International Journal of Multidisciplinary Research and Growth Evaluation.

Risk mitigation in shallot farming in Gondang District, Nganjuk Regency

Slamet Subari [1*], Pretty Carolina Agustin [2]
[1] Magister Program Pengelolaan Sumber Daya Alam, Universitas Trunojoyo Madura, Indonesia
[2] Program Studi Agribisnis, Universitas Trunojoyo Madura, Indonesia

* Corresponding Author: **Slamet Subari**

Article Info

ISSN (online): 2582-7138
Volume: 06
Issue: 01
January-February 2025
Received: 09-12-2024
Accepted: 14-01-2025
Page No: 1765-1772

Abstract
National shallot production has increased, with Nganjuk Regency playing a significant role in shallot production within East Java. Despite its contribution, shallot farming in this region faces several risks that need to be addressed. This study aims to identify the sources of risk in shallot farming and to determine effective risk mitigation strategies for shallot cultivation in Gondang District, Nganjuk Regency. The location for this study was selected purposively, with key informants identified as the primary source of data. The analytical tool employed is the House of Risk methodology. The dominant risk agents in shallot farming in Gondang District include pest attacks, erratic rainfall, untimely availability of subsidized fertilizers, non-compliance with recommended input applications, and the use of uncertified seed varieties. To mitigate these risks, the following strategies are recommended is planning the shallot planting season effectively, controlling pests and diseases, monitoring and evaluating cultivation techniques, using certified and resistant shallot varieties, and utilizing liquid organic fertilizer as an alternative to subsidized fertilizers.

Keywords: House of risk, mitigation, risk, shallot

Introduction

Shallots are a widely consumed and highly demanded vegetable commodity in Indonesia, serving as a key ingredient in cooking and as a component in herbal medicines. Additionally, shallots can be processed into value-added products, such as snacks, which has motivated many farmers to engage in shallot cultivation. According to data from the Central Bureau of Statistics in 2022, Indonesia produced 19,823,602 kw of shallots. The increase in shallot production must be accompanied by a focus on quality to meet consumer standards and minimize potential losses for farmers and producers (Annisa, 2021) [2]. One of the major shallot producing regions in East Java is Nganjuk Regency, where a significant portion of the population is involved in shallot farming. In addition to farmers, many individuals in the shallot industry work as traders, collectors, fertilizer suppliers, slashers, and farm worker in the shallot fields. According to data from the Central Bureau of Statistics in 2021, Nganjuk Regency produced 1,936,524 kw of shallots, with an increase in 2022 to 1,939,881 kw. However, in 2023, shallot production declined to 1,837,579 kw. The Gondang sub-district is one of the significant contributors to shallot production in Nganjuk Regency, with an average productivity of 20 tonnes per hectare. In 2022, Gondang sub-district contributed 603,810 kw to shallot production, but this decreased to 450,413 kw in 2023. Consumer-preferred shallot products are characterized by superior traits, including large bulbs, dark red coloring, and a round shape. The firmness of the bulbs also plays a significant role in consumer demand. The shallots from Nganjuk Regency are particularly noted for their quality and durability. (Yulianti & Wicaksono, 2023) [22]. Although the bulbs of Nganjuk shallots are smaller compared to other varieties, they have a lower water content, which prevents them from rotting quickly and extends their shelf life. This unique quality makes Nganjuk shallots highly sought after in the market. However, despite their longevity and resistance to spoilage, the increasing demand for Nganjuk shallots has led to fluctuations in supply. This imbalance between supply and demand often results in price volatility at certain times. Shallots, as an agricultural commodity, are perishable and seasonal, which introduces complexities and various risks. (Pamungkassari *et al*., 2018) [14]. The uncertainty in production can cause price fluctuations, which in turn affect market share. Risk, in this context, refers to the potential impact that may arise from processes not executed appropriately, either in the present or the future.

A study by Linda (2019) aimed to identify and analyze production risks in shallot farming, with a focus on seasonal differences and the effect of input use on production risk.

The study found that the use of inputs such as male family labor, external labor, seeds, lime, organic fertilizer, insecticides, trap costs, and insect deterrent lamps significantly differed between the dry and rainy seasons. During the dry season, insecticides and seeds were the inputs that significantly influenced shallot productivity. In contrast, during the rainy season, seeds, Phonska fertilizer, ZA, NPK Mutiara, and herbicides were the inputs with a significant impact on productivity. Additionally, seed inputs had a significant and negative effect on productivity risk during the dry season. In the rainy season, Phonska fertilizer and NPK Mutiara also had a negative effect, while the input of female family labor had a positive and significant effect on productivity risk. (Astuti *et al*., 2019) [3]. Risk management begins with understanding the strategic objectives of an organization, as risk is inherently tied to these objectives. By clearly understanding these goals, it becomes easier for individuals within the organization to identify risks. The process includes decision-making and risk reporting stages, both of which address potential threats and opportunities. These stages precede the organization's decision on any form of risk handling. According to ISO 31000, the risk management process comprises three major steps:

- Context setting, which aims to identify and clarify organizational goals;
- Risk assessment, which includes risk identification, analysis, and evaluation; and
- Risk handling, which involves risk avoidance, mitigation, transfer, and acceptance. (eko sudarmanto, 2020) [5].

One of the key challenges in the shallot agribusiness system is the farming risk, which directly affects production levels. To minimize losses, a strategic approach to risk mitigation is essential. The House of Risk (HOR) method is particularly effective in identifying risk events, sources, and appropriate mitigation strategies. Risk mitigation aims to reduce or minimize the impact of risks, and in the context of shallot farming, it is crucial for achieving a sustainable agribusiness Therefore, this research aims to identify the sources of risk in shallot farming and to determine the appropriate actions for mitigating these risks in Gondang District, Nganjuk Regency.

Research Method

Study Area and Sampling

This research was conducted in the Gondang sub-district, Nganjuk Regency, which was selected purposively due to its status as a major shallot-producing area within the region. The study was carried out from January to February 2024. Respondents were selected using a purposive sampling method, focusing on key informants with a deep understanding of shallot farming practices, specifically the head of the farmer group in Senjayan Village, Gondang District, Nganjuk Regency. The data collected for this research included both primary and secondary sources. Primary data were obtained through direct field observations and interviews with respondents, guided by a structured questionnaire. Secondary data were derived from farm financial records, shallot harvest data from respondents, and additional information from the Agricultural Extension Office (BPP) and relevant literature.

Data Analysis

This study focused on analyzing the farming risks associated with shallot production in Gondang District, employing the House of Risk (HOR) method. The risk analysis commenced with the identification of risk events and risk agents, which are factors contributing to risk (Basyarahil *et al*., 2016) [4]. Following identification, a risk assessment was conducted to determine the severity of each risk by assigning a severity value. Severity indicates the potential impact of each identified risk (Teniwut *et al*., 2020) [20]. Subsequently, the likelihood of occurrence for each risk-causing agent was assessed and weighted accordingly. Both risk events and risk agents were evaluated on a 1-10 scale, with higher scores indicating a greater likelihood of occurrence (Suryani *et al*., 2023) [19]. The correlation between risk events and risk agents was also evaluated, with a weighting value assigned to measure the strength of their relationship. In the HOR 1 table, the Aggregate Risk Potential (ARP) was calculated to rank the risk agents. The ARP calculation follows the formula:

$$ARPj=O.\Sigma(S.R)$$

Description

ARPj : Aggregate Risk Potential
O: Measuring the probability of occurrence Risk Agent
S: Measurement of risk impact level
R: Measurement of event correlation value Risk

The subsequent stage involves designing mitigation strategies using the HOR 2 method. The HOR 2 table includes preventive actions (PAk), identifying the relationship values between the mitigation strategies and the identified risk agents, calculating the total effectiveness value (TEk), assessing the difficulty level in implementing the mitigation strategy to determine the Degree of Difficulty (Dk), and calculating the Effectiveness to Difficulty (ETDk) ratio. This ratio helps prioritize the existing strategies by ranking them. The calculations for TEk and ETD are as follows.

$$TEk= \Sigma ARPj.E$$

Description

Tek : Sum of effectiveness of each action
ARPj : Aggregate Risk Potential
E: Correlation between each preventive action and each risk agent

After determining the level of difficulty for the risk mitigation actions, the total effectiveness of each proposed risk mitigation action is calculated using the following formula:

$$ETDk=TEk/Dk$$

Description

ETDk : Total effectiveness of difficulty level
Tek : Amount of effectiveness
Dk : Difficulty level

Table 1: Severity Level

Ranking	Severity	Description
1	No	None
2	Very Slight	Very little risk consequences
3	Slight	Slight risk consequences
4	Minor	Minor risk consequences
5	Moderate	Moderate risk consequences
6	Significant	Large risk consequences
7	Major	Severe risk consequences
8	Extreme	Severe risk consequences
9	Serious	Serious risk consequences
10	Hazardous	Dangerous consequences

Source: Data processed, 2024

Table 2: Occurrence Scale

Ranking	Occurrence	Description
1	*Almost Never*	Risk cause almost does not occur
2	*Remote*	Risk cause is very rare
3	*Very Slight*	Causes of very little risk
4	*Slight*	Causes of slight risk
5	*Low*	Causes of low risk
6	*Medium*	Moderate risk cause
7	*Moderatly High*	Moderately high risk
8	*High*	Causes of high risk
9	*Very High*	Causes of very high risk
10	*Almost Certain*	Risk causes that almost always occur

Source: Data processed, 2024

Results and discussion

Risk Identification of Shallot Farming

The risk identification activities for shallot farming in Gondang District, Nganjuk Regency are categorized into risk events, each assessed based on the severity of the risk. Severity is evaluated using a rating scale from 1 to 10, where a higher value indicates a greater potential impact of the risk. The results of the risk event identification are presented in Table 3

Table 3: Risk Event

Number	***Risk Event***	Code	Severity
1	Explosion of pests (*Spodoptera exigua*) and diseases (onion rust)	E_1	9
2	Decreased quality and quantity	E_2	6
3	Growth is not uniform	E_3	5
4	Growth cycle disrupted	E_4	6
5	Land productivity decreases	E_5	7
6	Fertilizer and pesticide application becomes uneven	E_6	8
7	Difficult to control weeds	E_7	7
8	Production is not maximized	E_8	9
9	Uncertain profit	E_9	7
10	Decrease in shallot quality	E_{10}	6

Source: Primary Data, 2024

Table 3 indicates that shallot farmers in Gondang Subdistrict have encountered 10 distinct risks during their farming activities. Among these, two risk events exhibit the highest severity impact: pest outbreaks (*Spodoptera exigua*) and diseases (such as onion rust), as well as suboptimal production. According to interviews with farmers, the most common pests attacking shallot crops include caterpillars that consume onion leaves, leading to significant damage, and bulb-eating pests that can cause crop failure. The proliferation of these pests is often attributed to factors such as unsuitable land conditions (either too dry or too wet), improper use of fertilizers and pesticides, and inadequate cultivation techniques. Onion rust, a disease that causes shallot leaves to curl and turn yellow, is exacerbated by an unpredictable rainy season. Research by Indri focused on identifying the technical aspects of shallot farming and its associated risks. The study found that erratic weather patterns, climate variability, and pest infestations are key risk sources. To mitigate these risks, strategies such as planting according to the seasonal pattern, as well as farmer training and counseling, are recommended to enhance knowledge of shallot cultivation (Muhammad Darma Wijaksana, 2021) [11]. The other high-severity risk event identified is the failure to maximize production, which received a severity score of 9. Factors contributing to suboptimal production include untimely and improper application of inputs, as well as the erratic rainy season. During the dry season, shallots are prone to drought and caterpillar infestations, while in the rainy season, they are susceptible to rot and diseases such as purple spot and anthracnose. In addition to seasonal variability, the choice of seed variety also affects yield. Farmers often use seeds from previous plantings, leading to reduced productivity over time (Aldila *et al*., 2017) [1]. This issue is compounded by the higher cost of certified seed varieties compared to non-certified ones (Rasoki *et al*., 2016) [17]. Good quality seed tubers for planting should be disease-free, properly shaped, not stored for too long, and should have broken their dormancy period. Healthy, optimally sized seed tubers that exhibit visible buds are generally more resistant to pests and diseases and have a high growth capacity (Palupi & Alfandi, 2018) [13]. Research by Rizal aimed to identify the sources of risk in shallot production, assess the risk level, and determine factors influencing the risk of off-season shallot farming in Petak Village. The study identified five key risk sources: weather and climate, pests and diseases, seed quality, land fertility, and human resources. The study concluded that off-season shallot farming poses high risks, which can be mitigated by crop rotation during the rainy season and by applying fertilizers and pesticides according to recommended dosages (Ghozali & Wibowo, 2019) [7]. Rizal's findings are consistent with Rini's research, which sought to determine the risk level of shallot farming and farmers' risk management behaviors, as well as the factors influencing shallot farming risks. The study found that shallot farming in Batu City is categorized as high-risk, and farmers tend to be risk-averse. Key factors affecting shallot farming in Batu City include labor, pesticide use, and NPK fertilizer application. The study suggests combining pesticides with organic fertilizers or using natural pesticides as alternatives to chemical ones (Mutisari, 2019) [12]. Fertilization and pest control in shallot farming are critical factors that significantly influence crop yields. The scarcity of subsidized fertilizers negatively impacts farmers' profits or income, forcing them to switch to more expensive, non-subsidized fertilizers, thus increasing production costs (Maulia *et al*., 2023) [10]. Research conducted by Wijaya explored the diversity, efficiency, and factors influencing production and risk in shallot farming. The study identified several factors affecting shallot farming in Gebang District, including land area, seed quality, SP-36 fertilizer, KCL fertilizer, and labor. The study also found that imbalanced use of KCL and SP-36 fertilizers leads to waste and negative outcomes, highlighting the need for routine counseling on balanced fertilizer use. (Wijaya *et al*., 2023) [21].

Another critical factor influencing yield is soil quality.

Optimal soil for shallot cultivation should be loose, not overly dense, and not too soft (Putri *et al*., 2021) [15]. Soil fertility can be enhanced through intensive tillage, improved fertilization, crop rotation, and irrigation practices. During the harvest and post-harvest stages, additional risks include uncertain profits due to price fluctuations and a decline in shallot quality resulting from improper post-harvest handling.

Each risk event is associated with a corresponding risk source (risk agent), which is assessed for its probability of occurrence on a scale of 1 to 10. The results of the risk agent identification are presented in Table 4.

Table 4: Risk Agent

Number	Risk Agent	Code	*Occurance* (Ei)
1	Erratic rainy season	A_1	8
2	Pest and disease attack	A_2	9
3	Use of uncertified seed varieties	A_3	8
4	Untimely availability of subsidized fertilizers	A_4	6
5	Land health is not guaranteed due to excessive use of fertilizers and pesticides	A_5	7
6	Inappropriate planting distance that makes it difficult to care for plants	A_6	5
7	Saprodi application is not on time and not as recommended	A_7	6
8	Price fluctuations	A_8	6
9	Inappropriate post-harvest treatment	A_9	7

Source: Primary Data, 2024

Table 4 indicates that the primary sources of risk in shallot farming in Gondang Sub-district, Nganjuk Regency, include pest infestations with an occurrence value of 9, erratic rainy seasons with an occurrence value of 8, and the use of non-certified seed varieties, also with an occurrence value of 8.

House of Risk Phase I (Risk Level Analysis of Shallot Farming)

After identifying each risk event and risk source (risk agent), the next step is to calculate ARP (aggregate risk potential) by providing a correlation value between the risk event and the existing risk source. This aims to determine the priority of risks that will be given the main handling or mitigation. While the scale used is 0 meaning no correlation, 1 meaning weak correlation, 3 meaning moderate correlation, and 9 meaning high correlation (Firmansyah *et al*., 2022) [6]. The results of the correlation assessment are compiled in the HOR (House of Risk) Phase 1 table, which includes an ARP calculation table as the final step in risk identification. The HOR Phase 1 table also details the severity of each risk event, the occurrence value of each risk source, and the correlation between risk events and risk sources. Based on this analysis, risk agents are ranked according to priority, with mitigation strategies proposed accordingly. The following is the HOR Phase 1 table.

Table 5: HOR Phase 1

Risk Event	Risk Agent									Si
	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	
E_1	9	9	3	3	3	1	3			9
E_2	9	9	1	3	1		3			6
E_3	3	9	9	3		1				5
E_4	3	9	1	9	3	3	3			6
E_5		1		3	9					7
E_6				3		9	3			8
E_7	1			3	1	9	3			7
E_8	9	9	3	3	3	1	9			9
E_9	1	3						9	3	7
E_{10}	3	9	3	1		1	3		9	6
O_i	8	9	8	6	7	5	6	6	7	
ARP	2248	3573	1032	1278	952	910	1242	378	525	
P_j	2	1	5	3	6	7	4	9	8	

Source: Primary Data, 2024

The ARP value in the table above reflects the level of danger or risk associated with each risk agent. A higher ARP value indicates a greater level of risk, and vice versa. According to the HOR Phase 1 table, the risk agent with the highest aggregate risk potential (ARP) is A2, which corresponds to pest and disease attacks with an ARP value of 3573. This risk agent significantly influences the occurrence of risks in shallot farming in Gondang District, making it a top priority for mitigation strategies. Several other dominant risk agents were also identified, including A1 (erratic rainy seasons) with an ARP value of 2248, A4 (delayed availability of subsidized fertilizers) with an ARP value of 1278, A7 (untimely and incorrect application of inputs) with an ARP value of 1242, and A3 (use of uncertified seed varieties) with an ARP value of 1032. These top five risk agents are critical considerations in developing risk mitigation strategies to minimize losses.

House of Risk Phase II (Shallot Farming Risk Management)

The prioritized risk agents identified in HOR Phase 1 are then further analyzed in HOR Phase 2. This phase aims to determine the most effective risk mitigation strategies to reduce the likelihood of risk events associated with the identified risk agents. Mitigation strategies were developed through discussions with farmers and consultations with reference sources, taking into account the difficulty and effectiveness of implementation.

In HOR Phase 2, nine mitigation actions were designed to address the five dominant risk agents. Each mitigation action was assigned a degree of difficulty (Dk), where a value of 3 indicates that the action is easy to implement, 4 indicates that it is somewhat difficult, and 5 indicates that it is difficult. The following is a table of the proposed risk mitigation strategies.

Table 6: Degree of difficulty of mitigation strategy

Kode	Mitigation	Dk
PA1	Planning the onion planting season	3
PA2	Pest and disease control	3
PA3	Using shallot varieties that are certified and resistant in two seasons	5
PA4	Combining manure as an alternative to POC	4
PA5	Conducting monitoring and evaluation of shallot cultivation techniques carried out	4

Source: Primary Data, 2024

After defining the mitigation strategies and their associated difficulty levels, a weighted value is calculated for the correlation between each mitigation strategy and the dominant risk agents. The effectiveness of each mitigation strategy is then assessed.

Table 7: HOR Phase 2

Risk Agent	Prevention Action					ARP
	PA1	PA2	PA3	PA4	PA5	
A2	3	9	3	1	3	3573
A1	9		9		3	2248
A4	9			9	3	1278
A7					9	1242
A3			9		3	1032
TeK	42453	32157	40239	15075	35571	
D_k	3	3	5	4	4	
ETD_k	14151	10719	8047.8	3768.75	8892.75	
Rank Priority	1	2	4	5	3	

Source: Primary Data, 2024

Based on the HOR Phase 2 table, the mitigation strategies are ranked according to their ETDk (Effectiveness x Degree of Difficulty) values. The following is a prioritized ranking of the mitigation strategies based on the HOR Phase 2 calculations:

Table 8: Prioritization of mitigation strategies

Code	Mitigation	Priority
PA_1	Planning the shallot growing season	1
PA_2	Pest and disease control	2
PA_5	Conducting monitoring and evaluation of shallot cultivation techniques carried out	3
PA_3	Using shallot varieties that are certified and resistant in two seasons	4
PA_4	Using POC as an alternative to subsidized fertilizers	5

Source: Primary Data, 2024

The first mitigation strategy action is to plan the shallot planting season with an ETD_k value of 14151 with D_k 3, which means the mitigation action is easy to implement. A good planting season for shallots is during the dry season with sufficient irrigation, namely in April-May or July-August interspersed with other commodities if not planting shallots such as rice, corn, or red chili to break the chain of disease in shallots.

For irrigation, shallot farmers in Gondang Subdistrict use diesel and wells. Farmers must also pay attention to planting and harvesting times. By planning the planting season that refers to an integrated planting calendar, farmers can take into account season predictions, rain-prone areas and so on. During the dry season to increase productivity can be done by increasing the number of seeds, phonska fertilizer, NPK Mutiara and herbicides, and reducing the use of ZA fertilizer. While during the rainy season the addition of phonska and NPK fertilizers can increase shallot productivity.

The second mitigation strategy action is pest and disease control with ETD_k 10719 and D_k 3, which means the mitigation action is easy to implement. Pests and diseases can be prevented by conducting pre-emptive and routine control. Pest and disease control can be carried out in the second week to the eighth week after planting with an interval of 2-3 days. In addition, farmers can also carry out Integrated Pest Management (IPM). This is intended because IPM has a range of technologies that include technical culture control, mechanics and the application of bio pesticides. Technical cultural control is carried out by means of balanced fertilization, the use of pest-resistant varieties, and the use of natural enemies (parasitoids, predators and insect pathogens). Mechanical control is carried out by cutting diseased leaves or *Spodoptera exigua* egg clusters and using mosquito nets and various types of traps (sex pheromones, yellow traps, light traps and other methods). While the application of bio pesticides, such as virus-active insecticides to control onion caterpillar pests (*Spodoptera exigua* Hubn.) such as SeNPV (*Spodoptera exigua* Nuclear Polyhedrosis Virus). In addition, the use of selective pesticides based on the control threshold by taking into account the type, dose, spray volume, application method, interval and time of pesticide application. Excessive use of pesticides can be reduced by: not using a mixture of several types of pesticides, and using recommended pesticide concentrations, using a standard spuyer (nozzle) with sufficient pump pressure (Supartha *et al*., 2018) [18].

The third mitigation strategy action is to conduct monitoring and evaluation of shallot cultivation techniques carried out with ETD_k 8892.75 and D_k 4, which means the mitigation action is somewhat difficult to implement. This is done so that farmers can perform proper cultural techniques. This strategy ensures that farmers apply proper cultivation techniques. It is particularly important because untimely and incorrect application of agricultural inputs can lead to challenges in weed control and reduced yields. Farmers must engage in regular monitoring and evaluation, seeking guidance from extension workers or using social media to improve their cultivation practices.

The fourth mitigation strategy action is to use certified shallot varieties that are resistant in two seasons with ETD_k 8047.8 and D_k 5, which means difficult to implement. The use of high-quality seed varieties is crucial in shallot farming. Good seed varieties are typically 70-80 days old, have been stored for 2.5-4 months, are free from deformities and pests, and are not diseased. In Gondang Subdistrict, farmers use Thai seeds during the dry season. To cope with erratic weather, it is recommended that farmers use Bauji seeds, which are certified and resistant to two seasons. This variety helps optimize yields and encourages the use of certified seeds.

The last mitigation action is to use liquid organic fertilizer as an alternative to subsidized fertilizer with an ETDk value of ETD_k 3768.75 and D_k 4, this action indicating that it is somewhat difficult to implement. Increasing the use of organic fertilizers can reduce dependence on inorganic fertilizers. Organic fertilizers enhance soil productivity by increasing the organic nutrient content in the soil, which is often depleted by chemical fertilizers. This practice improves soil fertility and helps maintain the soil's physical, chemical, and biological properties. Research by Andi supports the use of liquid organic fertilizers like biourine, which has been found to be moderately accepted by farmers (Khoir *et al*., 2020) [9].

Based on the analysis of shallot farming activities in Gondang District, 10 risk events and 9 risk agents were identified. Among the 9 risk agents, five were found to be dominant: pest attacks (A_2), erratic rainy seasons (A_1), delayed availability of subsidized fertilizers (A_4), improper timing and application of inputs (A_7), and the use of uncertified seed varieties (A_3). To address these risks, five mitigation strategies were proposed for shallot farming in Gondang Sub-district, each selected based on their effectiveness. These strategies include: planning the shallot planting season (PA_1), implementing pest and disease control measures (PA_2), monitoring and evaluating shallot cultivation techniques (PA_5), utilizing certified and season-resistant shallot varieties (PA_3), and using liquid organic fertilizer as an alternative to subsidized fertilizer (PA_4).

Recommendations for shallot farmers in Gondang Sub-district are as follows: 1) carefully plan the shallot planting season, 2) implement integrated pest management, 3) regularly monitor and evaluate shallot farming practices, 4) use the Bauji variety of shallots, and 5) adopt liquid organic fertilizer in place of subsidized options.

Acknowledgment

We would like to express our sincere gratitude to the Fisheries Office of Sidoarjo Regency for their invaluable support and facilitation throughout this research. We also extend our heartfelt thanks to the fish farming community groups in Tulangan District for their active participation and for providing essential data that significantly contributed to the success of this study. Additionally, we thank our colleagues and advisors for their insightful guidance, constructive feedback, and encouragement during the preparation and completion of this research.

Authors' Contributions

1. **Slamet Subari**: Responsible for conceptualizing the research framework, developing the methodology, and supervising the overall study. Contributed to the literature review, data interpretation, and revised the manuscript for intellectual content and clarity.
2. **Pretty Carolina Agustin**: Conducted data collection, performed data analysis, and prepared the initial manuscript draft.

Funding Information

Optiona

References

1. Aldila HF, Fariyanti A, Tinaprilla N. Daya saing bawang merah di wilayah sentra produksi di Indonesia. J Manaj Agribis. 2017;14(1):43–53. DOI: 10.17358/JMA.14.1.43
2. Annisa WN. Mitigasi risiko pada rantai pasok bawang merah (*Allium ascalonicum* L.) di Kabupaten Bantul, Daerah Istimewa Yogyakarta. J METRIS. 2021;22(01):27–36. DOI: 10.25170/metris.v22i01.2565
3. Astuti LTW, Daryanto A, Syaukat Y, Daryanto HK. Analisis resiko produksi usahatani bawang merah pada musim kering dan musim hujan di Kabupaten Brebes. J Ekonomi Pertanian Dan Agribisnis. 2019;3(4):840–852. DOI: 10.21776/ub.jepa.2019.003.04.19
4. Basyarahil A, Irham I, Waluyati LR. How to mitigate the production risks on coastal red chilli farming in Kulon Progo Regency. Ilmu Pertanian (Agricultural Science). 2016;1(1):037. DOI: 10.22146/ipas.9295
5. Sudarmanto E. Manajemen risiko: Deteksi dini upaya pencegahan fraud. J Ilmu Manaj. 2020;9(2):108.
6. Firmansyah F, Arkeman Y, Arief II. Strategi kebijakan impor sapi berbasis manajemen risiko di masa pandemi. J Ilmu Pertanian Indonesia. 2022;28(1):93–102. DOI: 10.18343/jipi.28.1.93
7. Ghozali MR, Wibowo R. Analisis risiko produksi usahatani bawang merah di Desa Petak Kecamatan Bagor Kabupaten Nganjuk. J Ekonomi Pertanian Dan Agribisnis. 2019;3(2):294–310. DOI: 10.21776/ub.jepa.2019.003.02.7
8. Nadhira KA, Oktiarso T, Harsoyo TD. Manajemen risiko rantai pasok produk sayuran menggunakan metode supply chain operation reference dan model house of risk. Kurawal - Jurnal Teknologi, Informasi Dan Industri. 2019;2(2):101–117. DOI: 10.33479/kurawal.v2i2.260
9. Khoir AM, Krisnawati E, Widyastuti N. Minat petani terhadap penggunaan biourine sebagai pupuk organik cair pada tanaman bawang merah (*Allium ascalonicum*. L) di Kecamatan Tarumajaya Kabupaten Bekasi. JIP. 2020;1(4):791–798.
10. Maulia T, Fathurrahman R, Claudia PC, Sidauruk T, Rahmadi MT. Analisis kelangkaan pupuk bersubsidi untuk petani padi (Studi kasus Dusun VIII Desa Pematang Setrak Kecamatan Teluk Mengkudu). J Laguna Geography. 2023;02(1):16–23.
11. Wijaksana MD, Program LA dan MR. Analisis risiko produksi bawang merah (*Allium ascalonicum* L.) di Desa Suato Lama Kecamatan Salam Babaris Kabupaten Tapin. J Tugas Akhir Mahasiswa (JTAM). 2021;5(2):118–124. Available from: http://ppjp.ulm.ac.id/journals/index.php/fag/article/view/6027
12. Mutisari R, Universitas B. Kata kunci: Risiko Produksi, Usahatani, Bawang Merah. Analisis Risiko Produksi Usahatani Bawang Merah Di Kota Batu. 2019;3:655–662.
13. Palupi T, Alfandi. Pengaruh jarak tanam dan pemotongan umbi bibit terhadap pertumbuhan dan hasil tanaman bawang merah (*Allium ascalonicum* L.) varietas Bima Brebes. J AGROSWAGATI. 2018;6(1):678–692.
14. Pamungkassari AR, Marimin M, Yuliasih I. Analisis kinerja, nilai tambah dan mitigasi risiko rantai pasok agroindustri bawang merah. J Teknologi Industri Pertanian. 2018;28(1):61–74. DOI: 10.24961/j.tek.ind.pert.2018.28.1.61
15. Putri RY, Akbar WK, Merah PB, Panen G. Rasionalitas petani bawang merah saat gagal panen di Jorong Galagah Nagari Alahan Panjang Kecamatan Lembah Gumanti Kabupaten Solok. Pendidikan Tambusai. 2021;5(3):5830–5839.
16. Ramadhan DL, Febriansyah R, Dewi RS. Analisis manajemen risiko menggunakan ISO 31000 pada smart canteen SMA XYZ. JURIKOM (Jurnal Riset Komputer). 2020;7(1):91. DOI: 10.30865/jurikom.v7i1.1791
17. Rasoki T, Fariyanti A, Rifin A. Pembandingan efisiensi pemasaran bawang merah konsumsi dan benih di Kabupaten Brebes, Provinsi Jawa Tengah. J Agro Ekonomi. 2016;34(2):145–160.
18. Supartha IW, Kesumadewi I, Susila IW, Sarjana Dewa G R, Suniti NIW. Teknologi pengelolaan terpadu hama dan penyakit tanaman bawang merah di Kabupaten Gianyar. Angew Chem Int Ed. 2018;6(11):951–952. (Issue Mi).
19. Suryani A, Masyhuri, Waluyati LR, Utami AW. Risk analysis on the cassava value chain in Central Lampung Regency. Agraris. 2023;9(2):150–173. DOI: 10.18196/agraris.v9i2.333
20. Teniwut WA, Betaubun KD, Marimin M, Djatna T. Mitigasi rantai pasok rumput laut dengan pendekatan

house of risk dan fuzzy AHP di Kabupaten Maluku Tenggara. AgriTECH. 2020;40(3):242. DOI: 10.22146/agritech.27770

21. Wijaya W, Dwirayani D, Savitri MI, Wahana S, Cipto Astuti L. Efisiensi dan risiko usahatani bawang merah di Kecamatan Gebang, Kabupaten Cirebon, Jawa Barat. J Agribisnis Indonesia. 2023;11(2):408–421. DOI: 10.29244/jai.2023.11.2.408-421
22. Yulianti F, Wicaksono PA. Perancangan mitigasi risiko pada proses produksi bibit bawang merah Kabupaten Nganjuk Abstrak. Available from: https://ejournal3.undip.ac.id/index.php/ieoj/article/view/40270/29507