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Risk Analysis of Straw Mushroom (Volvariellavolvaceae) Farming, Case Study in Karawang Regency, Indonesia

Siti Sarah Melani[1)], Lies Sulistyowati[2)]

[1]*Student in Magister Agribusiness study program Faculty of Agriculture, Padjadjaran University, Indonesia.*
[2,]*Lecturer in Department of Agricultural Socio-Economics, Faculty of Agriculture, Padjadjaran University. Indonesia.*

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ABSTRACT: Mushroom is one of the leading vegetable commodities in Karawang Regency, Indonesia. The consumption growth of this mushroom commodity always increases every year. Therefore, this study aims to identify and analyze the sources of risk and how big the risk is in mushroom farming in Karawang Regency, identify mitigation and risk mapping that occurs in straw mushroom farming in Karawang Regency, and analyze the risks involved. The research design used a mix method. While the data analysis used is the risk analysis of the HOR (House of Risk) model and Descriptive Analysis. The location of this research is in Jatisari District, Karawang Regency, because Jatisari District is the sub-district that has the most mushroom cultivation farmer groups. The data used are primary data obtained from a number of 120 respondents and secondary data obtained from related agencies. The results showed that the risk management of mushroom farming could be pursued in the form of access to capital and management of the mushroom marketing system. Alternative risk mitigation actions that can be taken by farmers include: (1) Farmers apply for capital loans or production inputs to agricultural shops, (2) Farmers apply for capital loans to sources of financing, and (3) Improve farmers' financial management.

KEYWORDS: Income, Mitigation, Mushroom farming, Risk analysis

I. INTRODUCTION

Mushrooms are one of the horticultural products whose demand continues to increase. The trend of changing consumption patterns of some people has placed mushrooms as one of the popular alternative foods, because of their high protein content. According to FAOStat in 2016, world mushroom production reached 10,790,859 tons. The five largest producing countries are China with production of 7,797,929 tons, followed by Italy, USA, Netherlands, Poland. Meanwhile, Indonesian mushroom production is ranked 15th in the world with a production of 40,906 tons, although it is still below Australia's 50,387 tons. However, Indonesia's production is still higher than India, South Korea and Vietnam.

In Indonesia, edible mushroom is the most widely cultivated mushroom, reaching 55-60% of national mushroom production (http://www.hortikultura-bandung.com), because mushroom is one of the vegetable horticultural commodities that are starting to be in great demand by people in Indonesia. . Most of the mushroom production is marketed in fresh form, especially to big cities (Pasaribu, et al. 2002). The production and productivity of edible mushrooms in Indonesia from 2015 to 2021 shows an increasing trend, due to the increasing demand for straw mushrooms.

Mushroom production has increased from 2015 to 2021 reaching 236%, although there was a drastic decline in 2018 where production was 31,052 quintal or decreased by 16.12% from the previous year. The data above also shows that harvested area has little effect on the level of mushroom production. This can be seen by comparing the 2015 and 2019 data. In 2015 the total harvested area of edible mushrooms was 536 hectares, only able to produce edible mushroom production of 33,485 quintal, while in 2016 with a total land area of 467 hectares it could produce 40,914 quintal.

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Table 1. Harvested Area, Production, and Productivity of Straw Mushrooms in Indonesia, 2015-2021

Year	Producti-on(Kw)	Planted Area (Ha)	Productivity (Kw/Ha)
2015	33,485	536	62.47
2016	40,914	467	87.61
2017	37,020	475	77.93
2018	31.052	440	70.57
2019	33,163	462	71.78
2020	33,688	514	65.54
2021	112.837	1244	90,70

Source: Central Bureau of Statistics (2020), Horticulture Statistics (2021)

One of the centers of edible mushroom in Indonesia is West Java Province. According to the Directorate General of Horticulture (2021), several areas that become centers of vegetable production in West Java include Karawang, West Bandung, Bogor, Subang, and Cianjur. Meanwhile, the production center for mushroom producing with the highest production level is in Karawang Regency. However, the production of edible mushroom in Karawang Regency is experiencing a declining trend. The existence of a downward trend indicates that there are production risks that are often faced by farmers.

Table 2. Production Straw-Mushrooms from Year 2015 - 2021 in Karawang Regency

Year	Harvest Area (Ha)	Production (Kg)	Productivity (Kg /Ha)
2015	147	4,131,191	28,103.34
2016	111.09	3,415,450	30,744, 90
2017	101.19	3.388.170	33,483.24
2018	69.04	2,032,056	29,433.02
2019	48.73	1,382,706	28,374.84
2020	51.36	1 717 725	33,444.80
2021	42.48	11 803	277.84

Source: Karawang Regency in Figures (2022)

The obstacle faced in marketing is that mushroom is a commodity that is very perishable, so it cannot last long when stored at room temperature. Vegetable product marketing activities are constrained by the quality of vegetable products which are sometimes difficult for consumers to accept. Sometimes the vegetable products sold are rotten, wilted, and not fresh anymore. This is because vegetables are stored for too long and are not packaged properly. Vegetables in general have criteria that are perishable, cannot be stored for long, and are easily damaged. This brief description of the mushroom commodity business can illustrate that the mushroom farming has greater obstacles than other commodity farming. The obstacle in question is the high level of risk faced, both related to production and marketing risks. The consumption growth of this mushroom commodity always increases every year. The demand for edible mushrooms per day reaches 4-10 tons, while the supply is only around 4-7 tons (Karawang Regency Agriculture Office, 2019).

According to Diana Putri, C. (2021) based on the advantages and feasibility of developing mushroom farming prospects with an area of 37 m2 kumbung and a total shelf area of 67.44 m2, it is feasible to cultivate and provide benefits for farmers. The feasibility study analysis obtained the results: the NPV value of IDR. 32.866,796 which means NPV>0. The Internal Value of Return (IRR) of the straw mushroom farming is 113%, this value is greater than the discount rate used, which is 11.25%, it can be said that mushroom farming

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based on the IRR and NPV criteria, is feasible to cultivate.

Although a feasibility study was conducted, mushroom farming was feasible, but in farming activities extreme situations often occur, namely risk events and uncertain events. The risk of agricultural production is greater than the risk of non-agriculture, because agriculture is strongly influenced by nature such as weather factors, poor use of seeds, cultivation processes, as well as limited knowledge of human resources, pests and diseases and weather changes (Ministry of Agriculture, 2019).). In addition to nature, risk can also be posed by marketing activities. Price risk is caused by the fact that market prices cannot be controlled by farmers, so that price fluctuations are more common in agricultural products. The size of the risk faced by farmers will have an impact on the level of production and income obtained by farmers. The higher the risk faced by farmers, the higher the chance of experiencing losses.

Risk is the possibility of the occurrence of possible losses that can be known in advance. Uncertainty is something that cannot be predicted in advance, and therefore the chances of a loss occurring are not known beforehand. (Debertin, David l. 1986, Sudjarwo,2019). An important source of uncertainty in the agricultural sector is fluctuations in agricultural production and price fluctuations. In addition, price uncertainty causes price fluctuations where traders want to get big profits and a long marketing chain resulting in price fluctuations. According to DecyEkaningtias(2011), there are several factors that affect income in farming, namely first production, the size of production will greatly affect the income of the farm. Second, the size of the kumbung, the size of the kumbung is also very influential on agricultural production and farm income.

Based on the description above, it can be concluded that the edible mushroom faces production risk which is characterized by variations in the productivity of the straw mushroom. Production risk is thought to be caused by the use of production inputs and environmental influences. In addition to production risk, it is suspected that farmers also face three other risks, namely: price and market risk, human risk and financial risk. The risk has an impact on decreasing the income of mushroom farmers. Therefore, it is necessary to conduct research on the sources of risk and risk mitigation in mushroom farming.

The objectives to be achieved in this study are: What are the sources of risk faced by farmers in mushroom farming in Karawang Regency, and how to mitigate and map the risk of edible mushroom in Karawang Regency?

II. RESEARCH METHOD

The research design used was a mix method, namely a combination of qualitative and quantitative methods. The type of data used is primary data from farmers and secondary data from related agencies/institutions. Data collection methods through structured interviews and documentation. The sampling technique uses a census, with the number of samples taken from all members of farmer groups in Jatisari District, Karawang Regency, as many as 120 respondents who cultivate straw mushrooms.

Data analysis used:
1). House of Risk (HOR) Model Risk Analysis. House of Risk (HOR) is an analysis that is often used in risk management. HOR is a framework developed by developing the FMEA (Failure Mode and Effect Analysis) method and the QFD (Quality Function Deployment) method which is expected to be able to control risk agents that are considered priority so that risk mitigation actions can run effectively (Pujawan,2009). The application of HOR consists of two stages, namely:

a). House of Risk 1
HOR phase 1 is the initial stage used to identify risk events and risk agents that have the potential to arise so that the output of HOR phase 1 is the grouping of risk agents into priority risk agents according to the Aggregate Risk Potential (ARP) value. Calculation of the value of the risk priority index / Aggregate Risk Potential (ARP) which is the result of the possibility of the emergence of the risk agent / source and the aggregate effect of the occurrence of risk caused by the risk source. Sort the sources of risk based on the ARPj value, starting from the largest value to the smallest value. Aggregate Risk Potentials from risk agents can be calculated by:

$$\mathbf{ARPj} = \mathbf{Oj} \sum_{\mathbf{i}} \mathbf{SiRij} \ldots (\mathbf{1})$$

Information:
ARPj = Aggregate Risk Potential Agent
Oj = Opportunity of occurrence of risk
Si = Impact of risk events
Rij = Level of connectedness between risk sources and risk events (correlation)

b) House of Risk 2
House of Risk 2 is used to determine which treatment must be completed first. The company or

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farmer must choose the ideal handling action, meaning that it is low in difficulty if it is carried out but is effective in reducing the possibility of an agent or source of risk. Risk mapping can be done using a frequency matrix or the likelihood and significance of the risk impact. Risk can be grouped into two dimensions, namely the dimensions of frequency and impact. The risk map is a graph that illustrates the position of the risk that the risks in this quadrant have a small impact on achieving the goals and targets of farmers (Pujawan,2009).

III. RESULTS AND DISCUSSION

3.1. Characteristics of Straw Mushroom Farmers in Karawang, Indonesia

Characteristics of each different mushroom farmers, will affect the performance of farming ranging from technical aspects to the resulting production.

Table 3. Characteristics of Straw-Mushrooms Farmer in the Karawang Regency

Characteristics Farmer Straw Mushroom	Number (person)	Percentage (%)
1). Age (years)		
30 – 40	55	45.83
40 – 50	45	37.50
50 – 59	15	12.50
> 60	5	4.17
2).Education Level		
Primary school	63	52.50
Junior high school	27	22.50
Senior High School	30	25
Bachelor	0	0
Characteristics Farmer Straw Mushroom	Number (person)	Percentage (%)
3). Experience in farming mushroom (year)		
1 - 20	36	30.03
21-40	78	64.97
>40	6	5
4).Amount dependents family (person)		
1 -2	71	59,20
3-4	45	37.50
>5	4	3.30

Source: primary data analysis

From Table 3, it can be seen that the percentage of the age distribution of mushroom farmers is the majority in the age range of 30-40 years and 40-50 years. This shows that mushroom farmers are still in their productive age. From the aspect of education, more than half (52.5 percent) of mushroom farmers have elementary education. This shows that farmers' education is dominated by farmers with a low level of education. The low level of formal education that has been successfully completed by mushroom farmers causes the ability of farmers to manage farming to be less than optimal. But judging from the experience, the majority of mushroom farmers have experienced between 21 to 30 years.

According to Yunita (2011), the experience possessed by farmers is related to the ability to run their farm, because while running a farm, farmers will experience a learning process including getting lessons on how to overcome the problems they face, including dealing with business risks. While the family dependents on mushroom farmers, the majority (59.2%) have family dependents of 1-2 people. Based on the results of research Novita and Ratina (2007) stated that the number of family dependents affect the cost efficiency of farming. With the presence of family

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members can help in farming activities, so as to reduce the cost of labours.

3.2. Identification of Risk Sources

Identification of sources of mushroom farming risk in the form of production risk, market and price risk, financial risk and human risk. (Harwood et al, 1999).

1).Production Risk

Based on the results of the study, information was obtained that the production risk in mushroom farming came from: lack of production inputs, wrong handling of mushroom treatments, unpredictable weather, plants attacked by pests and diseases, crop failure, and delays in planting. Changes in temperature are a source of production risk that need to be considered, because straw mushrooms in Karawang Regency can grow optimally in hot enough temperatures, at least cultivation must be adapted to the conditions of the natural habitat of straw mushrooms in nature. When entering the dry season, temperature changes can change significantly and can affect room temperature, especially in rearing kumbung, so that the maximum growth of the mushroom fruiting body, the kumbung temperature must be maintained at around 32 to 34 degrees Celsius. Sudden changes in temperature can interfere with the growth of edible mushrooms and cause planting media if changes in temperature occur, mushroom farmers do it manually by using lights or drums for the temperature inside the mushroom kumbung to remain at the desired temperature then the growth of straw mushrooms is not possible.

2). Price and Market Risk

The price risk in mushroom farming comes from fluctuations in the price of seed logs that occur due to the difficulty of getting good seed logs. One source that can cause price fluctuations is the price of edible mushroom. The price of mushroom seed logs follows the development of consumption mushroom prices. If the price of edible mushroom increases, the price of seeds also goes up and vice versa if the price of consumption mushroom goes down, the price of seeds also decreases. The lower limit on the price risk of BS edible mushroom is IDR. 28.000/kg or super mushroom IDR. 30,000/kg. This means that the lowest price received by farmers at the time of the price risk is IDR. 28.000/kg. Where the results have exceeded the lower limit, it can be stated that this mushroom farming is profitable. However, if the lower limit value is mostly BS mushrooms, then the business is not profitable.

3). Human Risk

This risk is caused by human behaviour in the production process. Human resources need to be considered to produce optimal output. Human morals can cause losses such as negligence, causing fires, theft and damage to production facilities. Based on the results of the field survey, the risks that often occur in mushroom farming are: sometimes making mistakes/negligence, which results in decreased production, both quantity and quality. This is due to the lack of a generation of farmers who cultivate straw mushrooms, so most of the farmers are old.

4). Financial Risk

Financial risk is the lack of capital obtained by farmers, so farmers prefer to borrow capital from moneylenders, sources of capital such as financial institutions or savings and loan cooperatives are also obstacles among mushroom farmers. The results of interviews with several informants can identify 16 risk events that occur from price and market risk, human risk and financial risk. Risk events that often occur during the last few seasons and have the opportunity to appear in the future.

3.3. Mapping House of Risk (HOR) Phase 1

The results of the analysis identified 18 sources of risk that occur from price and market risk, human risk and financial risk. The sources of risk that often occur during the last few growing seasons and are likely to arise in the future can be seen in Table 4.

Table 4. Results Measurement Source Risk (Risk Event)

No	Risk	Source Risk (Risk Event)	Code	Severity
1	Production	Plant attacked pest and disease	E1	5
		Fail harvest	E2	4
2	Price and Market	Price sell straw mushroom fluctuate	E3	7
		Price straw mushroom level middleman more low from on level market	E4	9
		Quantity Request no determined	E5	6

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		The sale of edible mushrooms is not smooth	E6	6
		Consumer straw mushroom only certain people just	E7	8
		Distance delivery	E8	5
		Standard quality supermarket exporter too high	E9	6
3	Man	Farmer start reluctant farming straw mushroom	E10	6
		Decrease power work in farming straw mushroom	E11	4
		Behavior farmer in activity less maximum production	E12	6
4	Financial	Lack of capital for farming straw mushroom	E13	9
		Expenditure to meet the needs of farmers is high	E14	8
		Not there is institution finance for borrow capital	E15	6
		Liquid old bank loan	E16	7
		High bank interest	E17	7
		Receivables not collectible	E18	8

Source: primary data analysis

Information:
1 No effect
2 Farmers can operate with minor disturbance
3 Farmers can operate with some decreased performance
4 Farmers can operate with significantly decreased performance
5 Farmers cannot operate without damage
6 Farmers cannot operate with minor damage
7 Farmers cannot operate with equipment malfunction
8 Farmers cannot operate in the presence of a destructive failure
9 Extremely high severity with warning
10 Extremely high severity without warning

The results of the calculation of the risk and impact of each source of production risk on the mushroom cultivation business have been calculated and the values analyzed. Then a risk mapping can be carried out with the intention of measuring risk and generating risk status and risk maps. Risk status is a measure that shows the level of risk from several sources of production risk that have been previously identified

Table 5. Source Risk Farming Straw mushroom and Occurrence Rate

Code	Source / Agent Risk	Occurrence Rate (Occurrence)
A1	Fail harvest	5
A2	Price sell straw mushroom fluctuate	8
A3	Price straw mushroom level middleman more low from on level market	9
A4	The sale of edible mushrooms is not smooth	7
A5	Consumer straw mushroom only certain people just	7
A6	Farmer start reluctant farming straw mushroom	6
A7	Farmer behaviour in activity less maximum production	6
A8	Lack of capital for farming straw mushroom	9
A9	Expenditure to meet the needs of farmers is high	7
A10	Not there is institution finance for borrow capital	5
A11	Liquid old bank loan	8
A12	High bank interest	6

Source: primary data analysis

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Information:
1 Unwanted failure
2 The probability of failure is relatively small
3 Very little chance of failure
4 Possible failure multiple
5 Possibility of occasional failure
6 Moderate probability of failure
7 The probability of failure is quite high
8 High probability of failure
9 The probability of failure is very high
10 Failure is almost inevitable

Mapping in this model is done by entering the results of measuring the severity of risk events (Table 3) and occurrence of risk agents (Table 4) and measuring their correlation. The correlation value (correlation level) between the source of risk and the occurrence of risk uses a scale of 0.1, 3, 9. A scale of 0 if there is no correlation, 1 if the correlation is low, the correlation is moderate using a scale of 3 and a scale of 9 indicates a high correlation. The purpose of this mapping is to find the ARP (Aggregate Risk Potential) value.

Grouping of Priority Risk Agents with Pareto Calculations

In risk management, not all risk agents get a treatment. This is caused by several factors, namely the costs incurred in the handling process and the level of impact caused is considered too small. Therefore, you can choose a risk agent that is considered a priority by using Pareto's law or what is known as the 80:20 law. According to Kountur (2008) the application of Pareto's Law on risk is that 80 percent of losses are caused by 20 percent of crucial risks. By focusing on the crucial 20 percent of risk, the impact of 80 percent of the risk can be overcome. The determination of the priority risk agent category can be seen in Table 6 and Figure 1 below.

Table 6. Pareto Calculation of Agent Risk farming straw mushroom in the KarawangRegency

Rating	Agent Risk	ARP	Cumulative ARP	% ARP	% Cumulative ARP	Category
1	A8	3393	3393	18,189	18,189	Priority
2	A2	2248	5641	12,051	30,240	Priority
3	A3	1989	7630	10,662	40,903	Priority
4	A9	1715	9345	9,193	50.096	Priority
5	A4	1554	10899	8,331	58,427	Priority
6	A11	1488	12387	7,977	66,404	Priority
7	A12	1242	13629	6,658	73.062	Priority
8	A10	1145	14774	6,138	79,200	Priority
9	A6	1134	15908	6,079	85,279	Non Priority
10	A5	1120	17028	6,004	91.283	Non Priority
11	A7	996	18024	5,339	96.623	Non Priority
12	A1	630	18654	3,377	100	Non Priority
Amount		18654				

Source: primary data analysis

Pareto calculation of risk agents to show the priority value of mushroom farming risk. Based on the calculation results, priority values are obtained, namely: lack of capital for mushroom farming, the selling price of edible mushrooms fluctuates, the price of edible mushrooms at the middleman level is lower than at the market level, expenditures to meet the needs of farmers are high, sales of edible mushrooms are substandard, bank loans are difficult to disburse, high bank interest and there are no financial institutions to borrow capital.

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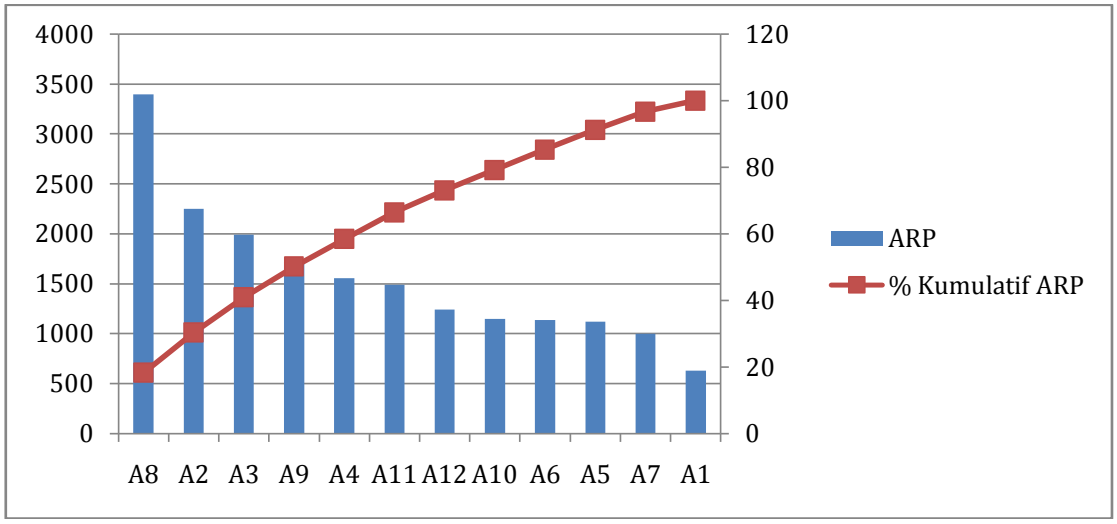

Figure 1. Pareto Diagram of Mushroom Farming Risk Agents

The ARP value is obtained from the multiplication of the severity value, the occurrence value and the correlation value of the risk event and the risk agent. The calculation of the ARP value aims to determine the priority level in handling a risk agent. The risk agents will then be sorted based on the highest to lowest ARP values. Through the results of the risk analysis, the ARP value is obtained which is the result of the phase 1 HOR output. The ARP value is obtained from the multiplication of the severity value, the occurrence value and the correlation value of the risk event and the risk agent. The calculation of the ARP value aims to determine the priority level in handling a risk agent. The risk agents will then be sorted based on the highest to lowest ARP values. Through the results of the risk analysis, the ARP value is obtained which is the result of the phase 1 HOR output.

Risk Mitigation Action Planning

These risk sources (agents) are then incorporated into the Phase 2 HOR model for the design of mitigation actions. Mitigation action in question is action to reduce the impact of a risk agent before the risk occurs. Alternative mitigation actions were obtained from discussions with several leaders, members of farmer groups, farmers, extension workers and the Department of Agriculture. The focus of this mitigation action design is based on the selected risk source (agent) (Table 6). Based on these risks, eight criteria are formed along with alternative mitigation actions that are used to minimize losses that occur as a result of the risks that arise in the risk, then analyzed using the House of Risk Phase 2 method (criteria and alternative risk mitigation actions in mushroom farming). The weighting of the criteria is carried out to determine the priority criteria. According to Nobar, et al. (2011), the weighting is done by doing a pairwise comparison between the components of the source of the risk agent and the mitigation action and then evaluating it using the criteria so that the weight of the criteria is obtained. Based on the calculation of the Pareto diagram, the highest risk of mushroom farming risk is borrowing capital of 79.200% with a cumulative ARP value that can cause other risks, so it is necessary to carry out risk mitigation action options from selected risk agents in the following table.

Table 7. Options Action Mitigation Risk from Agent Risk Selected

Source / Agent Risk (Aj)		Action Mitigation / Preventive Action (Sir)	
Lack of capital for farming straw mushroom	A8	Government help capital farming straw mushroom and institution other	PA1
Price sell straw mushroom fluctuate	A2	The need monitoring price in the market	PA2
Price straw mushroom leveled middleman more low from on leveled market	A3	To do socialization to middleman so that the price could upgraded	PA3
Expenditure for sufficient	A9	Stage training about management finance in	PA4

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needs farmer is high		farming	
The sale of straw mushrooms is not smooth	A4	Record consumer permanent good by small nor party big	PA5
Bank loans are difficult to disburse	A11	Simplify the disbursement process in banking via FDG with party institution finance	PA6
High bank interest	A12	Determine policy flower loan to loan for farming	PA7
Not there is institution finance for borrow capital	A10	Socialize with party institution finance to open agent at each villages	PA8

Source: primary data analysis

The results of the analysis show that the sources of risk agents that are prioritized are 8 criteria, namely: lack of capital for mushroom farming, the selling price of edible mushrooms fluctuates, the price of edible mushrooms at the middleman level is lower than at the market level, expenditures to meet the needs of farmers are high, sales of edible mushrooms are lacking, bank loans are difficult to disburse, bank interest is high, there are no financial institutions to borrow capital. These criteria were chosen in the study according to the conditions in the field because they are important aspects that can determine the risk mitigation analysis carried out by mushroom farming.

Mapping House of Risk (HOR) Phase 2

This mitigation action mapping is carried out by mapping the mitigation action options (Pak) with the selected risk agent (Aj). The results of this calculation are then combined with the results of the mitigation action (Pak) with the selected risk agent (Aj) from each production risk source to describe the status and priority of each production risk source and its position on a risk map. The risk map is a description of the risk position on a map from the placement of the risk position based on the results of the calculation of identified risk events that have been carried out previously.

Mitigation action mapping consists of several steps, namely;

1. Measuring the correlation value between the mitigation action and the selected risk agent
2. Measuring the degree of difficulty (Dk) to determine the degree of difficulty of implementing mitigation actions. The value scale in degrees of difficulty is:
   - 3: Mitigation actions are easy to implement
   - 4: Mitigation actions are rather difficult to implement
   - 5: Mitigation actions are difficult to implement
3. Measuring total effectiveness by multiplying the correlation value between risk agents and preventive actions. The calculation of total effectiveness aims to assess the effectiveness of the mitigation actions.
4. Measuring the effectiveness of difficulty ratio by dividing the total value of effectiveness (TEk) by the scale of the degree of difficulty in performing the action. The calculation of the effectiveness of the degree of difficulty aims to determine the priority ranking of all actions.

After carrying out the steps above, the results of the mapping of risk mitigation actions based on priority rankings are obtained as shown in Table 8.

Table 8. Priority Rank Action Mitigation

Priority Rank	Action Mitigation / Preventive Action (Sir)		ETD
1	Farmer submit capital loan or production company to shop agriculture	PA1	13034
2	Farmers apply for capital loans to informal and formal sources of financing	PA6	7491
3	Repair management finance farmer	PA4	6794
4	Increase quality product straw mushrooms	PA2	6721
5	Farmer shape cooperative agriculture	PA8	5803
6	KUR program in sector agriculture	PA7	5141
7	Look for an alternative market for sale mold continuous straw mushrooms	PA5	4440
8	Manage straw mushrooms becomes something product processed	PA3	4341

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Source: primary data analysis

Explanation of priority risk mitigation actions that can be applied to straw-mushroom farming in Karawang Regency:

1) Farmers apply for capital loans or production inputs to farm shops

This risk mitigation action with the highest ranking has a total effectiveness value (TE) of 39103, the effectiveness value of the degree of difficulty (ETD) is 13034 and the value of the degree of difficulty (D) is 3 which means this action is easy to implement. Mushroom farmers apply for capital loans or production inputs to farm shops at mushroom cultivation locations.

2). Farmers apply for capital loans to informal and formal sources of financing

The risk mitigation action with the second rank has a total effectiveness value (TE) of 29963, the effectiveness value of the degree of difficulty (ETD) of 7491 and the value of the degree of difficulty (D) is 4 which means this action is rather difficult to implement. Some respondents think that doing farmers submit.

3). Improve farmers' financial management. The risk mitigation action with the third rank has a total effectiveness value (TE) of 20382, the effectiveness value of the degree of difficulty (ETD) is 6794 and the degree value (D) is 3 which means this action is easy to implement. Some farmers often attend training so that they gain insight into mushroom farming. Farmers in rural areas have never recorded their finances either in farming or the cost of their needs. So that with the financial management of farmers, it is quite difficult to improve the financial system of individual farmers, lending capital to sources of financing is rather difficult.

4). Improving the quality of mushroom products

The risk mitigation action with the fourth rank has a total effectiveness value (TE) of 26883, the effectiveness value of the degree of difficulty (ETD) of 6721 and the value of the degree of difficulty (D) is 4, which means this action is rather difficult to implement. Improving the quality of edible mushroom products is a bit difficult for mushroom farmers to do.

5). Farmers form agricultural cooperatives

The risk mitigation action with the fifth rank has a total effectiveness value (TE) of 23214, the effectiveness value of the degree of difficulty (ETD) of 5803 and the value of the degree of difficulty (D) is 4 which means this action is rather difficult to implement. Mushroom farmers face capital problems, because the sources of access to financial institutions are quite far away, so farmers get their capital from middlemen. The solution offered is that farmers form agricultural cooperatives. Cooperative institution can be used as a place to borrow capital for farmers. Likewise with the role of cooperatives as a place to sell edible mushrooms which have an impact on the welfare of farmers.

6). Participate in the KUR (People's Business Credit) program in the agricultural sector

The risk mitigation action with the sixth rank has a total effectiveness value (TE) of 25705, the effectiveness value of the degree of difficulty (ETD) is 5141 and the value of the degree of difficulty (D) is 5 which means that this action is difficult to implement. Provisions for banking interest rates have been determined from the centre, so farmers can't determine the interest rate on loans. However, the reason farmers do not apply for capital to financial sources is one of them considering the interest rate.

7). Looking for alternative markets for the continuous sale of edible mushrooms

The risk mitigation action with the seventh rank has a total effectiveness value (TE) of 22201, the effectiveness value of the degree of difficulty (ETD) is 4440 and the value of the degree of difficulty (D) is 5 which means that this action is difficult to implement. Market share is one of the problems faced by mushroom farmers. Farmers often sell their produce to merchant shops in small quantities and sell to middlemen at lower prices.

8). Processing mushroom into a processed product

The risk mitigation action with the eighth rank has a total effectiveness value (TE) of 21703, the effectiveness value of the degree of difficulty (ETD) is 4341 and the value of the degree of difficulty (D) is 5, which means that this action is difficult to implement. The existence of middlemen in Karawang District is the main source of capital for mushroom farmers, so there is a price difference with the market. Farmers prefer to sell to middlemen because there are no permanent consumers and if they sell directly to the market they need transportation costs. The solution offered to farmers is to make processed products that can provide value added to herbal medicine farmers. According to Fitriady (2011), the advantage of

straw-mushroom (Volvariellavolvaceace) is that it is not only good quality edible mushrooms, but low quality ones can also be processed into crackers, chips, sticks, and others at relatively high prices.

IV. CONCLUSION

1. Sources (agents) of risk in mushroom farming that have occurred in recent seasons and have the potential to reappear in the future, namely: (1) Lack of capital for mushroom farming, (2) The selling price of edible mushrooms fluctuates, (3) The price of edible mushroom at the middleman level is lower than at the market level, (4) Expenditures to meet the needs of farmers are high, (5) Sales of edible mushrooms are substandard, (6) old bank loans are liquid, (7) high bank interest, and (8) There are no financial institutions to borrow capital.
2. Alternative risk mitigation actions that can be taken include: (1) The government seeks financial assistance for mushroom farming, (2) Facilitates the disbursement process in banks through FGDs with financial institutions, (3) Conducts training on financial management for farmers, (4) The need for monitoring market prices, (5) Socializing with financial institutions to open agents in every village, (6) Determining loan interest policies that are affordable for farmers, (7) Collecting consumer data and maintaining good relations, so that the sale of edible mushrooms can continuously, and (8) Conducting socialization to middlemen so that price determination is more transparent so that the price received by farmers can be increased.

SUGGESTION

1. Based on the results of the study showing that farmers are still experiencing difficulties in their farming capital, it is hoped that the government will provide a capital assistance program for mushroom farmers.
2. For farmers, it is necessary to carry out various risk mitigation alternatives, so that production and income can be relatively stable.

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