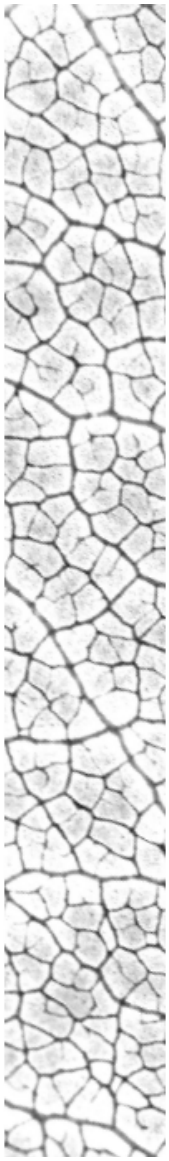

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Farmer's behavior towards Lembah Palu shallot farm risks in Central Sulawesi, Indonesia

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Abstract
The land in Central Sulawesi, particularly in Sigi Regency, is still quite large to cultivate shallots. With suitable rainfall and temperature as well as adequate facilities and infrastructure, the variety of shallots planted by farmers in Sigi Regency is Lembah Palu variety (local). Lembah Palu shallots are suitable to be processed as fried shallots because, in addition to having distinctive aroma and taste, they remain dry/crispy although stored for a long time. With such potential, it is necessary to make efforts to increase Lembah Palu shallot production. In fact, low production and quality of farm yields have made it difficult to gain maximum profits. In addition to considering the profits to gain, farmers also pay attention to any potential farm risks. (A high production risk will affect farmers' behavior in decision making). This study aimed to reveal farmers' behavior towards Lembah Palu shallot farm risks. The study was conducted in February to May 2018 at the center of Lembah Palu shallot production in Sigi Regency. The data analysis was done using a quantitative descriptive approach. Production risk was analyzed using multiple linear regressions with Cobb-Douglas production function as well as Just and Pope production function; Farmers' behavior was analyzed using Khumbakar mathematical model. The results showed that 69.68% of the behavior of Lembah Palu shallot farmers in Sigi Regency was risk averse and 30.32% as risk takers. Recommendation. In order to gain higher yields, farmers should be risk takers.

Keywords: behavior, risk level, production, utility function

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INTRODUCTION

The national development strategy which emphasizes agricultural development basically has the direction that agribusiness and agro-industry development is the most crucial effort to achieve a number of objectives, i.e. promoting the emergence of new agricultural industries; creating a resilient, efficient and flexible agricultural structure; creating added values, increasing foreign exchange, creating employment opportunities, and increasing income (Soekartawi 2001).

One agricultural sub-sector that has a quite high contribution is horticultural commodities which include fruits, vegetables, ornamental plants, and medicinal plants. Shallot (*Allium ascalonicum* L) is one of the leading vegetable commodities intensively cultivated by farmers for a long time, and this has a large market opportunity in the agribusiness sector, making it a source of income and employment opportunities that has a significant contribution to economic development. Community's consumption of shallots continues to increase, even at the present time, shallots are needed not only to meet household needs but also to supply restaurants, hotels, food processing industries as well as fried shallot industries. Along with the growth of these industries, the demand for shallots tends to increase in the following years.

An increase in domestic shallots must be accompanied by an increase in domestic production, both in quality and in quantity by intensification and extensification. Shallot in Indonesia has a quite high production potential, evident by shallot production which had a tendency to increase from 2012 to 2016 and continued to increase. In 2012 the harvested area was 99,519 ha and the production was 964.195 tons, in 2013 the harvested area was 98,937 ha and the production was 1,010,773 tons, in 2015 the harvested area was 120,704 ha and the production was 1,233,984 tons, in 2015 the harvested area was 122,126 ha and the production was 1,229,184 tons, in 2016 the harvested area and production were at the highest level, i.e. 149,635 ha and 1,446,860 tons (BPS and Directorate

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General of Horticulture 2017). Overall, shallot production in Indonesia increased each year. Such increase occurred due to an increase in the cultivation area, the development of production technology utilized by farmers, more intensive supervision and facilities for farmers, better business management, and the presence of institutional strengthening.

The land in Central Sulawesi, particularly in Sigi Regency, is still quite large for shallots. With suitable rainfall and temperature as well as adequate facilities and infrastructure, the variety of shallots planted by farmers in Sigi Regency is Lembah Palu variety (local). Lembah Palu shallots are suitable to be processed as fried shallots because, in addition to having distinctive aroma and taste, they remain dry/crispy although stored for a long time.

It is recorded that Central Sulawesi Province has a total harvested area of Lembah Palu shallot commodities of 1.797 ha, production of 9,061.40 tons with average productivity of 4.77 tons/ha. Sigi Regency is one of the producers of Lembah Palu shallots, evident by the fact that this area has a quite large harvested area, land area, and production compared with other regions. With a harvested area of 839 ha, Sigi Regency has production of 4,427 tons, followed by Parigi Moutong Regency with a harvested area of 299 ha and production of 2,039 tons, and Donggala Regency with a harvested area of 248 ha and production of 990 tons (BPS 2017). Based on these data, Sigi Regency has the potential to develop Lembah Palu (local variety) shallot commodities.

In terms of the potential of land resources, market share and contribution to farmers' income in Central Sulawesi Province, especially in Sigi Regency, Lembah Palu variety is a local superior commodity which is well-known, most commonly cultivated by farmers, and has great potential to be developed. To meet market demand which tends to increase each year in local, regional, national and international markets, it is necessary to make efforts to increase shallot production through the provision of quality seeds on an ongoing basis.

In order to increase the production and productivity of Lembah Palu shallots in each agricultural land, farmers are faced with some problems related to the use of capital and technology. In fact, the major problem faced by farmers is an inappropriate use of production factors, leading to low production.

Low production, productivity, and quality of farm yields have made it difficult to obtain maximum profits. In addition to considering the profits to gain, farmers also pay attention to any potential farm risks. Barry (1984), mentions that in general farm risks are concentrated more on smallholders individually.

Behavior in maintaining natural resources and agricultural business is very closely related to farmers' habits in managing to farm. Agricultural business is in uncertainty, consequently, the yields are always uncertain as well (Ningsih 2013). In addition, according to Just & Pope (1979), risk factors play a major role in decision-making related to the use of inputs, i.e. whether certain inputs used in farming activities need to be increased or reduced to affect production. Uncertainty and risk are two conditions always faced by every farmer in agricultural production processes. The farming system adopted by farmers also contributes to determining to what extent the risks that they face. The application of risk management strategies and tools which are the most complicated decisions that must be made by farmers to reduce the risk of production (Martin and Johan 2018). Richard (2019), in research on farmers' risk preferences and the application of risk management strategies to measure risk aversion and a detailed survey collected data on input use, farm production and non-farm activities to specifically assess whether risk aversion, risk perceptions, and socioeconomic affect the risk management strategies of farm households in Northern Ghana. The results of the study indicate that production risk is mostly to increase diversification into crop production. Variables that influence the risk management strategy is one of which socioeconomic variables such as access to extension services, cultivated areas, age, and gender.

Agricultural risk can be usefully classified into three categories based on its scale of magnitude: micro, meso, and macro levels. Micro-level risks apply to individual farms and farm households. Meso-level risks apply to entire communities or groups of farms and are more difficult to contain. These include local droughts, floods. Macro-level risks refer to those that apply to multiple countries. These often relate to changes in global commodity prices and may result from policies that have unintended effects on markets (Ademola Braimoh et al. 2018).

The risk in Lembah Palu shallot farming activities is the possibility of product failure due to factors beyond the control of farmers; the production risks which most often cause losses to farmers are pests and diseases whose attacks can never be predicted beforehand. The attacks of pests and diseases could occur due to changes in the weather, weeds, or improper care of plants. Farmers in Swedish, providing insurance to plants is one of the risk management tools available to reduce the risk of production caused by unforeseen weather events (Martin and Johan 2018). In fact, high production risks will affect farmers' income, in line with research conducted by Sriyadi (2010), showing that the income risk of garlic farming is mostly caused by the diversity of production. The amount of income and risk greatly affect farmers' behavior in decision-making.

Farmers' behavior towards risks can be categorized into two, namely: 1). Efforts to control the possibility of risks; 2). Actions to reduce the effects of risks (Jolly 1983). When farmers are more risk-averse, it is more

likely that the scale of their business is inefficient; when farmers are more risk taker, it is more likely that the scale of their business is more efficient in terms of both cost and price (Dhungana et al. 2004). Decisions to become risk taker basically require farmers to manage their farming more seriously, for examples by applying more advanced technology to increase production. On the other hand, being risk-averse will lead to simple business decisions and simple business actions, thus gaining inadequate yields. In other words, farmers' behavior in dealing with risks has an important role in affecting agricultural productivity.

Based on this background, it is necessary to conduct a study of farmers' behavior towards Lembah Palu shallot farm risks in Sigi Regency. This study aimed to reveal the farmer's behavior in dealing with Lembah Palu shallot farm risks.

RESEARCH METHODOLOGY

Research Location and Samples

The basic method used in this study was descriptive analysis method, namely a method used in studying a group, human, an object, or a set of conditions in the present. The study was conducted in Sigi Regency, Central Sulawesi Province, Indonesia**,** on farmers who cultivated Lembah Palu (superior commodity) shallots. The location of the study was selected purposively (purposive sampling) by considering that the research location was the center of Lembah Palu shallot production. The study was conducted in February until May 2018. 155 respondents were selected using proportional random sampling as the samples of this study.

The data source in this study used both primary and secondary data. The data were collected through observation (direct observation) of objects in the field, direct interviews with respondents using questionnaires containing a list of questions that had been prepared beforehand to assist in analyzing problems related to farmers' behavior towards Lembah Palu shallot farm risks and using literature study, i.e. by collecting data through relevant Government Offices such as the Central Bureau of Statistics, the Agricultural Services in Sigi Regency, as well as other data sources relevant to this study.

Data Analysis

In addressing the objective of this study, a model developed by Kumbhakar and Tsionas (2008) was used, adapted to analyze behavior towards risk. Kumbhakar and Tsionas' model, based on the assumptions of production technology from Just n Pope production function, is generally formulated as follows:

$$y = f(x_{it}, z_{it}) + u_{it} = f(x_{it}, z_{it}) + h(x_{it}, z_{it})\varepsilon_{it} \quad (1)$$

Where:

Y = Lembah Palu shallot production,

x_{it} = Vector of inputs used,

z_{it} = Quasi-fixed input vector,

$f(x_{it}, z_{it})$ = Denoting average production functions,

$h(x_{it}, z_{it})$ = Denoting production risk functions,

ε_{it} = error term

Model of Producers' Behavior towards Production Risks

Farm risk was analyzed by assuming the inputs and outputs in competitive markets so as to know the prices, whether or not price risks exist. Another assumption was that producers maximized utility (expected utility) which was a normalized expected profit function. The utility function can be formulated (Khumbakar & Tsionas 2008) as follows:

$$E\left[U\left(\frac{\pi^e}{p}\right)\right] \quad (2)$$

The normalized expected profits are formulated as follows:

$$\frac{\pi^e}{p} = y - \frac{w'x}{p} = f(x,z) - \frac{w'x}{p} + h(x,z)\varepsilon = f(x,z) - \widetilde{w}'x + h(x,z)\varepsilon \quad (3)$$

where:

$\widetilde{w}$ = vector of normalized input price $\widetilde{w_j} = \frac{w_j'}{p}\ \forall\ j = 1, \dots, J$

Assuming that producers maximized the expected utility from the normalized expected profits $E\left[U\left(\frac{\pi^e}{p}\right)\right]$, then the first-order condition

$$E\left[U'^{\left(\frac{\pi^e}{p}\right)}\left(f_j(x,z) - \widetilde{w_j} + h_j(x,z)\varepsilon\right)\right] = 0\ \forall\ j = 1, \dots, J \quad (4)$$

Where:

$DU'\left(\frac{\pi^e}{p}\right)$ = Marginal utility of normalized expected profits

f_j = the first derivative of the production function with respect to the ke-j variable

input

h_j = the first derivative of the production function of the ke-j variable input

Equation (4) can be rewritten, in order to gain the function of behavior towards risks, as follows:

$$f_j(x,z) = \widetilde{w_j} - h_j(x,z)\frac{E\left[U'\left(\frac{\pi^e}{p}\right)\varepsilon\right]}{E\left[U'\left(\frac{\pi^e}{p}\right)\right]} = \widetilde{w_j} - h_j(x,z)\theta_1 \forall\ j = 1, \dots, J \quad (5)$$

To gain:

$$f_j = \widetilde{w_j} - h_j\theta_1 \quad (6)$$

So, the function of behavior towards risks is

$$\theta_1 \equiv \frac{E\left[U'\left(\frac{\pi^e}{p}\right)\varepsilon\right]}{E\left[U'\left(\frac{\pi^e}{p}\right)\right]} \quad (7)$$

Decision criteria:

If $h_j > 0$ and $\theta_1 < 0$, then producers are risk averse (RA)

Table 1. Analysis Results of Regression Coefficients of Production Function and Production Risk Function of Lembah Palu Shallot Farming in Sigi Regency, 2018

Variable	Coefficients of Production Function	t-count	Coefficients of Risk Function	t-count
Constanta	6.7169***	13.2680	0.6788*	2.2742
Land Area	0.5616***	8.6194	0.0279ns	0.7278
Seed	0.2365***	3.4366	-0.0702*	-1.7294
Urea Fertilizer	-0.0731***	-2.6499	-0.0012ns	-0.0737
KCL Fertilizer	-0.0041ns	-0.1364	-0.0287ns	-1.6241
NPK Fertilizer	0.0443**	1.9548	0.0114ns	0.8507
Pesticides	0.0443ns	0.1756	0.0289ns	1.2074
Labor	0.0901**	2.4832	-0.0183ns	-0.8544
R-squared	0.8968		0.0873	
Adjusted R-square	0.8919		0.0439	
F-count	182.561***		2.0097*	

Source: Primary data Analysis 2019
*** significant at α = 1% (t-table=2,6097)
** significant at α = 5% (t-table=1,9762)
* significant at α = 10% (t-table=1,6553)
ns = no significant
F-table α = 10% (1,7581)

If $h_j > 0$ and $\theta_1 > 0$, then producers are risk seeking/taker (RS)

If $h_j > 0$ and $\theta_1 = 0$, then producers are risk neutral

On the other hand:

If $h_j < 0$ and $\theta_1 > 0$, then producers are risk averse (RA)

If $h_j < 0$ and $\theta_1 < 0$, then producers are risk seeking/taker (RS)

If $h_j < 0$ and $\theta_1 = 0$, then producers are risk neutral

Coefficient of determination (R^2) is done to determine the accuracy of the model; F test is done to determine if independent variables have a simultaneous effect on dependent variables; t-test is done to determine the partial effects of independent variables on dependent variables (Gujarati 2003).

RESULTS AND DISCUSSION

It is necessary to pay attention to the risks of Lembah Palu shallot farming because generally, these risks result in losses borne by farmers. The risks will also affect farmers' behavior in decision-making to allocate inputs (Villano et al. 2005). Farmer behavior can be seen from the decisions he made in running the economy related to the risks faced in his farming. Decision making by farmers can be know from the aspect of production, work time allocation, income, and household expenditure (Adevia et al. 2017, Swares dan Bakce 2017).

According to Swares and Bakce (2017) decision making on production aspects is influenced by dominant factors, namely, harvest area and total work time allocation. That way farmers tend to consider risks with the harvested area and allocated work time In fact, every farmer has different behaviors in dealing with risks; some are risk taker, risk-averse and risk neutral. Wardani (2015) states that farmers who are risk-averse will allocate inputs differently to those who are risk takers and risk neutral.

Production risk was analyzed using the Cobb-Douglas Just and Pope production function model. The model showed the effect of production factors on the production of Lembah Palu shallots, followed by estimation using the least square method to reveal the factors affecting the production risks. The analysis results can be seen in **Table 1.**

Coefficient of determination (R^2) is used to test the accuracy of the model, in order to reveal the extent to which the independent variables are correlated with the dependent variables. The coefficient of determination (R^2) in the production function was 0.8968, meaning that 89.68% of the production variation could be explained by the independent variables used in the model while the remaining 10.32% was explained by other variables not included in the model. Meanwhile, the coefficient (R^2) in the risk function was 0.0873, indicating that 8.73% of production risk variation could be explained by the independent variables used in the model while the remaining 91.27% was explained by other variables not included in the model.

The results of F-count showed that f-count in the production function was 182.561 (α=1%) and f-count in the risk function was 2.0097 (α=5%). This means that the independent variables simultaneously had a significant effect on the dependent variables (production and risks).

The results of the t-test on the independent variables in the production function showed that land area, seed, NPK fertilizer, and labor had a positive effect on production, which was significant at α=1% and 5%. This means that the addition of each of these production factors will increase the production of Lembah Palu shallot. On the other hand, the production factor of urea fertilizer had a negative effect on production, which was significant at α=1%, meaning that the addition of urea fertilizer will reduce production.

The results of the t-test on production risks indicated that the independent variable which had a negative regression coefficient and a significant effect (α=10%) on the production risks was a seed. This means that the addition of seeds will lower production risk. On the other hand, the factors of urea fertilizer, KCL fertilizer, and labor had a negative coefficient sign (as expected), but they did not affect production risk. The regression

Table 2. Distribution of Farmers' Behavior towards Lembah Palu Shallot Farm Risks in Sigi Regency, 2018

Farmers' Behavior	Farmer (org)	Percentage (%)
Risk Taker	47	30,32
Risk Averse	108	69,68
Risk Neutral	0	0
T o t a l	**155**	**100**

Source: Primary data Analysis 2019

coefficient of land area, NPK fertilizer and pesticides had a positive sign but did not affect production risks.

Based on the regression coefficient of the production function $f(x_{it}, z_{it})$ and risk function $h(x_{it}, z_{it})$, an analysis was then performed to determine farmers' behavior towards Lembah Palu shallot farm risks. The method used to analyze farmers' behavior towards risks was the method by Kumbhakar and Tsionas. Based on the analysis results, the distribution of Lembah Palu shallot farmers' behavior can be seen in **Table 2**.

Based on the analysis results in **Table 2**, it can be seen that farmers' behavior which was risk averse was higher (69.68 %) than risk taker (30.32 %). This means that most of Lembah Palu shallot farmers avoid risks by minimizing the use of inputs to minimize costs, so these farmers are satisfied with the income and production achieved. Risk-averse behavior in this study is caused by several factors, including ownership of a relatively small land area (around 0.69 ha), price fluctuations leading to a high-income risk which causes farmers to reduce the use of inputs, and uncertain weather.

The results of this study are in line with those of a study conducted by Ellis (1998), showing that most of the smallholders in developing countries are risk-averse. Pujiharto and Sri W (2017) Farmers' behavior in dealing with the risk of highland vegetable farming shows that most farmers who grow potatoes, cabbage, tomatoes and scallions (68.75%) are risk-averse, while farmers who are risk-neutral are 23.75% and a small most (7.5%) risk lover, attitude to avoid risk to farmers done using certified seeds with the hope of higher productivity, the use of large amounts of organic fertilizer and ponska fertilizer to supplement NPK needs, this is to reduce the risk of declining soil fertility due to soil erosion and slope of land, watering plants during the dry season and scheduling pest control to reduce the risk of pest attacks. Hidayati et al. (2015) state that farmers' behavior towards organic cabbage farm risks in Baso District, Agam Regency, West Sumatera is still risk-averse. The results of a study by Thamrin (2013), show that 46% of Arabica coffee farmers in Enrekang Regency are risk-averse. The fact that most of the farmer sample was risk-averse is understandable because the lives of rural farmers are very close to substance border and uncertain weather. Besides, farmers have a distinct character, i.e. seeking to avoid failure instead of gaining greater profits by taking risks. This is in line with a statement made by Kebede (1988), that farmers tend to take actions to control, reflecting their risk-averse behavior.

The success of farm management is closely related to farmers' willingness to take risks, reflecting their willingness to use more inputs than other farmers in general. In relation to an increasingly advanced technological development in the present and future, farmers are expected to be risk taker instead of risk-averse because they must have a more optimistic and bright future. Van Vincent *et al.* (2016) stated that a distinction can be made between farmers willing to take a risk, who are more inclined to apply risk management strategies (input use factors) and risk-averse farmers who are less inclined to implement risk management strategies but rather cope with the consequences and diminish their effects when risks have occurred.

CONCLUSION AND SUGGESTION

Conclusion

Based on the results and discussion of this study, it can be concluded that:

The production risk in Lembah Palu shallot farming in Sigi Regency is relatively high, evident by the analysis results showing that most of the farmers' behavior (69.68 %) is risk-averse, while the remaining 30.32% is a risk taker.

Suggestions

1. Using production factors as recommended because this could affect risks and behavior in doing farming activities.
2. In order to obtain higher yields, farmers should be willing to be risk takers.

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