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The Analysis of Income and Risk Identification in Garlic Farming at Subak Aya Babahan

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ABSTRACT

Garlic is one of the horticultural subsector commodities that is essential for the Indonesian population. The per capita consumption of garlic in Indonesia from 2013 to 2019 experienced an average annual increase of 8%, from 0.34 kg per capita per year to 0.51 kg per capita per year. Subak Aya Babahan is a pilot project that has been receiving free garlic seed grants from the government since 2013. However, there have been several challenges faced in the farming activities, such as pest and disease attacks, as well as relatively high input costs. These conditions have placed farmers in a situation of uncertainty and risk, which impacts the income levels they generate. Thus, research is needed to analyze the income of garlic farmers, identify the risks associated with garlic farming, and develop mitigation strategies at Subak Aya Babahan using both quantitative and qualitative descriptive analysis methods. The study results indicate that the average income of farmers is IDR 1,881,191 per planting season. The findings also show that on the FMEA map, there are 5 risk agents (50%) in the green area, 2 risk agents (20%) in the yellow area, and 3 risk agents (30%) in the red area. The identified risks that require attention include pest and disease attacks, weather changes, labor skills, substandard seed quality, and pricing agreements with middlemen. Risk mitigation strategies include determining planting patterns, training in biological control, negotiating with partners regarding seed supply, and setting price contracts.
Keywords: garlic, Subak Aya Babahan, income analysis, risk identification, risk mitigation.

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1. INTRODUCTION

Horticultural products are among the agricultural commodities with significant potential for development, allowing them to become leading products that can improve the welfare of farmers in Indonesia. This includes horticultural products such as fruits, vegetables, medicinal plants, and ornamental plants (Pitaloka, 2017). Garlic (Allium sativum L) is one of the horticultural crops whose market demand continues to rise (Ulfa, 2018).

According to data from the Ministry of Agriculture (2020), the projected demand for garlic for consumption from 2020 to 2024 is expected to increase at an average rate of 1.38% per year. The total national demand for garlic in Indonesia can only be met by approximately 5-15%, while the remaining supply is fulfilled through imports (Ministry of Agriculture of the Republic of Indonesia, 2020).

The high demand for garlic has led the government to launch a national-scale garlic program in 2013. Subak Aya

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Babahan is one of the recipients of the government program aimed at developing garlic cultivation, particularly in the Penebel District, Tabanan Regency, Bali.

The garlic production in Penebel District, Tabanan Regency, has declined over the past three years (2021-2023) (Central Statistics Agency of Tabanan Regency, 2023). In response, the Tabanan Regency government has been working to expand the area planted with garlic. However, this effort has not aligned well with the targeted market, as middlemen/partners have been unable to purchase garlic at a favorable price according to farmers' conditions on the ground. This indicates the presence of issues and risks in garlic farming at Subak Aya Babahan.

For farmers, garlic farming carries a relatively high risk, which results in low productivity and income, with some experiencing crop failures multiple times. Naftaliasari et al. (2015) stated that the risk in farming refers to the potential for losses within a farming operation. However, the exact level of income and the risks faced by farmers have not been fully determined to date.

In the process of developing garlic farming at Subak Aya Babahan, an analysis is needed regarding the income earned by farmers, the identification of risks, and the levels of risk faced by garlic farmers, as well as the mitigation strategies that can be implemented as preventive measures for the next planting season. Risk identification is carried out through the application of elements within the Tri Hita Karana concept, which represents the balance in operational activities within the garlic farming area of Subak Aya Babahan.

Subsequently, a risk assessment is conducted using Failure Mode and Effect Analysis (FMEA) to determine the severity, frequency, and detectability of failures in garlic farming. This aims to formulate mitigation strategies that can be implemented to minimize failures caused by uncertainty and risks in garlic farming at Subak Aya Babahan.

2. METHODS

This study aims to evaluate: the income level from garlic farming; the identification and assessment of associated risks; and the development of risk mitigation strategies in garlic farming.

According to Gilarso (2003), total cost is the sum of all expenditures, including both fixed and variable costs, incurred in the production of output. The production cost of garlic farming is calculated using the following formula:

$$TC = FC + VC$$

Dimana:
TC = Total Cost (Rp)
FC = Fixed Cost (Rp)
VC = Variable Cost (Rp)

According to Suratiyah (2006), gross income or revenue can be calculated using the following formula:

$$TR = Y. Py$$

Where:
TR = Gross income/farming revenue (IDR)
Y = Quantity of production (Kg)
Py = Price of production (IDR/Kg)

Soekartawi (1995) stated that income is the difference between revenue and all farming costs. This can be expressed as follows.

$$Pd = TR – TC$$

Where:
Pd = Net income from farming (IDR)
TR = Total farming revenue (IDR)
TC = Total farming costs (IDR)

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In identifying risks, it is necessary to determine the risk event and risk agent. The determination of the risk event is carried out using the analysis of the application of Tri Hita Karana values. The sustainability cycle of a business, in the context of this study, refers to farming activities that align with the essence of implementing Tri Hita Karana, which will create harmony (Windia et al., 2015).

The identification of risk agents is carried out using a fishbone diagram. (Supiandi et al., 2021) The fishbone diagram is used to identify the root causes of failures. The fundamental problem is placed on the right side of the diagram, at the head of the fishbone, while the causes are placed along the fins and spines. The causes of the problems may include materials, machines and equipment, people, methods, measurements, and the environment (Putri et al., 2023).

Failure Mode and Effect Analysis (FMEA) is a structured procedure used to identify and prevent potential failure modes (Gaspersz, 2002).

The Risk Priority Number (RPN) determines the priority of failures. The RPN itself does not have inherent value or meaning. The value is used to rank process failures (Puspitasari & Martanto, 2014).
The RPN value can be expressed using the following equation:

RPN = S × O × D

Where:
S = *Severity*
O = *Occurance*
D = *Detection*

The RPN value provides information on the type of workplace failure or accident that requires priority attention.

3. RESULT AND DISCUSSION

3.1 Farmer's Income

Garlic farming is conducted within one planting season, from June to September. The production inputs used during a single planting season in garlic farming at Subak Aya Babahan include: seeds, fertilizers such as urea, NPK, and Valdis Grow. The types of pesticides used are Regent and Pestor. The labor force consists of both family labor and external labor.

The seeds used in the farming activities at Subak Aya Babahan are supplied by middlemen who have a partnership with the farmers. This partnership is based on a price contract, and the production yield will later be purchased by the middlemen who provided the seeds.

The fertilizers used include urea, NPK, and Valdis Grow. The total amount of fertilizer used per planting season across the entire cultivated area is as follows: 1,600 kg of urea, 1,600 kg of NPK, and 24 liters of Valdis Grow. The average prices are IDR 2,250 per kg for urea, IDR 2,300 per kg for NPK, and IDR 58,000 per liter for Valdis Grow. The total production cost for purchasing fertilizers amounts to IDR 8,672,000, or IDR 216,800 per planting season per respondent.

The pesticides used include Regent and Pestor. A total of 15 liters of Regent and 15 liters of Pestor are used per planting season. The total production cost for pesticides amounts to IDR 7,752,000, or IDR 193,800 per planting season per respondent.

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The garlic farming activities carried out by respondents during a single planting season, which involve family labor, include land preparation, planting, fertilizing, spraying, and harvesting. The calculation of family labor wages (TKDK) follows the prevailing wage rates in the research area. These wages are considered in the calculations but are not actually paid (Suratman, 2015). The calculation of family labor usage is based on person-days (HOK), where one HOK represents 8 hours of work per day. The total cost for family labor usage amounts to IDR 48,942,917, with an average expenditure of IDR 1,223,573 per respondent for family labor costs.

Garlic farming activities not only involve family labor but also external labor. The total cost for external labor usage amounts to IDR 44,207,692, with an average expenditure of IDR 1,105,192 per respondent for external labor costs.

The family dependents of the respondents are calculated as the variable costs incurred each month by the respondents. The greater the number of children and dependents a respondent has, the more effective the time allocated for work becomes (Sihol Situngkir, 2007). The total cost of family dependents for all respondents amounts to IDR 21,137,500 per planting season, or IDR 528,438 per planting season per respondent.

Revenue is the product of total physical output (production) and the price per unit of production. Farming revenue is the monetary value obtained from the sale of the produced goods, and its magnitude depends on both the volume of the product and its selling price (Syarifuddin A. Kasim, 1995). The average production from garlic farming at Subak Aya Babahan is 215 kg per respondent, or 8,604 kg per planting season per cultivated area. The average price received by farmers, as per the contract with the middlemen, is IDR 25,000 per kg. The revenue for one planting season of garlic farming amounts to IDR 215,100,000, or IDR 5,337,500 per respondent per planting season. Therefore, the total income for one planting season is IDR 75,247,641, or IDR 1,881,191 per respondent per planting season, as shown in Table 1.

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Table 1 Recapitulation of Garlic Farming Income

Costs	Description	Sub-description	Cost Sub-description	Total Per Planting Season	Total Per Respondent Per Planting Season
Variable	Seeds	0	0	0	0
	Fertilizers			8,672,000	216,800
		Urea	3,600,000		
		NPK	3,680,000		
		Valdi's Grow	1,392,000		
	Pesticides			7,752,000	193,800
		Pestor	4,408,000		
		Regent	3,344,000		
	TK			93,150,609	2,328,765
		Land Preparation	27,562,000		
		Planting	19,717,948		
		Fertilizing	6,500,000		
		Spraying	2,096,250		
		Harvesting	37,276,410		
	Family Allowance		21,137,500	21,137,500	528,438
Fixed	Depreciation			940,250	23,506
		Hoe	547,563		
		Sickle	226,021		
		Warehouse	166,667		
	Land and Building Tax (PBB)			400,000	10,000
	Warehouse Rent			7,800,000	195,000
Total Production Costs				139,852,359	3,496,309
Revenue				215.100.000	5.377.500
Income				75.247.641	1.881.191

Source: Processed data (attached)

According to Saragih (2007), a farming operation is considered profitable if the difference between revenue and expenses is positive. The larger the difference between revenue and expenses, the more profitable the farming operation is. This can be observed in Table 1 of this study,

3.2 Farming Risks

Identifying farming risks involves determining the risk events and risk agents. In determining the risk events, the application of elements from the Tri Hita Karana concept is considered. The level of implementation of elements with low scores is used as a reference for determining the risk events.

In this study, the determination of risk agents is done using a fishbone diagram to identify the cause-and-effect relationships of potential failures.

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Table 2 Risk Event and Risk Agent

Code	*Risk Event*	Code	*Risk Agent*
E1	Improper planting pattern	A1	Weather changes
E2	Improper procurement of production inputs	A2	Limited capital
		A3	Unskilled labor
		A4	Inadequate equipment
E3	Reduction in production	A5	Damage due to pests and diseases
		A6	Unscheduled irrigation
		A7	Incorrect fertilizer dosage
		A8	Incorrect pesticide dosage
		A1	Weather changes
		A3	Unskilled labor
E4	Reduction in revenue	A9	Reduction in the quantity and quality of garlic
		A10	Price set by the middleman

Source: Primary Data Analysis (2024)

Based on Table 2, the correlation between 4 identified risk events and 10 risk agents is shown. The correlation of each risk is interrelated. An identified risk event may have multiple risk agents identified as causes of the risk event. For example, in the case of the risk event "improper procurement of production inputs," the identified risk agents include non-standard seeds, high fertilizer prices, and high pesticide prices.

In this study, the risk level is analyzed using Failure Mode and Effect Analysis (FMEA). The risk is assessed by examining the values of severity (S), occurrence (O), and detection (D), which are presented in the form of an equation.

Table 3 Risks Requiring Mitigation

No	Code	*Risk Priority Number*
1	A1	378
2	A3	264
3	A5	448
4	A9	512
5	A10	512

Based on Table 3, there are 5 risk agents that contribute to the emergence of failure risks, thus requiring further attention regarding the mitigation measures that need to be implemented.

This risk level mapping is used to determine the priority of risks that need to be addressed. The mapping will be carried out based on Figure 1. The risk map is filled using the severity values and the Risk Priority Number (RPN). The goal of this process is to facilitate the prioritization of risk mitigation efforts.

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Risk Level		RPN		
		1 – 71	**72 – 391**	**392 – 1000**
Severity	**1 – 6**	A2, A6, A7, A8	A4	
	7 – 8		A1, A3	A5, A9, A10
	9 – 10			

Figure 1 FMEA Risk Level Map in Subak Aya Babahan

Description:
: *Broadly Acceptable* (BA)
: *As Low As Is Practicable* (ALARP)
: *Intolerable* (INT)

Based on Figure 6, the RPN values and risk agents of the garlic commodity are mapped, showing 5 risk agents in the green area, 2 risk agents in the yellow area, and 3 risk agents in the red area. The green area in the figure represents the Broadly Acceptable (BA) category, where the risks in this area are considered acceptable and only require simple controls. The yellow area represents the As Low As Is Reasonable Practicable (ALARP) category, indicating that the risks in this area require gradual risk mitigation measures, though control actions should still be implemented. The red area represents the Intolerable (INT) category, where the risks demand urgent action to reduce risk in farm management.

Based on the FMEA mapping, several mitigation alternatives were identified. For mitigating the risk of climate change, it is recommended to adjust the planting pattern for the next planting season to minimize the risk of crop failure. This is supported by the statement from Salsabila et al. (2024), which highlighted that seasonal changes can impact crop failure, plant damage, and the decline in crop quality. Furthermore, damage caused by pests and diseases also contributes to the risk of failure in garlic farming. This risk can be mitigated by applying the appropriate doses of production inputs (fertilizers and pesticides).

This finding aligns with the statement by Zikria & Damayanti (2019), who emphasized that proper fertilization helps maintain soil fertility. In contrast, over-fertilization, especially beyond the recommended dosage, can negatively impact the soil and environment in the long run.

The availability of unskilled labor requires special attention from both the government and stakeholders for capacity building initiatives. Another alternative is to reinstate the effectiveness of farmer activities through regular meetings (parum or subak meetings) to facilitate discussions with suppliers/partners regarding seed supply and pricing determination.

4. CONCLUSIONS

Based on the analysis results, the following conclusions can be drawn:

1. The revenue from garlic farming in Subak Aya Babahan amounts to IDR 215,100,000. This value is derived from a total production of 8,604 kg per planting season, with a price of IDR 25,000 per kilogram as set by the middlemen/trading partners. The production costs of garlic farming consist of fixed and variable costs. Fixed costs include depreciation of

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farming equipment, taxes, and warehouse rental fees, totaling IDR 9,140,250 per planting season. Variable costs comprise expenses for purchasing fertilizers, pesticides, labor wages, and family support costs, amounting to IDR 130,712,109 per planting season. Therefore, the total production cost is IDR 139,852,359 per planting season. The net income from garlic farming in Subak Aya Babahan is IDR 75,247,641 per planting season or IDR 1,881,191 per respondent per planting season.

2. There are 4 risk events and 10 risk agents identified in the garlic farming activities at Subak Aya Babahan. The risk priority assessment using the Risk Priority Number (RPN) method indicates that the highest RPN values are associated with damage caused by pest and disease attacks, the quality of seed availability not meeting standards, and pricing determination by middlemen. Based on the FMEA risk map, 5 risk agents (50%) are located in the green zone, 2 risk agents (20%) in the yellow zone, and 3 risk agents (30%) in the red zone. The proposed mitigation strategies include optimizing production inputs (fertilizers and pesticides), providing training on biological control agents to farmers by relevant authorities and stakeholders, and negotiating with supply chain partners to ensure that the provided seeds meet quality standards for improved production quantity and quality. Additionally, updating the pricing at each contract renewal to prevent price stagnation.

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REFERENCE

Badan Pusat Statistik Kabupaten Tabanan. (2023). Produksi Tanaman Sayuran Menurut Kecamatan Dan Jenis Tanaman Di Kabupaten Tabanan

Gaspersz, V. (2002). Pedoman Implementasi Program Six Sigma Terintegrasi Dengan ISO 9001.

Gilarso. (2003). Pengantar Ilmu Ekonomi Mikro. Yogyakarta : Penerbit Kanisius.

Kementerian Pertanian. (2020). Outlook Bawang Putih Komoditas Pertanian Subsektor Hortikultura.

Kementerian Pertanian RI. (2020). Perubahan Kedua Atas Keputusan Menteri Pertanian Nomor259/KPTS/RC.020/M/05/2020 Tentang Rencana Strategis Kementerian Pertanian Tahun 2020-2024.

Naftaliasari, T., Abidin, Z., & Kalsum, U. (2015). Analisis Risiko Usahatani Kedelai Di Kecamatan Raman Utara Kabupaten Lampung Timur. In JIIA (Vol. 3, Issue 2).

Pitaloka, D. (2017). Hortikultura: Potensi, Pengembangan Dan Tantangan.

Puspitasari, N. B., & Martanto, A. (2014). Penggunaan Fmea Dalam Mengidentifikasi Resiko Kegagalan Proses Produksi Sarung Atm (Alat Tenun Mesin) (Studi Kasus Pt. Asaputex Jaya Tegal). In J@TI Undip: Vol. IX (Issue 2).

Putri, A. S., Hanum, E., Djunaidi, M., Nugraha, I., & Syaifullah, H. (2023). Perbaikan Kualitas Proses Pencetakan Buku Tulis: Pendekatan FMEA Dan

Journal of Sustainable Development Science
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e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

Diagram Fishbone. Waluyo Jatmiko Proceeding, 231–240. Https://Doi.Org/10.33005/Wj.V16i1.12

Salsabila, Z., Rohmah, F., & Arisandi, D. (2024). Dampak Perubahan Iklim Terhadap Usahatani Dan Keberlanjutan Pangan Di Desa Reban Kecamatan Reban Kabupaten Batang. Jurnal Sahmiyya.

Saragih, L. S. (2007). Analisis Pendapatan Usahatani Dan Pemasaran Kopi Arabika Dan Kopi Robusta (Studi Kasus Di Desa Tambun Raya Kabupaten Simalungun Provinsi Sumatera Utara).

Supiandi, D., Yusworo Haryono, H., & Tobing, C. (2021). Jurnal Lembaga Ketahanan Nasional Republik Indonesia FMEA Dan Fishbone Analysis Untuk Mengetahui Risiko Kerusakan Komponen Flight Control System Penyebab Aircraft Vibration Helikopter Bell-412 TNI AL FMEA And Fishbone Anaysis To Determine The Risk Of Flight Control System Components Defect Doe To Aircraft Vibration On The Indonesian Navy Helicopter BELL-412.

Suratiyah, K. (2006). Ilmu Usaha Tani Edisis Revisi. Jakarta: Penebar Swadaya.

Suratman, A. Y. Y. (2015). Kontribusi Tenaga Kerja Dalam Keluarga Terhadap Pendapatan Usahatani Terong (Solanum Melongena L.) Di Kelurahan LandasanUlin Utara Kecamatan Liang Anggang Kota Banjarbaru. ZIRAA'AH, 40(3).

Soekartawi. (1995). Analisis Usaha Tani. Jakarta: Ui Press.

Syarifuddin. A. Kasim. (1995). Pengantar Ekonomi Produksi. Fakultas Pertanian Unlam. Banjarbaru.

Ulfa, R. (2018). Analisis Usahatani Bawang Putih (Allium Sativum L) dan Permasalahannya Di Nagari Salayo Tanang Bukit Sileh Kecamatan Lembang Jaya Kabupaten Solok.

Windia, W., Widnyani, & Ambarawati. (2015). Keberlanjutan Bisnis Pupuk Cair Organik PT Alove Bali Desa Saba, Kecamatan Blahbatuh, Kabupaten Gianyar. Jurnal Manajemen Agribisnis, 3(1).

Zikria, R., & Damayanti, A. (2019). Peran Penyuluhan Pertanian Dan Preferensi Risiko Terhadap Penggunaan Pupuk Berlebih Pada Usaha Tani Padi. Jurnal Agro Ekonomi, 37(1), 79. Https://Doi.Org/10.21082/Jae.V37n1.2019.79-94

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