include: sorting, grading, traction, storage, and packaging. Marketing subsystem indicators include: ease of marketing, partnerships, and market information. Supporting services subsystem indicators include: government policy, research institutions/universities, extension services, and access to capital.

Research tools

The analysis of the determinant of organic rice agribusiness performance was conducted by analyzing the agribusiness system consisting of various organic rice agribusiness subsystems in terms of their sustainability using the *Partial Least Squares-Structural Equation Model* (PLS-SEM) with Smart PLS. A conceptual framework can be seen in Figure 2. This study selected PLS-SEM methodology using Smart PLS version 3.0 because it is particularly suitable for exploratory research examining complex relationships between performance and subsystems of agribusiness. PLS-SEM provides higher statistical power compared to covariance-based SEM with a small sample (Anggita & Suprehatin, 2020).

The reliability test indicated the accuracy of measurement in determining the latent constructs, making the latent constructs reliable for assessing a structural equation model. For PLS-SEM, the construct reliability test was preferred with Cronbach's Alpha and Composite Reliability of more than 0.7 (Hair et al., 2014). Convergent validity measures the degree of correlation and validity of latent construct variables. This parameter was measured by the Average Variance Extracted (AVE) of more than 0.50. In conclusion, latent constructs had convergent validity, meaning they were acceptable to explain the variance of measured variables (Ghozali & Latan, 2014; Hair et al., 2019). The hypothesis tests (determinant of agribusiness performance) use the significance criteria (P value) of each coefficient path on the PLS-SEM. The hypothesis is accepted if the P value is < 0.05 or significant at a significance level of 5 %.

 e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

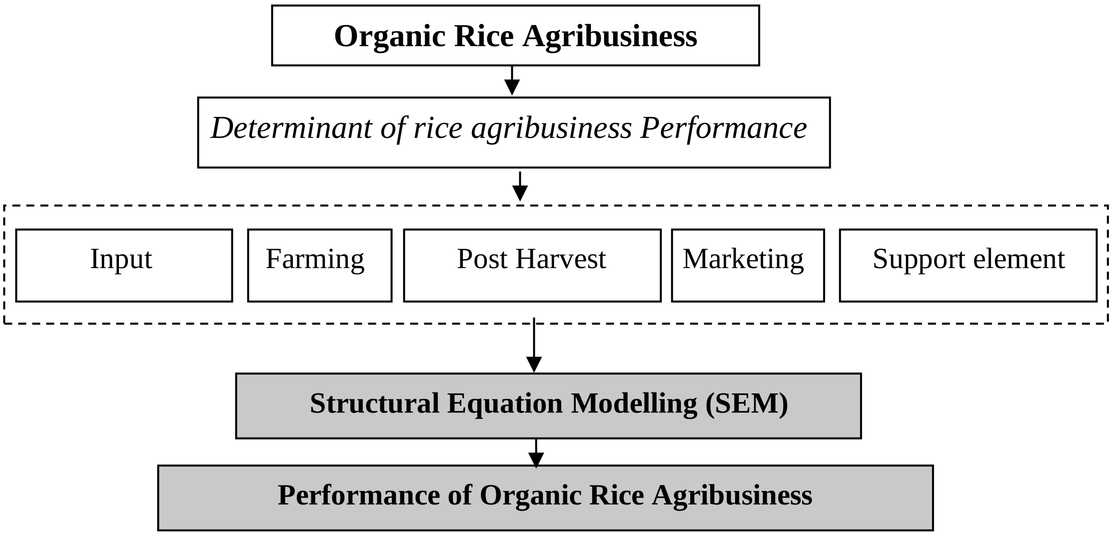

Figure 2. A conceptual framework

3. Results and Discussion

The sustainability agribusiness of organic rice was classified as good based on the results of the agribusiness index, with an average score of 3.63 (Table 2). Among the assessed subsystems, the marketing subsystem recorded the lowest performance index values. This finding aligns with the study by (Mubarok et al., 2025). Which reported that the marketing subsystem has a fair agribusiness index. To improve the performance of the marketing subsystem, strengthening farmers' bargaining position is needed, expanding market access, and increasing distribution efficiency so that marketing performance is more optimal. The performance of rice production in Lampung was also generally good (77.11%), although the marketing subsystem warranted particular attention.

The performance value of organic rice agribusiness in Lampung Province was obtained, as shown in Table 2. Organic rice agribusiness is an agricultural practice that integrates ecological rice cultivation patterns, taking into account environmental sustainability without using synthetic chemical fertilizers and pesticides. To encourage the growth of agribusiness performance, it not only depends on the application of proper cultivation but also on the influence of other agribusiness subsystems, such as inputs, post-harvest, marketing, and supporting elements. The determinant of organic rice performance consists of input, farming, post-harvest, marketing, and supporting elements.

Input subsystem

The input production subsystem is an economic activity that uses and produces production facilities, such as seeds, fertilizers, and pesticides (Rahim & Hastuti, 2005). This subsystem, organic rice farming, focuses on providing environmentally and sustainably produced inputs, organic standards. The performance of the production facilities subsystem received an average score of 4.10, categorized as Good. This indicates that most production facility components are able to support farming activities quite optimally. Seed and organic fertilizer variables provided excellent performance, meaning the seed variables were superior and the organic fertilizer was very adequate and available (Rahman et al., 2016). This is supported by the implementation of functional specialization in fertilizer provision, which has already been carried out by the Agung Makmur Farmers Group.

The availability of agricultural tools and machinery at the farmer level is considered

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

good, but not all farmers have tools and machinery that support cost-effectiveness and efficiency. Some farmers still use simple equipment from planting to harvesting. This is due to the limitations in knowledge, capital, and the capacity of farmers to individually carry out a series of organic rice agribusiness activities. The research by (Kusumawati et al., 2015) confirms that agricultural mechanization has proven capable of increasing production yields and time efficiency, but the main obstacles lie in accessibility, operational costs, and the lack of extension programs that promote the use of agricultural tools and machinery.

Irrigation is very important in organic farming systems, because irrigation on organic rice fields must be separate from non-organic farming irrigation to avoid damaging the organic principles of agriculture. Performance of irrigation is good and also supported by the plant-based pesticides, which are sufficiently available in terms of both quantity and quality, but not optimized. This finding aligns with (Kadar et al., 2016) research, which states that the performance of the production means subsystems play a significant role in the success of farming. Therefore, efforts to improve access to production inputs, especially in terms of agricultural mechanization, are a crucial priority for strengthening the competitiveness of the agricultural sector in the future.

Table 2. Synthesis of the achievement of organic rice agribusiness system performance in Lampung Province

Subsystem		Variable	Score		Performance
1. Input Production	X1.1	Tools and machinery	3.62		Good
	X1.2	Irrigation	4.06		Good
	X1.3	Seed	4.49		Excellent
	X1.4	Organic fertilizer	4.23		Excellent
	X1.5	Organic pesticide	4.10		Good
Total performance score of the Input Production subsystem				4.10	Good
2. Farming	X2.1	Variety selection	3.94		Good
	X2.2	Land area	4.36		Excellent
	X2.3	Cultivation technology	3.91		Good
	X2.4	Labour	3.34		Fair
Total performance score of the farming subsystem				3.77	Good
3. Post-harvesting	X3.1	Sorting and grading	3.51		Good
	X3.2	Quality	2.87		Fair
	X3.3	Storage	4.14		Good
	X3.4	Packaging	3.83		Good
Total performance score post-harvesting subsystem				3.66	Good
4. Marketing	X4.1	Ease of marketing	3.28		Fair
	X4.2	Partnership	2.71		Fair
	X4.3	Market information	2.90		Fair
Total performance score of the marketing subsystem				2.96	Fair
5.Supporting elements	X5.1	Government policy	3.00		Fair
	X5.2	University	3.85		Good
	X5.3	Counseling	4.03		Good
	X5.4	Capital	3.51		Good
Total performance score supporting elements subsystem				3.60	Good

Source: Primary data (2025)

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

Farming subsystem

The organic rice farming subsystem applies the principles of being good for the environment, sustainable, and non-chemical. The overall performance of the organic rice farming subsystem is good, with an average score of 3.77, indicating that organic cultivation practices are already being implemented, although they need strengthening. The Land indicator received the highest score and was categorized as Very Good (score 4.36), as most farmers manage their own land, making it a major strength and mediating variable connecting the entire agribusiness subsystem.

The land variable serves as a mediating factor that transforms the relationship between the upstream subsystem (input production) and the downstream subsystem (post-harvest and marketing). The average land for organic rice cultivation is 0.29 hectares. This falls into the category of smallholder farmers, with land ownership below 0.5 hectares. Many reasons why farmland conversion in developing countries increases continuously, boom population has been pressuring farmland, as well as a change of government policy for housing and industries (Adam et al., 2018).

The variety selection indicator (score 3.94) and technology application score 3.91 were rated as Good, indicating that farmers have selected organic derivative seeds and are beginning to adopt environmentally friendly technologies, although their application is not yet optimal. Limited knowledge and access to modern technology are constraints on agribusiness performance. Some farmers still rely on traditional methods that require more labor. Only a few farmers use modern technology in their farming business.

The transplant machine is only used by the Agung Makmur Farmers Group, while the farmer members do not use it because many rice seedlings fall over after planting due to their weak roots. Research by (Firdaus et al., 2024) explains that the application of modern cultivation technology in organic systems, such as the use of planting tools and environmentally friendly pest control, can increase crop yields by 15–25%. Therefore, it is necessary to improve farmer capacity with training, extension services, and access to organic technology innovations.

The fundamental weakness in the Labor indicator, which only performed Fair (score 3.34), is due to the labor-intensive nature of organic farming and constraints in labor availability, thus highlighting the need for mechanization and collective labor management to improve efficiency and productivity. The use of labor for organic rice is greater than for non-organic rice (Lestari et al., 2022). Labor performance is fair, which indicates that the availability of labor in organic rice cultivation is still a constraint. (Handayani et al., 2018), showing that the labor cost of organic rice farming is higher than that of non-organic farming. The restriction of Labor in the agricultural sector is often caused by the migration of young workers to non-agricultural sectors. As a result, most of the agricultural workforce is elderly, which impacts productivity.

Post-harvest subsystem

The post-harvest subsystem is part of the agribusiness system that focuses on activities after harvest, milling, and up to the point of being ready for market. The overall performance of the post-harvest and organic rice processing subsystems was good, with an average score of 3.66, but major weaknesses were still found in some aspects. The storage (score 4.14) and packaging (score 3.83) indicators show good performance, indicating that farmers have adequate storage facilities and are starting to pay attention to packaging, although not fully in line with modern market standards. Packaging has a positive effect on the Willingness to Pay of food products with eco-friendly packaging (Relawati et al., 2021). The sorting and grading indicator (score 3.51) is rated as Good, but not optimal, because it is still done traditionally, resulting in inconsistent production yields.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

The weakest point lies in the quality/traction indicator with the lowest score (2.87), which is categorized as fair. This reflects the limitations of farmers in utilizing modern mechanization tools for harvesting and processing, resulting in a lack of efficiency and a vulnerability to declining product quality. To carry out post-harvest activities, farmers do not use special equipment for sorting, and product packaging is carried out using only ordinary packaging without using vacuum packaging. Post-harvest losses, especially in remote areas due to poor roads (Natividad & Alvarez, 2025). It also necessitates intervention in providing facilities and road infrastructure.

Marketing subsystem

The marketing subsystem has an average score of 2.96, which indicates that the organic rice performance is fair, but it still has flaws that affect farmers' earnings. Despite the relatively strong performance of the ease of marketing indicator (score 3.28), farmers continue to encounter obstacles when trying to reach price-sensitive niche customers. With the lowest score (2.71), the partnership indicator showed that there were very few connections between farmers and business actors/institutions, which resulted in reliance on middlemen and inadequate price guarantees.

Most farmers in the research area use middlemen to market their produce. Reliance on middlemen prevents growers from capturing the fair price of their crops, as negatives who often take a huge share of the price in agricultural product marketing (Sudrajat et al., 2021). Most farmers have little access to data on actual market prices and demand, and they are in a weak bargaining position, making the Market Information indicator (score 2.90) also a low score. In general, low partnership and market information aspects are a critical issue that must be resolved by strengthening market access policies, logistics, facilitating fair partnerships, and accessing information technology. Strengthening market institutions is necessary to improve agribusiness performance. The technique can include partnership cooperation with modern markets to reach niche markets and using government policies for organic rice purchase quotas so that farmer institutions have a captive market.

Supporting elements subsystem

The performance of the agribusiness subsystem of supporting elements is the role of various support services that help ensure the smooth, efficient, and sustainable operation of farming activities. This subsystem includes government policies, research, university, counselling, and access to capital. In organic rice agribusiness, the performance of supporting elements providers can be assessed by the extent to which farmers receive technical assistance, easy access to capital, and relevant market information to improve productivity and competitiveness. The performance of the organic rice supporting elements subsystem is Good with an average score of 3.60, but this external institutional support is still not maximized. The Counseling indicator (score 4.03) performed as Good, with the effectiveness of farmer support despite limitations in the number of extension workers and the technical quality of extension implementation.

The University as a research institution indicator (score 3.85) was also rated as Good, with research results contributing to farmers' adoption of improved seeds, organic rice cultivation techniques, and post-harvest handling of organic rice products, although technology transfer to the field was still low. The main weaknesses in the government policy indicator (score 3.00) and capital access (score 3.51), both of which performed Fair. Institutional problems thought to constrain performance in traditional cooperatives (Dimas et al., 2022). This indicates that the implementation of subsidy and assistance policies has not been optimally felt by farmers, and that farmers still have difficulty accessing formal capital (micro credit), often forcing them to rely on informal loans and middlemen.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

Table 3. Cronbach's alpha, composite reliability, average variance extracted (AVE)

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Capital	0.853	0.910	0.772
Counseling	0.863	0.915	0.783
Ease marketing	0.876	0.915	0.730
Farming subsystem	1.000	1.000	1.000
Government policy	0.863	0.917	0.786
Input subsystem	1.000	1.000	1.000
Irrigation	0.838	0.891	0.673
Labor	0.917	0.920	0.743
Land area	1.000	1.000	1.000
Market information	0.846	0.897	0.686
Marketing subsystem	1.000	1.000	1.000
Organic fertilizer	0.900	0.915	0.732
Organic pesticide	0.879	0.913	0.725
Packaging	0.879	0.911	0.673
Partnership	0.885	0.921	0.745
Performance	1.000	1.000	1.000
Post harvest subsystem	1.000	1.000	1.000
Quality	0.782	0.871	0.693
Seed	0.871	0.909	0.715
Sorting	0.741	0.853	0.660
Storage	0.884	0.920	0.741
Supporting subsystem	1.000	1.000	1.000
Technology	0.889	0.930	0.816
Tool and machinery	0.919	0.943	0.805
University/research	0.764	0.858	0.668
Variety selection	0.867	0.908	0.713

Threshold set for Cronbach's Alpha >0.7, Composite Reliability >0.7, and AVE ≥0.5.

Performance of organic rice agribusiness shows good results in terms of production inputs (4.10), farming (3.77), post-harvest (3.66), and support elements (3.60), but faces significant challenges in the marketing subsystem (score 2.96), which only performs fairly. The main strengths in the ownership and management of excellent land, as well as the effectiveness of crop storage. However, the fundamental weaknesses hindering the sustainability and income of farmers are centered on three aspects: (1) weak market partnerships and information, (2) limited post-harvest quality/traction (mechanization), and (3) weak implementation of government policies and capital access. These results have not shown the most optimal performance, meaning that there are still many weaknesses in each subsystem that can run as expected. This is consistent with (Heryadi et al., 2018) statement that good agribusiness performance will be influenced by the development of the upstream agribusiness, agricultural, and downstream agribusiness, and the supporting services. Collective actions (farmers' groups) significantly improve market access and bargaining position, which impacts the performance of agribusiness (Noer et al., 2020). If this subsystem doesn't work, it will result in the failure of the agribusiness system.

 e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

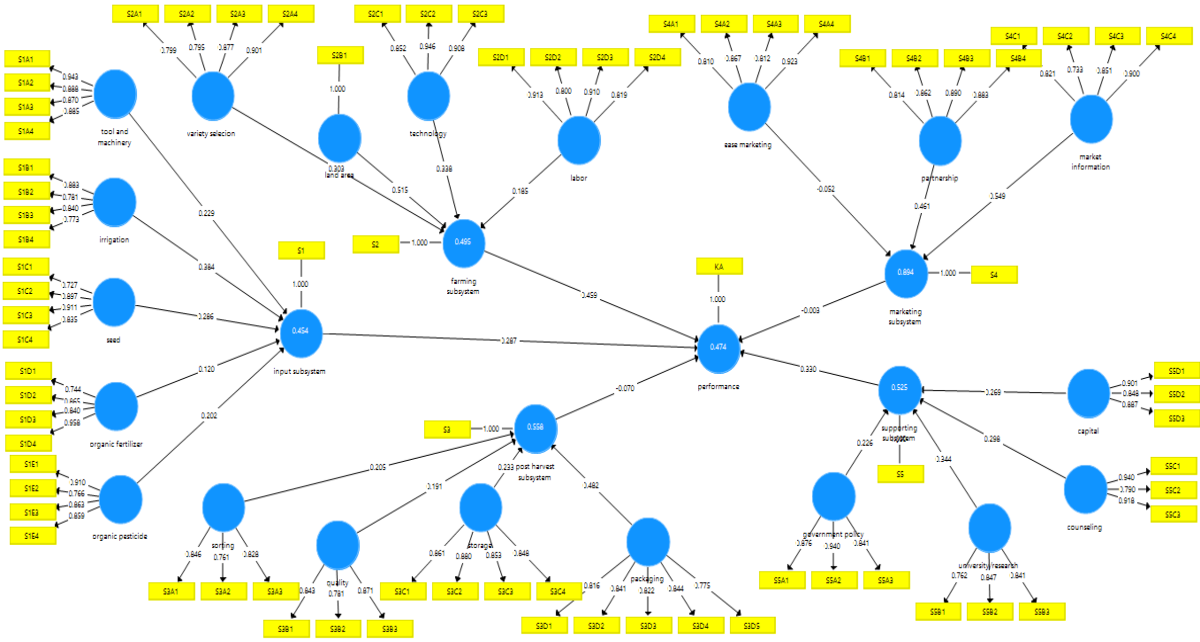

Figure 3. Resultant structural model

Determinant of Organic Rice Agribusiness in Lampung Province

PLS-SEM examines the constructs' predictive capabilities and causal relationships (Hair et al., 2023). The structural model consisted of twenty-six exogenous variables and one endogenous variable (Table 3). Table 3 shows Cronbach's Alpha and Composite Reliability of all latent constructs higher than a value of 0.7. The results indicated that all latent constructs were accurately measured by the measured variables and were reliable for the structural model. The convergent validity of all latent constructs of more than 0.50. In conclusion, latent constructs had convergent validity, meaning they were acceptable to explain the variance of measured variables.

Evaluating the measurement model is a crucial step in Structural Equation Model with SEM-PLS. The goal is to verify the quality of the relationship between latent variables (constructs) and the indicators used (Figure 3).

Table 4. Path coefficients and significance of agribusiness performance

Variable latent	Path coefficient	T Statistics	P Values
Input subsystem	0.287	2.089	0.037*
Farming subsystem	0.459	5.848	0.000*
Marketing subsystem	-0.003	0.029	0.977
Post harvest subsystem	-0.070	0.746	0.456
Supporting subsystem	0.330	2.239	0.026*
R^2	0.474		

Based on the results Table 4 obtained structural equation model of organic rice performance is as follows:

$$\eta 2 = 0.287\ \xi 1 * + 0.459\ \xi 2 * - 0.003\ \xi 3 - 0.070\ \xi 4 + 0.330\ \xi 5 *$$

The structural model in 3 shows R^2 of 0.454 for the input subsystem, 0.495 for the farming subsystem, 0.894 for the marketing subsystem, 0.558 for the post-harvest subsystem, 0.525 for the supporting

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

subsystem, and 0.474 for performance agribusiness, above 0.10 confirming the validity of the models (Falk & Miller, 1992). The performance variables of organic rice agribusiness have an R^2 value of 0.474. This means that 47.40% of the variation in organic rice agribusiness performance can be explained by the factors in the model, while the remaining 52.60% is influenced by other variables not analyzed. This value can be categorized as strong, indicating that the model used is sufficiently representative to describe the determinants of organic rice sustainability.

All agribusiness performance variables, namely input production Subsystem Performance ($\xi1$), Farming Subsystem Performance ($\xi2$), Post-Harvest Subsystem Performance ($\xi3$), Marketing Subsystem Performance ($\xi4$), and Supporting Element Subsystem Performance ($\xi5$), can determine the variation in Agribusiness Performance Variables. In evaluating the influence of exogenous variables on the variance of endogenous variables, the R^2 value should be higher than 0.10 (Falk & Miller, 1992).

The performance of the post-harvest subsystem and the marketing subsystem has no significant impact. The variables of Production Input Subsystem Performance ($\xi1$), Farming Subsystem ($\xi2$), and Supporting Element Subsystem Performance ($\xi5$) have a significant and positive relationship with the Agribusiness Performance Variable ($\eta2$). This indicates that in Lampung Province, the performance of the post-harvest and marketing subsystems does not support the performance of organic rice agribusiness.

This result aligns with the existing problems in the post-harvest subsystem, low quality/traction caused by farmers' limited use of mechanization and modern equipment (lowest score 2.87). This leads to dependence on manual labor, resulting in inefficiency, longer processing times, increased production costs, and a decline in product quality due to delayed handling. Another cause is the inconsistency in product quality due to the sorting and grading (quality determination) process still being done simply and manually (score 3.51). The packaging used is not yet up to modern market standards. This result is consistent with what was stated by (Gusti et al., 2021; Linda et al., 2018), that implementation of sorting and grading, traction, and packaging that meet standards can increase the selling price of the product by up to 20% - 30%.

If this component does not meet farmers' expectations and there is no good management improvement, then the performance of the organic rice post-harvest subsystem agribusiness is questionable. In the marketing subsystem, problems are also still being addressed, which is not very supportive of the performance of organic rice agribusiness. These include the majority of respondents stating that it is difficult to market products, the absence of a marketing institution specifically handling the marketing of organic rice, limited partnerships, and very limited marketing information. This problem is linked with rice production in Thailand. The Thai government had built up a policy to support rice production and network marketing. This led to a high of rice production through rice growing by investing in irrigation systems, infrastructure, and other pro-rice projects (Kerdnoi et al., 2014).

The support service performance variable has a positive and significant effect on the agribusiness performance variable. This indicates the variables of government policy, extension and training, universities as research institutions, the existence of farmer groups, and financial institutions. The government has encouraged the development of organic rice farming from its previous state, and other activities that boost agribusiness performance include extension and training to improve the performance of organic rice farming, and the role of universities in transferring knowledge and technology.

The theoretical contribution of this research lies in the development of an

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

agribusiness system integration model, where the performance of organic rice is not viewed in isolation but as a result of synergy between upstream and downstream subsystems. By using SEM, this research successfully constructed complex latent variables such as policy, partnership, and sustainability that are difficult to measure conventionally. As a result, this research provides a new theoretical foundation that the improvement of organic rice agribusiness performance highly depends on the strength of the systemic relationship structure between input supply management factors, farm management, and institutional supporting services.

4. Limitations and Future Directions

This study has several limitations that should be acknowledged for proper interpretation of the results. First, the research was conducted with a relatively small sample size of 50 certified organic rice farmers across four districts in Lampung Province. Although the SEM PLS approach is suitable for small samples, the findings may not fully capture the variability of organic rice agribusiness performance across other regions or production systems in Indonesia. Second, the study relies primarily on farmers' self-reported perceptions through Likert-scale questionnaires, which may introduce subjectivity or recall bias, particularly in evaluating subsystem performance. Third, the variables examined focus on the core components of the agribusiness system—input, farming, post-harvest, marketing, and supporting services while other relevant dimensions, such as social capital, innovation adoption, environmental performance indicators, and risk management, were not included in the current model. These omitted factors may also influence the sustainability of organic rice agribusiness.

Future studies should consider expanding the sample size and geographical coverage to include multiple provinces or national-level organic rice clusters for broader generalizability. Longitudinal research designs would also be beneficial to analyze changes in subsystem interactions and sustainability outcomes over time. Incorporating mixed methods such as qualitative interviews, value-chain mapping, and field-based environmental assessments could provide deeper insights into institutional dynamics, farmer behavior, and ecological impacts. In addition, future models may include advanced variables such as digital marketing adoption, climate resilience strategies, cooperative governance performance, and innovation readiness to better explain sustainability pathways in organic agribusiness systems.

5. Conclusion

The results of the organic rice agribusiness system in Lampung Province show good performance, with an overall score of 3.63 (72.7%). Input, farming, post-harvest, and supporting element subsystems showed good performance, while the marketing subsystem exhibited relatively lower performance. Strengthening market institutions into business units (cooperatives) can serve as aggregators that consolidate harvests both in quantity and quality. This will create economies of scale and improve farmers' bargaining power.

Despite its contributions, this study has several limitations. The relatively small sample size and its focus on certified organic rice farmers in selected districts of Lampung Province may limit the generalizability of the findings. In addition, the reliance on self-reported Likert-scale data may introduce subjectivity in assessing subsystem performance. Furthermore, the model focused on core agribusiness components, while other relevant dimensions such as social capital, innovation adoption, environmental performance, and risk management were not examined. Future research should expand the geographical scope and sample size, adopt longitudinal and mixed-methods approaches, and incorporate additional variables related to digitalization, climate resilience, and cooperative

 e-ISSN 2655-853X
https://doi.org/10.37637/ab.v9i1.2587

governance to provide a more comprehensive understanding of sustainability pathways in organic rice agribusiness systems.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors used generative AI tools to assist with grammar correction, sentence refinement, and structural organization. These tools did not contribute to the generation of scientific ideas, research design, methodology, data analysis, results interpretation, or conclusions. All content has been reviewed and validated by the authors, who take full responsibility for the accuracy and integrity of the manuscript.

Authorship Contribution Statement

Sri Handayani (Author 1st): conceptualization, methodology, data curation, formal analysis, investigation, visualization, writing - original draft, writing - review & editing. Wan Abbas Zakaria (Author 2nd): conceptualization, methodology, supervision, validation, & review. Novi Rosanti (Author 3rd): validation, investigation, and resources. Hamim Sudarsono (Author 4th): methodology, validation, supervision, investigation, and review. Dwi Haryono (Author 5th): investigation and review.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research is supported by the Ministry of Higher Education, Science, and Technology.

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