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Farmers' decision-making in adopting organic agriculture to support agricultural biosecurity

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La toma de decisiones de los agricultores en la adopción de la agricultura orgánica para apoyar la bioseguridad agrícola

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ABSTRACT

This study aims to analyze farmers' decision-making in adopting organic agriculture to support agricultural biosecurity at the farm level in rural areas. The research was conducted among 60 organic farmers in Ambon and Saparua Islands, selected through purposive sampling. A mixed-method approach was applied, combining qualitative analysis to contextualize agricultural biosecurity as farm-level practices for environmental protection, input safety, and sustainable production, with quantitative analysis using SEM-PLS to examine factors influencing adoption decisions. The results indicate that organic agriculture contributes to agricultural biosecurity by enhancing environmental protection, reducing chemical dependency, and supporting sustainable crop production. Quantitative findings reveal that community support and the availability of production inputs and marketing networks significantly influence farmers' decisions to adopt organic agriculture. Among these factors, the availability of inputs and marketing networks shows the strongest direct effect on adoption, indicating that access to resources and market connectivity plays a crucial role in strengthening farm-level biosecurity practices. Overall, the study highlights that farmers prioritize environmentally friendly, healthy, and high-quality agricultural production, and that strengthening institutional support and market access is essential to promote organic agriculture as a strategy for agricultural biosecurity in rural areas.

Keywords:
Agricultural biosecurity
Farmers' decision-making
Market access
Organic farming adoption
Sustainable agriculture

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RESUMEN

Este estudio tiene como objetivo analizar la toma de decisiones de los agricultores en la adopción de la agricultura orgánica para apoyar la bioseguridad agrícola a nivel de finca en zonas rurales. La investigación se realizó con una muestra de 60 agricultores orgánicos de las islas Ambon y Saparua, seleccionados mediante muestreo intencional. Se utilizó un enfoque de métodos mixtos, combinando un análisis cualitativo para contextualizar la bioseguridad agrícola como prácticas a nivel de finca orientadas a la protección ambiental, la seguridad de los insumos y la producción sostenible, con un análisis cuantitativo mediante SEM-PLS para examinar los factores que influyen en la adopción. Los resultados muestran que la agricultura orgánica contribuye a la bioseguridad agrícola al mejorar la protección del medio ambiente, reducir la dependencia de insumos químicos y fortalecer la producción sostenible. Los resultados cuantitativos indican que el apoyo comunitario y la disponibilidad de insumos y redes de comercialización influyen de manera significativa en la decisión de los agricultores de adoptar la agricultura orgánica. Entre estos factores, la disponibilidad de insumos y el acceso a los mercados presentan el efecto directo más fuerte, lo que resalta la importancia del acceso a recursos y la conectividad del mercado para reforzar las prácticas de bioseguridad a nivel de finca. En conjunto, el estudio evidencia que los agricultores priorizan una producción agrícola ecológica, saludable y de alta calidad, y que el fortalecimiento del apoyo institucional y del acceso al mercado es clave para promover la agricultura orgánica como una estrategia de bioseguridad agrícola en las zonas rurales.

Palabras clave:
Bioseguridad agrícola
Toma de decisiones de los agricultores
Acceso al mercado
Adopción de la agricultura orgánica
Agricultura sostenible

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Food safety and organic agriculture are crucial for creating a healthier and more sustainable food future. In this study, organic agriculture is not only viewed as an environmentally friendly farming system, but also as a farm-level strategy to enhance agricultural biosecurity by reducing chemical dependency, minimizing biological risks, and supporting safer food production. The benefits of organic farming are extensive, encompassing positive impacts on human health and food security, the environment, the economy, and society. This practice reduces exposure to chemical residues, improves soil quality and biodiversity, and creates sustainable economic opportunities (Tiwari 2023). By investing in both, the world can build a stronger, more equitable, and more sustainable food system for future generations. It ensures that food remains safe for consumption, as reflected in national food safety regulations, which align with internationally recognized principles of public health protection and sustainable food systems. Food safety requires a holistic approach that encompasses production, processing, and consumption, and is recognized globally as a critical public health priority. Organic agriculture is widely regarded as a method capable of producing healthier and more nutritious food (Yanti 2005). Organic food consumption patterns have become popular due to the increasing public awareness of the importance of a healthy lifestyle (Shaharudin et al. 2010; Andersen et al. 2022). Consumer preference for diets free from additives, preservatives, and synthetic dyes continues to increase; however, not all consumers have fully transitioned to organic agricultural products (Khorniawati 2014). In response to this growing demand, farmers have increasingly promoted organic agriculture by utilizing natural inputs as a strategy to enhance agricultural biosecurity and reduce potential risks to public health. Organic farming has expanded globally and in developing countries, including Indonesia, with increasing land area, farmer participation, and market demand over time (Ermalia et al. 2025).

The development of organic farming in Indonesia has shown a generally upward trend over the past decade, reflecting increasing certification, farmer participation, and production capacity. National statistics indicate a gradual but consistent expansion of organic agricultural land and the number of operators, driven by growing consumer awareness, environmental concerns, and policy support for sustainable agriculture. In addition, Indonesia's fertile natural resources provide strong potential for the international marketing of organic products, particularly fruits and spices (Najib et al. 2020).

Biosecurity is a key concept in sustainable agriculture because it is the first line of defense to protect plant and animal health and ensure food safety. This concept encompasses a set of measures and practices aimed at preventing the introduction, spread, and transmission of infectious diseases, pests, and other harmful biological agents into agricultural areas. The farm sector can operate more efficiently, resiliently, and environmentally with strong biosecurity. The knowledge gap is one of the most significant barriers farmers face in deciding to switch to or effectively implement organic farming. Although many farmers recognize its potential benefits, a lack of practical knowledge and credible information can hinder the adoption of this practice. This is exacerbated by the lack of equitable extension services and access to information, limiting the adoption and development of organic farming. Farmers accustomed to conventional methods often lack sufficient information about organic techniques, which makes them reluctant to adopt new approaches. Organic farming in Indonesia faces several challenges. One is farmers' limited land ownership. Another challenge is the unequal awareness of the importance of organic agriculture among farmers and farmer groups. Furthermore, limited organic farmland is often surrounded by conventional agricultural land. Moreover, farmers lack the knowledge and skills to implement organic farming methods, making it difficult without expert guidance. Island regions face distinct challenges in agricultural development, including geographic isolation, limited market access, and higher dependency on local social institutions. Within this context, Ambon and Saparua Islands provide a relevant setting for examining the implementation of organic agriculture in island environments. Ambon Island functions as a regional economic and administrative center with relatively better infrastructure and market connectivity, while Saparua Island represents a smaller and more peripheral island characterized by stronger reliance on community-based support systems and local networks. The selection of these two islands enables the study to capture variations in how community support, farmer decision-making, government support, and access to inputs and marketing networks shape the adoption of organic agriculture under different island conditions. Based on the description above, this study aims to analyze the factors influencing farmers' decisions to adopt organic agriculture in rural areas, particularly in relation to strengthening agricultural biosecurity at the farm level.

Research hypotheses

Based on the theoretical framework that emphasizes the role of individual decision-making, social influence, and structural support in shaping farmers' behavior, this study proposes the following research hypotheses: H1: Community support has a positive and significant effect on farmers' decision-making regarding the implementation of organic agriculture, H2: Government support has a positive effect on the implementation of organic agriculture, H3: The availability of agricultural inputs and marketing networks has a positive and significant effect on the implementation of organic agriculture, and H4: Farmers' decision-making has a positive and significant effect on the implementation of organic agriculture.

MATERIALS AND METHODS

This study was conducted in Ambon and Saparua Islands, Maluku Province, Indonesia, during September–October 2023. These locations were selected because they represent rural island-based agricultural systems where organic vegetable farming has been promoted as part of sustainable agriculture and agricultural biosecurity initiatives. Ambon Island represents a relatively more accessible island context, with better infrastructure, stronger market linkages, and more intensive interactions between farmers and government institutions. In contrast, Saparua Island reflects a more peripheral island setting, characterized by limited market access, higher transportation constraints, and a stronger reliance on local community networks. A total of 60 organic vegetable farmers were selected using purposive sampling. The sample size was considered adequate for Partial Least Squares Structural Equation Modeling (PLS-SEM), which is suitable for exploratory studies with relatively small sample sizes and complex model structures. The inclusion criteria were vegetable farmers who actively applied organic farming practices using natural inputs and were involved in initiatives supporting agricultural biosecurity. Data were collected using structured questionnaires and analyzed using a mixed-method approach. Qualitative analysis was applied to contextualize agricultural biosecurity practices and their relevance to organic farming systems, while quantitative analysis was conducted to identify the factors influencing farmers' decisions to adopt organic agriculture. Quantitative analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS software. This method enables the simultaneous estimation of measurement and structural models, allowing the assessment of relationships among latent variables, indicator reliability, and path significance. PLS-SEM was selected due to its robustness in handling non-normal data distributions and its suitability for small to medium sample sizes. Survey responses were measured using a five-point Likert scale, where 1 = "not good," 2 = "less good," 3 = "adequate," 4 = "good," and 5 = "very good." Higher scores indicate more favorable perceptions toward organic agriculture adoption and agricultural biosecurity practices. The selection of variables and indicators was based on a review of previous studies on organic farming adoption, agricultural innovation, and biosecurity practices, as well as field observations in the study area. The variables and their corresponding indicators are presented in Table 1 and illustrated in Figure 1. To ensure the robustness of the SEM-PLS model, validity and reliability tests were conducted. Convergent validity was assessed using outer loadings and average variance extracted (AVE), while internal consistency reliability was evaluated using Cronbach's alpha and composite reliability. Structural relationships were examined using path coefficients, *t*-statistics, and *p*-values obtained through bootstrapping procedures. Discriminant validity was assessed using the Fornell–Larcker criterion and cross-loadings to confirm that each latent construct shared more variance with its associated indicators than with other constructs in the model. The structural model was evaluated using a non-parametric bootstrapping procedure in SmartPLS version 3.0. This approach was applied to estimate the significance of the hypothesized relationships by generating t-statistics and *P*-values for the path coefficients. Bootstrapping is commonly used in PLS-SEM to provide robust inference without requiring normal data distribution assumptions.

Table 1. Study variables and indicators.

Variable	Indicator
Government Support (GS)	GS1: support the manufacture of organic fertilizer. GS 2: support the provision of biological pesticides. GS3: support environmental balance and public health for the consumption of organic products.
Community Support (CS)	CS1: support community-based organic agriculture. CS2: Participate in the development of organic agriculture through ideas and opinions.
Availability of Agricultural Production Inputs and Marketing Networks (APIMN)	APIMN1: availability of production facilities and infrastructure. APIMN 2: organic vegetable marketing network.
Farmer Decisions (FD)	FD1: Pay attention to the principles of health, ecology, justice, and protection. FD2: preserve and improve the health of the soil, plants, animals, humans, and the earth as one and inseparable unit. FD3: provide a good quality of life for everyone involved.
Implementation of Organic Agriculture (IOA) to Support Biosecurity	IOA1: environmentally friendly farming supports biosecurity. IOA2: reduce air, soil, and water pollution. IOA 3: improve health and productivity among flora, fauna, and humans. IOA 4: optimal, sustainable, and profitable utilization of natural resources, and sustainable for the benefit of the present and future generations.

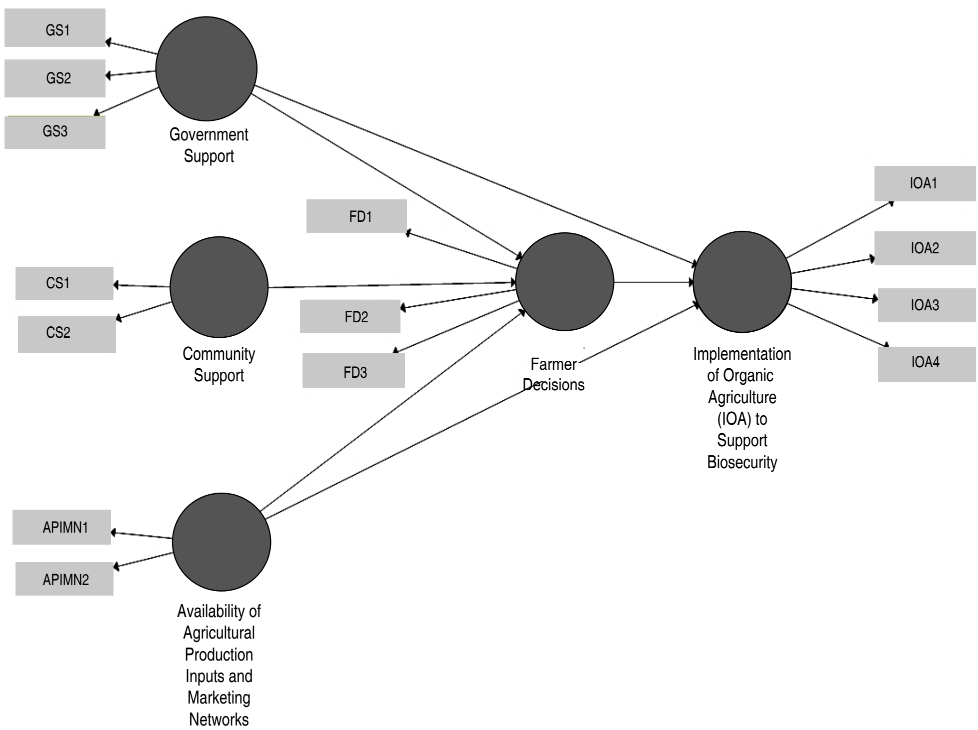

Figure 1. SEM-PLS modeling of factors affecting the implementation of organic agriculture. Source: Primary data.

RESULTS AND DISCUSSION

Profile of organic vegetable farmers

The characteristics of organic vegetable farmers in Ambon Island and Saparua Island are shown in Table 2. The characteristics of farmers are related to age, education level, size of business land, and experience in organic vegetable farming. Age is a condition where a person is categorized according to their age level, specifically as productive or unproductive. Organic vegetable farmers in Ambon Island and Saparua Island are classified as being of productive age. Farmers can produce according to their age level. The average age of farmers aged 41-51 years is 56.67%. Young farmers possess the physical and mental abilities necessary to perform their farming activities effectively.

Table 2. Distribution of respondents based on age, education level, land area, and farming experience.

Description	Number (People)	Percentage (%)
Age (years)		
30-40	8	13.33
41-51	34	56.67
52-62	13	21.67
>62	5	8.33
Total	60	100
Education		
Elementary School	7	11.67
Junior High School	25	41.67
High School	28	46.67
Total	60	100
Land Area (ha)		
<0.5	48	80.00
0.5 – 1	10	16.67
>1	2	3.33
Total	60	100
Farming Experience (years)		
<4	25	41.67
4 - 6	32	53.33
>6	3	5.00
Total	60	100

The current agricultural workforce tends to be less physically productive than the older generation, resulting in limited physical capacity for farming activities. In contrast, individuals of productive age generally exhibit stronger motivation to develop their farming enterprises, as higher economic needs encourage them to adopt more effective and efficient farming practices compared to relatively older farmers. The younger a person is, the more enthusiastic they are about learning about things they do not yet know, so they will try to be faster in adopting innovations, even though they are not experienced in doing so (Zhang et al. 2024). One of the factors that can affect a person's ability and knowledge is education. The higher a person's level of knowledge, the higher their ability to adapt to changes. Generally, individuals with higher levels of formal or informal education tend to have broader insights. The education level of organic vegetable farmers ranges from elementary school to high school, with 46.67% holding a high school education. Organic agriculture farmers tend to have a relatively good level of education, which aligns with previous research showing that higher educational attainment is positively associated with the adoption of organic farming and other sustainable agricultural innovations. For example, studies have found that education and knowledge significantly influence farmers' attitudes and decisions toward adopting organic practices, as more educated farmers are better able to access information, understand production requirements, and adopt environmentally friendly practices compared to less educated counterparts (Prodhan et al. 2023). Managing organic vegetable farming requires precision and patience from farmers. Farmers must make their own organic fertilizers and plant pesticides and then apply them to the farmland.

Land area is the mainstay for developing organic vegetable farming. The average farmer's own is less than 0.5 ha, accounting for 80%. Farmers have their land for developing organic vegetable farming. This is important because farmers do not work or rent other people's land to cultivate organic vegetables, making it easier for farmers. Land utilization is optimal because several business group members do everything personally and assist, from land clearing and land processing to planting. The land for farming is quite large if it is to be cultivated sustainably; however, there is limited labor available for land clearing and processing. Therefore, farmers work the land for organic vegetable cultivation effectively and efficiently, considering the availability of land and their own abilities.

Organic vegetable development has been implemented in Ambon Island and Saparua Island since 2015 (Timisela et al. 2021). Information about organic vegetable cultivation was obtained from online media. The harvest results were encouraging, so farmers were enthusiastic about expanding their business operations. Thus, the experience of organic vegetable farming is still relatively new, with less than 4 years' experience, as well as experience between 4 and 6 years, accounting for 41.67 and 53.33%, respectively. Organic vegetable farming supports several Sustainable Development Goals, particularly SDG 1 (No Poverty) through improved farmer livelihoods, SDG 3 (Good Health and Well-being) by reducing chemical exposure, and SDG 12 (Responsible Consumption and Production) through environmentally sustainable farming practices.

Sustainability of organic farming in Maluku

Organic farming is an environmentally friendly cultivation system. It encourages farmers to care more about the environment in every farming activity (Charina et al. 2018; Nasirudin et al. 2021). Public awareness of the importance of health and the environment has indeed driven the popularity of organic farming. People are increasingly seeking foods that are more natural and freer from pesticide residues and other synthetic chemicals. In addition, organic farming is also considered more environmentally friendly because it does not damage the soil and biodiversity. High-quality organic fertilizers can enhance plant health, reduce susceptibility to pests and diseases, and minimize the need for pesticides. Healthy soil with a diverse population of microorganisms can also help suppress the development of soil pathogens. By paying attention to the essential aspects of organic fertilizers and pesticides, the organic farming system can operate optimally, producing healthy and safe products for consumers while preserving the environment.

Organic agriculture is recognized as an approach that supports sustainable food production by minimizing chemical inputs and mitigating adverse impacts on natural resources while addressing global challenges such as environmental degradation and food security (Cidón et al. 2021). The study's results by Hasyim et al. (2025) show a positive impact of community service activities in Haria Village. Increasing farmers' knowledge of organic farming technology and making organic fertilizers is crucial. This indicates that farmers in Haria Village increasingly understand more sustainable and environmentally friendly agricultural practices. Their ability to produce organic fertilizers independently also has the potential to reduce dependence on chemical fertilizers and reduce production costs. Overall, these findings hold promise for the development of organic farming in Haria Village and may serve as a model for other villages in the Maluku region.

The sustainability of organic farming in Maluku is crucial for protecting the environment and supporting the local economy. Organic agriculture in Maluku emphasizes the use of organic fertilizers, natural pest control, and garden hygiene management, guided by the principle of *kalesang* (maintaining, organizing, and preserving). This helps mitigate negative environmental impacts and enhances the quality of agricultural products.

Organic farming supports food security by ensuring the availability of healthy and safe food. Organic farming is a sustainable approach to producing agricultural products in Maluku, which protects the environment and supports the local economy. With the use of local wisdom and support from various parties, organic farming can be an ideal agricultural model in the future. The environment is also protected, which contributes to sustainable environmental management. The action of biosecurity in agriculture is presented in Figure 2.

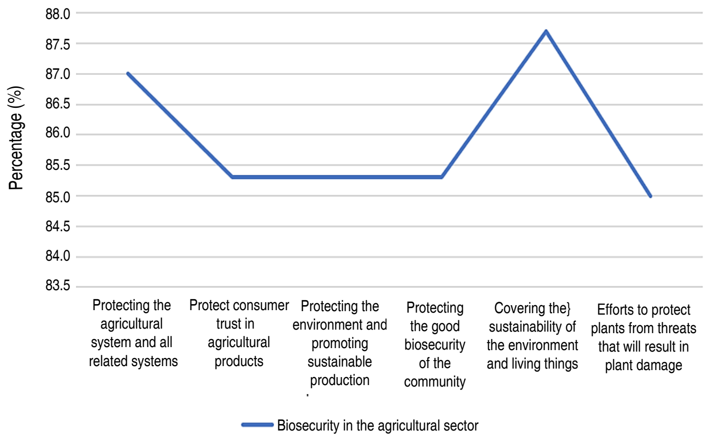

Figure 2. Biosecurity measures in the agricultural sector on the Ambon and Saparua Islands. Source: Primary data.

Figure 2 shows that 87% of farmers' responses emphasized the importance of protecting the agricultural system. This reflects the meticulous efforts of farmers to maintain focus on organic agriculture, ensuring the system remains free from contamination by non-organic cultivation methods. Consistent attention to organic farming is essential for sustainability. An 85.33% response rate shows the importance of consumer trust in agricultural products, which grows when the dedication of farmers is evident. This trust strengthens the relationship between producers and end users, ensuring confidence in agricultural outputs. Therefore, biosecurity measures are essential for the development of sustainable organic agriculture. Organic agriculture, when appropriately implemented, fosters consumer trust in farmers. This trust is crucial as the demand for organic vegetables has increased across socio-economic classes, including lower, middle, and upper groups. The rising popularity of organic vegetables is evident in both traditional and modern markets. The demand for vegetables in Ambon City has been increasing, driven by greater public awareness of the health benefits (Timisela et al. 2018). Similarly, Grzywińska-Rąpca et al. (2025) stated that consumers purchase organic food because they believe it is healthier, tastier, fresher, and environmentally friendly.

Communities that engage in agricultural activities often face various threats that can damage crops and other natural resources essential for the community's biological resilience; therefore, it is crucial to implement a biosecurity system (Nahumury and Ndoen 2015). Biosecurity plays a crucial role in protecting the environment and promoting sustainable production. The assertion is supported by 85.3% of respondents in a survey who affirmed that biosecurity in agriculture protects the environment and promotes sustainable practices. These benefits apply to all types of crops cultivated by farmers. Proper advancements in organic agriculture have a positive influence on the surrounding natural environment, thereby improving the quality of other crops. Organic farming is a sustainable practice that minimizes the environmental and ecological impact of agriculture. Using more organic matter in agricultural practices can reduce the adverse environmental effects by preserving natural cycles during the recovery process. Organic farming may also enhance food quality (Gamage et al. 2023). Organic farming is one such approach that should be practiced attaining the goal of sustainable agriculture. Organically cultivated food products have gained popularity due to their numerous health benefits (Soni et al. 2022).

Using organic fertilizers in organic agriculture significantly benefits the sustainability of ecosystems in the surrounding environment. These fertilizers, composed of natural materials such as animal waste, including cow, chicken, and goat manure, were produced by farmers who raised these animals. Implementing biosecurity measures on livestock farms, particularly during pre-production, is essential. The measures prioritize cleanliness to ensure well-being and integrate broader practices that harmonize the care of animals, plants, and the environment. Organic agriculture operates on the principles of health, ecology, justice, and protection, as outlined by Karyani et al. (2019). The health principle emphasizes that agricultural activities should preserve and enhance the well-being of soil, plants, animals, the earth, and humans, recognizing their interconnectedness.

This farming approach aligned with life's natural cycles and ecological systems, ensuring fairness among humans and other living organisms. Achieving practical organic agriculture requires careful and responsible management to safeguard the health and well-being of both present and future generations. It is important to acknowledge that crop diversity is a hallmark of organic agriculture. In contrast to conventional farming, which often relies on monoculture—the mass production of a single crop—organic farming frequently adopts polyculture, where multiple crops are cultivated on the same land (IFOAM 2010). Polyculture supports beneficial insects, soil microorganisms, and other elements that enhance soil health (Sharma 2024). Furthermore, crop diversity helps preserve species near agricultural areas, preventing extinction and promoting ecological balance.

Potential benefits associated with a cross-sectoral biosecurity approach

A cross-sectoral biosecurity method offered significant benefits, including improved public health, enhanced inter-village trade, increased agricultural production, and strengthened environmental protection. According to Figure 3, these benefits outlined the importance of integrating biosecurity measures across different sectors. Organic farming is designed to produce high-quality, nutritious food supporting health and well-being. Therefore, using fertilizers, pesticides, veterinary drugs, and food additives with diverse health effects should be avoided. In Maluku, biosecurity and organic farming are intertwined and essential to improving the welfare of farmers and the environment. Biosecurity helps prevent diseases and pests in crops, while organic farming utilizes natural methods to manage these issues without the use of chemical pesticides. The combination of the two can produce healthier and more sustainable agricultural products. By combining effective biosecurity measures with the application of organic farming principles, farmers in Maluku can produce healthier, more environmentally friendly, and higher-value agricultural products.

Promoting public health is a crucial initiative to foster healthier lifestyles within families. Organic agriculture practiced by farmers on the Ambon and Saparua Islands represented a practical approach to biosecurity, which aimed to enhance community health. Gradually, these communities have come to recognize the health benefits of consuming organic foods. Local vegetable farmers employed soil- and water-based cultivation methods, adopting a rural farming model inspired by urban agricultural technologies.

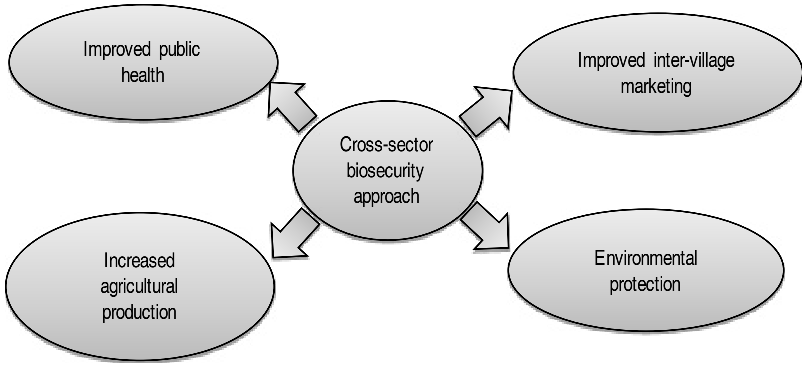

Figure 3. Potential benefits associated with a cross-sectoral biosecurity approach (FAO 2007).

Organic products are free from synthetic chemicals, which can accumulate in the body over time and pose health risks. Preventive measures, such as adopting an organic diet, are cost-effective and efficient in reducing the likelihood of illness, making organic consumption a viable and appealing option. According to Regulation

No. HK. 00.06.52.0100 of the Head of the Indonesian Food and Drug Authority (BPOM) on the Supervision of Organic Processed Food, organic food is derived from agricultural systems that adhere to an integrated and balanced ecosystem. The growth of organic farming reflects increased awareness of environmental conservation, food safety, and health (Durbul et al. 2021; Kasih 2020).

Agricultural business actors should uphold environmental protection and awareness. In this context, environmentally friendly agricultural practices ensure that products are harvested, consumed, and distributed safely, healthily, and high quality. Biosecurity's main objective is to prevent, control, and manage risks to life and health within the sector. Consequently, it plays a crucial role in sustainable agricultural development.

The ecological principle situates organic agriculture within the environmental system of life. It emphasized that production should be based on ecological processes and cycles. Food and well-being are derived from the ecology of a specific production environment. For instance, plants require fertile soil, animals need a well-functioning farm ecosystem, and aquatic organisms, including fish, depend on a healthy aquatic environment. Organic agriculture, livestock farming, and the harvesting of wild products should adhere to natural ecological cycles and balances. While these cycles are universal, their application is site-specific. Organic management practices should be adapted to local conditions, ecology, culture, and scale. Input materials must be minimized through reuse, recycling, and efficient management of resources and energy to maintain, improve, and protect natural resources. Organic agriculture promotes ecological balance by fostering farming systems, habitat development, and preserving genetic and agricultural diversity. Producers, processors, marketers, and consumers of organic products should collectively work to protect and benefit the environment, encompassing soil, climate, habitats, biodiversity, air, and water.

Improved human health and well-being are the ultimate outcomes of a biosecurity system that bridges the gap between agriculture and health. Poor agricultural or food production practices can create biosecurity threats, directly impacting public health and food safety. The benefits of a more harmonized and integrated approach are evident in various national contexts. A holistic method would help avoid inconsistencies, close gaps, prevent unnecessary trade barriers, and protect human health and consumer confidence in agricultural products.

Analysis of factors influencing farmers' decisions in the implementation of organic agriculture

The factors influencing farmers' decisions to implement organic agriculture include government and community support, as well as the availability of production inputs and marketing networks (Figure 4). Analysis shows that community support is a key factor in these decisions. This is especially important in the study area, where the community prioritizes health by consuming organic food. Community support includes backing for community-based organic agriculture and active participation in its development through ideas and suggestions. Community support in this study extends beyond general social encouragement and is reflected in several concrete forms observed during fieldwork. Farmer groups play a central role in facilitating peer learning, where experienced farmers share knowledge on organic cultivation techniques, compost production, and pest management with other group members. This informal knowledge exchange reduces uncertainty and increases farmers' confidence in adopting organic practices.

In addition, community support is manifested through collective activities such as joint production of organic fertilizers, shared use of farming tools, and coordinated planting schedules. These practices not only lower individual production costs but also strengthen mutual trust among farmers, which is particularly important in island contexts characterized by limited access to external inputs.

Government support was not statistically significant. This finding can be explained by the specific socio-economic and institutional context of the study area, limited access to information, bureaucratic procedures, and the lack of sustained technical assistance reduce the effectiveness of government interventions at the farm level. In island contexts characterized by geographic dispersion and logistical constraints, informal support mechanisms such as farmer groups, peer learning, and collective input production appear to play a more immediate and practical role in influencing farmers' behavior. Therefore, the non-significant effect of government support does not indicate its irrelevance, but rather highlights the need for more consistent, context-sensitive, and integrated policy interventions to support organic agriculture in island regions.

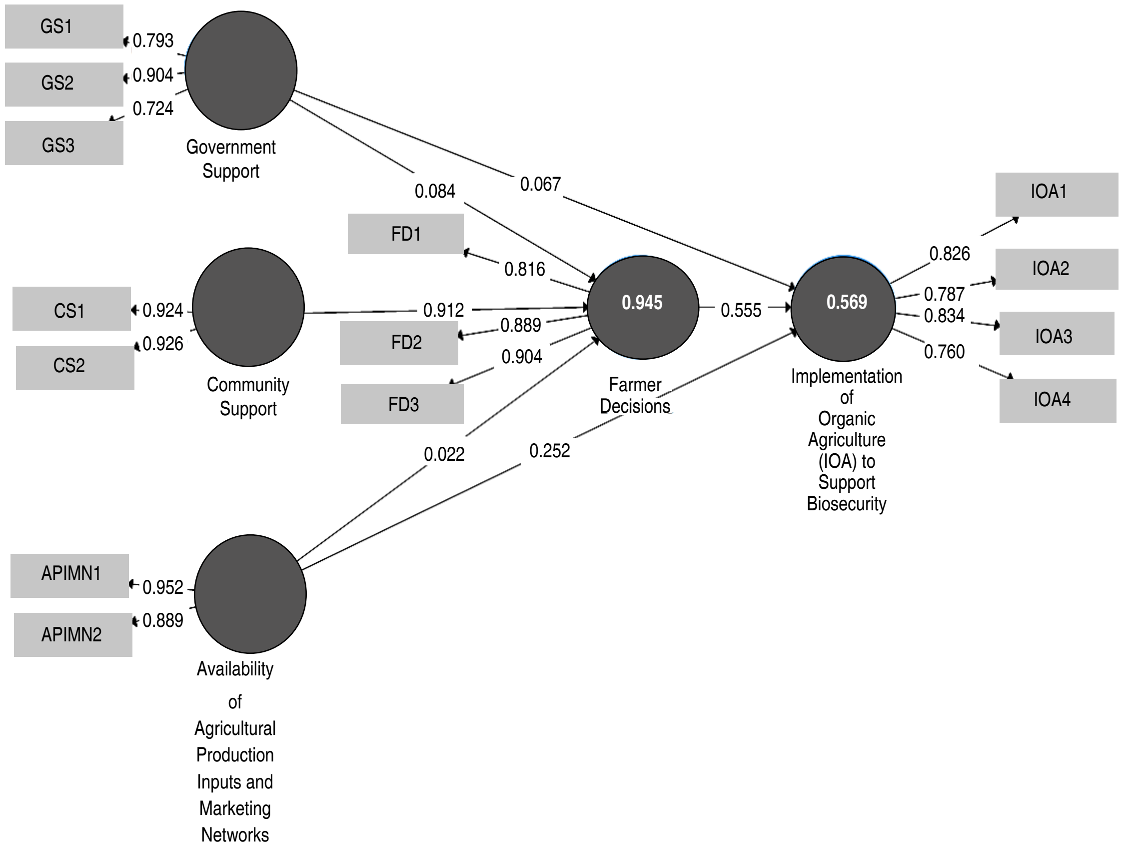

Figure 4. Loading factor values (outer path), path coefficients (inner path), and R-squares are standard values in the model. Source: Primary data.

The model measurement adopted reliability and validity analysis. Reliability analysis was conducted using Cronbach's Alpha, with a minimum acceptable value of 0.7 and an ideal range of 0.8 to 0.9. Additionally, the composite reliability (ρc) value was utilized, interpreted similarly to Cronbach's Alpha. Each latent variable was required to account for at least 50% of the variance of its indicators. Consequently, the absolute correlation between a latent variable and indicators must exceed 0.7, as reflected by the outer standard loadings. The Cronbach's Alpha and Construct Reliability values are presented in Table 3. Cronbach's Alpha represents the lower bound of a construct's reliability, whereas composite reliability provides a more accurate estimate of internal consistency. Composite reliability was generally regarded as a superior metric for assessing the internal consistency of a construct. According to the rule of thumb proposed by Ghozali (2016), a composite reliability value exceeding 0.7 and a Cronbach's Alpha value greater than 0.7 were deemed satisfactory. The analysis showed that all Cronbach's Alpha and Construct Reliability values exceeded the threshold of 0.7.

Discriminant validity was evaluated using the Fornell-Larcker criteria and the cross-loadings method. The Fornell-Larcker criterion posits that a latent variable should account for more variance in its indicators than in other latent variables. Statistically, this implied that the Average Variance Extracted (AVE) value of each latent variable should exceed the highest squared correlation

Table 3. Construct reliability and validity values.

	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted
Community Support (CS)	0.831	0.831	0.922	0.855
Government Support (GS)	0.737	0.779	0.850	0.656
Farmers' Decisions (FD)	0.841	0.856	0.904	0.758
Availability of agricultural production Inputs and Marketing Networks (APIMN)	0.828	0.925	0.918	0.848
Implementation of Organic Agriculture (IOA) to support biosecurity	0.816	0.821	0.878	0.644

(Ω^2) value with other latent variables. Table 4 presents the root AVE values for each construct, signified in bold. These values were compared with the squared correlation values of the model, which showed an R^2 value of 0.569 (Table 5).

Table 4 showed that the root AVE scores of all variables surpassed the R^2 value, confirming their validity for further testing. The R^2 value of 0.569 was categorized as moderate, indicating that the combined effects of farmer decision-making, community support, government support, and the availability of agricultural inputs and marketing networks explained 56.9% of the variance in the implementation of organic agriculture. The remaining 44.1% was attributed to factors not included in the study model.

Table 4. Fornell-Larcker criterion values.

	Community Support	Government Support	Farmers Decisions	Availability of agricultural production Inputs and Marketing Networks	Implementation of Organic Agriculture
Community Support (CS)	0.93	-	-	-	-
Government Support (GS)	0.56	0.81	-	-	-
Farmers' Decisions (FD)	0.97	0.60	0.87	-	-
Availability of agricultural production Inputs and Marketing Networks (APIMN)	0.48	0.33	0.48	0.92	-
Implementation of Organic Agriculture (IOA) to support biosecurity	0.69	0.49	0.72	0.54	0.80

Table 5. Nilai R Square.

Latent variable	*R*-square
Implementation of Organic Agriculture (IOA) to Support Biosecurity	0.569

The structural model analysis in this study was continued using the bootstrapping method in SmartPLS version 3.0, with a significance level of 0.05. To determine the direction of the relationship between variables, a one-way (one-tailed) test was used. The t-statistic value should be above 1.64 for one-tailed hypothesis testing (Jogiyanto 2011).

Table 6 shows that community support, farmer decisions regarding the implementation of organic agriculture, and the availability of agricultural production inputs and marketing networks all have a positive influence on organic agriculture practices. Bootstrapping was adopted to assess the significance or probability of direct, indirect, and total effects. Additionally, it evaluated the significance of other values, including R-squared, Adjusted R-squared, F-statistic, outer loading, and outer weight. The complete PLS-SEM bootstrapping method analyzed all values within the PLS framework to generate probability values (Figure 5).

Table 6. Path coefficient value of the bootstrapping results.

Construct	Original Sample	Sample Mean	Standard Deviation	t-Statistic	P-Values
Availability of Agricultural Production Inputs and Marketing Networks (APIMN) -> Farmer Decisions (FD)	0.022	0.028	0.047	0.464	0.643
Availability of Agricultural Production Inputs and Marketing Networks (APIMN) -> Implementation of Organic Agriculture (IOA) to Support Biosecurity	0.252	0.248	0.113	2.238	0.026
Community Support (CS) -> Farmer Decisions (FD)	0.912	0.902	0.044	20.946	0.000
Farmer Decisions (FD)-> Implementation of Organic Agriculture (IOA) to Support Biosecurity	0.555	0.579	0.139	3.993	0.000
Government Support (GS) -> Farmer Decisions (FD)	0.084	0.094	0.057	1.483	0.139
Government Support (GS) -> Implementation of Organic Agriculture (IOA) to Support Biosecurity	0.067	0.044	0.178	0.379	0.705

The path coefficient ranges from -1 to +1, with values closer to +1 signifying a stronger positive relationship, while those nearing -1 suggest a stronger negative relationship (Sarstedt et al. 2022). The community considers consuming organic vegetables healthier and of higher quality than non-organic alternatives. This preference for organic food is associated with health benefits and improved quality of life. Consequently, farmers' decisions to implement organic agriculture play a critical role in meeting this demand. The availability of inputs and marketing networks is also vital, as organic inputs are essential for production, and a consistent marketing network motivates farmers to expand organic agriculture output. Through organic farming, farmers and consumers will gain significant benefits for both their health and economic sustainability. This is supported by research from Sarstedt et al. (2022) and Widiarta et al. (2011), which demonstrates that organic farming practices have been proven to have a positive impact on the economic sustainability of farmers. The p-values for each construct—community support for farmer decisions, farmer decisions for implementation

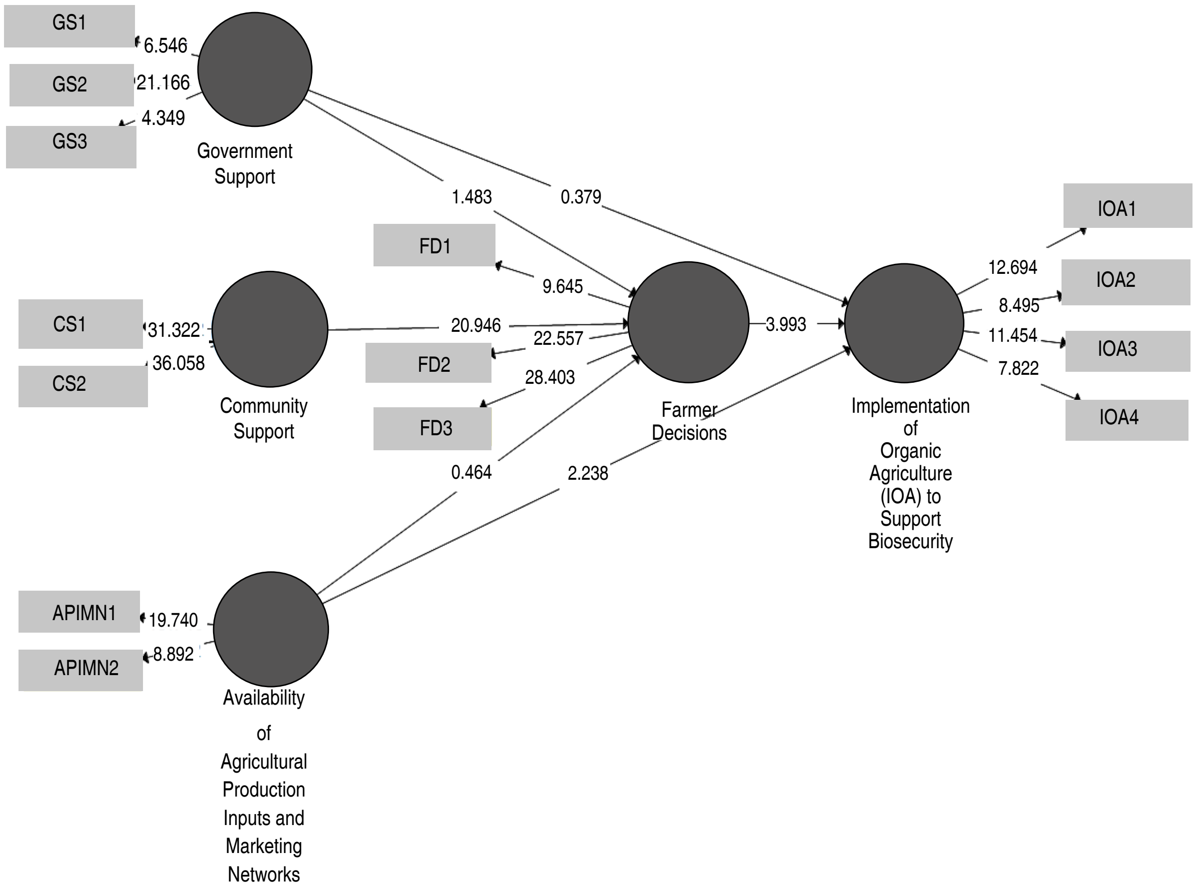

Figure 5. Bootstrapping t-value between constructs (Inner model). Source: Primary data.

of organic agriculture to support biosecurity, availability of agricultural production inputs and marketing networks for implementation of organic agriculture, —are 0.000, 0.000, and 0.026, respectively, all of which are below the 0.05 threshold. Therefore, this indicates that the direct influence of agricultural input availability and marketing networks on the implementation of organic agriculture is statistically significant.

CONCLUSION

The results indicate that the model has a moderate explanatory power, with 56.9% of the variation in the implementation of organic agriculture explained by farmer decision-making, community support, government support, and the availability of agricultural inputs and marketing networks. The findings further confirm that community support, farmer decision-making, and the availability of inputs and marketing networks have a statistically significant direct influence on the implementation of organic agriculture. This suggests that organic farming adoption is shaped not only by individual farmer choices but also by broader social and market-related factors.

These findings provide important practical and policy implications, particularly for island contexts where farmers often face geographic isolation and limited access to markets and inputs. At the practical level, strengthening farmers' decision-making capacity through training and peer learning within farmer groups can enhance the adoption of organic practices. Community-based support systems are also crucial in sustaining farmers' commitment to organic agriculture under constrained conditions. From a policy perspective, improving access to organic inputs and strengthening local marketing networks should be prioritized to support organic agriculture development in island regions. Government interventions that integrate extension services, community empowerment, and market facilitation can help reduce structural barriers and improve the long-term sustainability of organic farming. Therefore, promoting organic agriculture in island contexts requires not only technical solutions but also supportive institutional and market frameworks.

CONFLICT OF INTERESTS

The authors declare no potential conflicts of interest.

REFERENCES

Andersen JLM, Frederiksen K, Raaschou-Nielsen O et al (2022) Organic food consumption is associated with a healthy lifestyle, socio-demographics and dietary habits: A cross-sectional study based on the Danish diet, cancer and health cohort. Public Health Nutrition 25(6):1543–1551. https://doi.org/10.1017/S1368980021001270

Charina A, Kusumo RAB, Sadeli AH and Deliana Y (2018) Factors affecting farmers in applying standard operational procedure (SOP) of organic farming system in Bandung Barat Regency. Journal Penyuluhan 14(1):68–78. https://doi.org/10.25015/penyuluhan.v14i1.16752

Cidón CF, Figueiró PS and Schreiber D (2021) Benefits of organic agriculture under the perspective of the bioeconomy: A systematic review. Sustainability 13(12): 6852. https://doi.org/10.3390/su13126852

Durbul A, Fertő I and Zaien S (2021) Is organic food good for health and the environment? Regional and Business Studies 13(2):11–30. https://doi.org/10.33568/rbs.2919

Ermalia S, Noer I and Nuryanti NS (2025) Potential and challenges of organic rice development in Pringsewu Regency, Lampung: A review of secondary data to support local food security. ICCMS (Proceeding International Collaborative Conference on Multidisciplinary Science). 2(2):109-117. https://doi.org/10.70062/iccms.v2i2.143

FAO (2007) FAO Biosecurity Toolkit. Italy.

Gamage A, Gangahagedara R, Gamage J et al (2023) Role of organic farming for achieving sustainability in agriculture. Farming System 1(1):100005. https://doi.org/10.1016/j.farsys.2023.100005

Ghozali I (2016) Multivariate analysis application with IBM SPSS 23 program. 8th ed. Diponegoro University Publishing Agency.

Grzywińska-Rąpca M, Grzybowska-Brzezińska M, Jakubowska D and Banach J K (2025) The perception of organic food characteristics and the demographic and social profile of consumers: A Study of the polish market. Foods 14(2): 308. https://doi.org/10.3390/foods14020308

Hasyim DM, Nuswantoro P, Rijal S, Anwar S and Rachman A (2025) Organic farming innovation: Building public awareness of the health and environmental benefits of organic farming. Journal Sikapatau. 2(2):1-17. https://doi.org/10.61220/jsipakatau.v2i2.251

IFOAM EU Group (2010) Working for organic farming in Europe. Annual Report. International Federation of Organic Agriculture Movements EU Group.

Jogiyanto H (2011) Concept and Application of Variant-Based Structural Equation Modeling (SEM) in Business Research. Yogyakarta: UPP STIM YKPN.

Kasih AP (2020) Is Organic Food Healthier? https://edukasi.kompas.com/read/2020/08/12/193000371/benarkah-pangan-organik-lebih-sehat-ini-penjelasan-pakar-unair?page=all

Karyani T, Arifin F, Hapsari H and Supriyadi E (2019) Organic Rice Farming For Sustainable Development in The Nurani Sejahtera Farmers Group. IOP Conf. Series: Earth and Environmental Science. 306. https://doi.org/10.1088/1755-1315/306/1/012013

Khorniawati M (2014) Organic agricultural products in Indonesia: A review of Indonesian consumers' preferences towards organic agricultural products. Journal of Chemical Information and Modeling 8(2):171–182. https://journal.trunojoyo.ac.id/kompetensi/article/view/657

Nahumury GAF and Ndoen ML (2015) Biosecurity supporting the livelihoods of the Kanike community, North Seram, Maluku. Kritis 24(2):140–59. https://doi.org/10.24246/kritis.v24i2p140-159

Najib M, Sumarwan U and Septiani S (2020) Organic food market in Java And Bali: Consumer profile and marketing channel analysis. Buletin Ilmiah Litbang Perdagangan 14(2): 283-304. https://doi.org/10.30908/bilp.v14i2.447

Nasirudin M, Faizah M, Rahman AK and Tijanuddaroro MW (2021) Training on yard land utilization and kitchen waste processing as liquid organic fertilizer. Jumat Pertanian: Jurnal Pengabdian Masyarakat 2(1):12–15. https://doi.org/10.32764/abdimasper.v2i1.1148

Prodhan FA, Afrad MS, Haque ME, Hoque MZ et al (2023) Factors driving the adoption of organic tea farming in the northern region of Bangladesh. Research in Globalization 7(100145). https://doi.org/10.1016/j.resglo.2023.100145

Sarstedt M, Ringle CM and Hair JF (2022) Partial least squares structural equation modeling. Pp 587–632 in Handbook of Market Research, edited by Homburg C, Klarmann M and Vomberg A. Springer.

Shaharudin MR, Pani JJ, Mansor SW and Elias SJ (2010) Factors affecting purchase intention of organic food in Malaysia's Kedah State. Cross-Cultural Communication 6(2):105–116. http://www.cscanada.net/index.php/ccc/article/view/j.ccc.1923670020100602.013

Sharma R (2024) Benefits and Challenges of Polyculture: A Comprehensive Summary. J Agri Allied Sci. 13:005. https://www.rroij.com/open-access/benefits-and-challenges-of-polyculture-a-comprehensive-summary.php?aid=94846

Soni R, Gupta R, Agarwal P and Mishra R (2022) Organic farming: A sustainable agricultural practice. Vantage: Journal of Thematic Analysis 3(1):21–44. https://www.researchgate.net/publication/360469332_Organic_farming_A_sustainable_agricultural_practice

Timisela NR, Leatemia ED and Polnaya FJ (2018) Organic vegetable supply chain in Ambon City. Proceedings of LPPM - Surabaya State University. Pp. 637–645. Surabaya.

Timisela NR, Polnaya FJ and Titaley S (2021) Farmers perception and income in the development of organic vegetables during pandemic Covid 19. Annals of the Romanian Society for Cell Biology 25(5):4761-4770. http://annalsofrscb.ro/index.php/journal/article/view/5767

Tiwari AK (2023) The Role of Organic Farming in Achieving Agricultural Sustainability: Environmental and Socio-economic Impacts. Acta Biology Forum 2(2):29-32. https://doi.org/10.51470/ABF.2023.2.2.29

Widiarta A, Adiwibowo S and Widodo W (2011) Analysis of sustainability organic farming practise on farmer. Sodality: Jurnal Sosiologi Pedesaan 5(1):71–89. https://doi.org/10.22500/sodality.v5i1.5831

Yanti R (2005) Application of organic farming technology: Implementation of organic farming by rice farmers in Sukorejo Village, Sragen Regency, Central Java. Tesis. Universitas Indonesia. https://lib.ui.ac.id/detail?id=83419&lokasi=lokal

Zhang X, Yang Q, Al Mamun A, Masukujjaman M and Masud MM (2024) Acceptance of new agricultural technology among small rural farmers. Humanities and Social Sciences Communications 11(1641). https://doi.org/10.1057/s41599-024-04163-2