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Analysis of the Uncertainty of Rice Farming Income in Subak Munggu, Cempaga Village, Bangli Regency

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Abstract

Indonesia is a fertile country with a tropical climate, which makes it a country with great potential to produce commodities in the agricultural sector. Farming is defined as a business in the agricultural sector (food, horticulture, ornamental crops, plantations, fisheries, forestry, and livestock). The population in this study is all farmers who are members of Subak Munggu, where the sample was deliberately determined through a census of 70 farmers. To analyze income uncertainty, production and income value data are needed, then measure the spread of risk using a quantitative approach that can be calculated using the expected yield value as an indicator of the probability of investment and the variety and standard deviation measures as risk indicators. The higher the value of the coefficient of variation, the higher the risk to a farm, and vice versa. So, it can be said that the farmer who has the highest coefficient of variation is the riskiest. The lower limit of the highest yield or the upper limit of income is the lowest nominal value of the income that the farmer may receive. If the value is less than zero, then it is likely that the farmer will suffer losses.

Contents

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1 Introduction

Background

Indonesia is a developing country with the agricultural sector as the livelihood of the majority of its population, so most of its population depends on farming activities (Lumintang et al., 2016). The agricultural sector is a sector that plays an important role, so it receives considerable attention from the government because of its role in economic development. The agricultural sector can be used as a basis for the development of rural economic activities so that the income of rural communities can be developed through the development of farming or agriculture-based businesses, namely agribusiness. In addition, the agricultural sector also plays a role in providing food for the population and providing raw materials for industry and for export development (Suarsini, 2014).

Farming is an activity that seeks and coordinates production factors as effectively and efficiently as possible in the form of land, labor, and capital so as to provide the best benefits and provide the maximum possible income (Barokah, 2014). In essence, the development of farming aims to produce food for family needs, so it is called self-sufficient farming. Because of the better management system by farmers, it produces more products and can be marketed, so that it has a self-sufficient farming pattern, financially. Because it can be market-oriented, the farming will become a commercial farm.

Based on Bali Provincial Regulation No. 9 of 2012, subak is a traditional organization of indigenous peoples in Bali in the field of water and plant management that is socio-agricultural, religious, and economic at the farming level. According to Windia (2010), daily subak activities or activities include spiritual activities related to various religious ceremonies, cooperation of subak organizational activities regulated in customary regulations (awig-awig), management of irrigation systems with the concept of proportionality, related to mutual lending of water, and others. The subak activities or activities are related to the five functions of subak as an irrigation system, namely (1) carrying out religious ceremonial activities, (2) distributing and distributing irrigation water, (3) managing or mobilizing farmer resources, (4) maintaining irrigation canals, and (5) handling or managing conflicts (Windia, 2018).

The existence of climate change is a major determining factor for plant growth and productivity. Almost all agricultural sectors are affected by climate change. The agricultural sector, especially horticulture and livestock, has a high risk of being threatened by climate change. The uncertainty faced by rice farmers caused by the obstacles mentioned above will have an impact on production and income. Farmers in farming consider the high and low uncertainty faced, which can result in reduced income and may even result in negative income. In addition, Indonesian agriculture is also faced with the problem of fluctuations in the price of agricultural commodities, which affect the value of agricultural commodities and the amount of costs incurred to obtain optimal production, which is a risk to the income expected by farmers (Nicholson & Snyder, 2012).

The urgency of this study is to further understand decision-making in monoculture rice farming and minimize risks in rice farming in Subak Munggu. Therefore, it is considered necessary to conduct research to answer as explained in the objectives of this research related to the economic income of farmer households and the sustainability of subak in the future. Based on this background, it is necessary to research the uncertainty of income in rice farming in Subak Munggu, Cempaga Village, Bangli Regency.

Problem Formulation

Based on the above background, the research problem can be formulated as follows namely how much income uncertainty in rice farming in Subak Munggu, Cempaga Village, Bangli Regency.

Research Objectives

Based on the formulation of the problem above, this study aims to determine the magnitude of income uncertainty in rice farming in Subak Munggu, Cempaga Village, Bangli Regency.

2 Materials and Methods

Research Methods

Research Location and Time
The research was carried out in Subak Munggu, Cempaga Village, Bangli Regency. This research was carried out for 7 months, from March to October 2023.

Research Data
This study uses quantitative and qualitative data types. Quantitative data is data that can be expressed in the form of numbers, such as the number of respondents, the age of the respondents, the land area, the number of plants, the number of productions, and so on. Meanwhile, qualitative data is data that can be expressed in the form of non-numbers, such as the type of fertilizer used, land status, risks faced by farmers, and other data that is not in the form of numbers.

Primary data is a data source that directly provides data to data collectors obtained through interview techniques. In this study, questionnaires were given to farmers and focused on rice farmers in Subak Munggu. As for secondary data, it is data obtained indirectly from the source. Secondary data were obtained from library sources and documents from the Agricultural Extension Center, Central Statistics Agency (BPS) of Bali Province, field observation records, supporting books, and journals related to research on farming activities. This secondary data was obtained to find out time series data on the amount of rice production, the amount of rice harvest land, and rice productivity in the region (Miyata et al., 2009).

The data collection methods used in this study are as follows: 1) Interview, which is a data collection technique that is carried out through face-to-face and direct and in-depth questions and answers with rice farmers to obtain the information and data needed using questionnaire instruments. 2) Literature study, which is a data collection technique by studying and recording data from several literature related to agricultural research and documents in government or private agencies (Palm et al., 2014).

Recorded parameters
The main parameters recorded in this survey are as follows: 1) Characteristics of farmers: age, education, land area, land ownership status; 2) Rice crops and seasons planted, proportion of farmers and area/area planted, proportion of farmers and farming costs incurred; 3) Household income sourced from agriculture.

Research and measurement variables
Farming is an activity carried out in processing natural resources to obtain high production, and ultimately can increase farmers' income. Rice farming income is obtained from the difference between the revenue and costs incurred in rice farming production, calculated over a certain period. Revenue is the result of the sale of rice farming, while the cost incurred is the cost required in all production processes in rice farming. Income is the net amount received by rice farmers, which is obtained from the amount of revenue minus the total cost of production. The variables used in this study are the source of risk, the magnitude of uncertainty, and risk mitigation in rice farming. The variables, indicators, parameters, and measurement variables can be seen in Table 1 below.

Table 1
Variables and Measurement of Uncertainty in Rice Farming

Variable	Indicator	Parameter	Measurement
Sources of risk	The Risks of Rice Farming	What are the risks faced in rice farming in Subak Munggu	Qualitative
The magnitude of uncertainty	Average production, price, and revenue	The amount of production in rice farming	Quantitative
	Standard deviation values, coefficients, and variations	Total income in rice farming	

Variable	Indicator	Parameter	Measurement
Risk Mitigation	Mitigation/risk reduction efforts	Efforts that need to be made to mitigate all risks in rice farming in Subak Munggu	Qualitative

Population and Sample

A population is a collection of individuals consisting of objects/subjects with certain qualities and characteristics that have been determined by researchers. Meanwhile, the sample is part of the number and characteristics possessed by the population (Sugiyono, 2013). The population in this study is all farmers who are members of Subak Munggu, which amounts to 70 farmers. Where sampling is carried out by census by taking the entire population is used as a sample.

Data Analysis Methods

Rice farming revenue can be calculated by multiplying the price of rice production by the amount of production obtained with the following formula:

$$TR = Pq \times Q$$

Information:
TR : Total Revenue (Rp/area of cultivation/year)
P : Production Price (Rp/year)
Q : Obtained production

The Cost of Farming

All farming costs incurred by rice farmers in Subak Munggu aim to generate optimal income. The total cost (TC) in rice farming is the total amount of production costs incurred. The total cost consists of fixed costs and variable costs.

a) Fixed Cost
Fixed costs consist of production costs and depreciation costs of agricultural equipment. Production costs are the costs incurred in rice farming activities and the cost of depreciation of agricultural tools such as hoes and sickles. The amount of depreciation cost of agricultural tools used for rice farming is calculated using the straight-line method. The formula of the straight-line method is as follows:

$$\textbf{Depreciation of Building Equipment} = \frac{\textbf{Purchase value} - \textbf{Residual Value}}{\textbf{Economic Life}}$$

b) Variable Costs
Variable costs are calculated from the cost of fertilizers, medicines, and labor used in rice farming. To find out the total production cost incurred, it is necessary to calculate the total cost. Production cost can be calculated with the following formula:

$$TC = TFC + TVC$$

Information:
TC : Total Cost (Rp/year/working area)
TFC : Total Fixed Cost (Rp/year/working area)
TVC : Total Non-Fixed Costs (Rp/year/area of cultivation)

To increase income, farmers must try to increase production in order to obtain an increase in income by maximizing inputs that affect rice farming. Rice farming income can be calculated by reducing the total income of farmers minus the total cost during farming with the following formula:

$$\boldsymbol{\Pi = TR - TC}$$

Information:
Π : Revenue (Rp/year)
TR : Total Revenue (Rp/year)
TC : Total Cost (Rp/year)

To answer the magnitude of the uncertainty of rice farming income in Subak Munggu, Cempaga Village, Bangli Regency, data on the production value and income of rice farmers is needed, which can be measured using formulas.

a) Variety
According to Ichsa in Shinta (2011), to measure the spread of risk using a quantitative approach, it can be calculated by using the expected yield value as an indicator of the probability of investment, and the measure of *variance* and standard deviation (*standard deviation*) as the risk indicator. The variety can be calculated by the formula:

$$S^2 = \frac{\sum(Q - Qi)^2}{n - 1}$$

Information:
S^2 : Variance
Q : Production Yield (Kg/year) or Price (Rp/Kg) or Revenue (Rp/year)
Qi : Average Production Yield (Kg/year) or Average Price (Rp/Kg) or Average Income (Rp/year)
n : Number of Farmer Samples
The *standard deviation* can be calculated by the formula:

$$S = \sqrt{S^2}$$

The higher the variety value (S^2) and the standard deviation (S), the higher the level of uncertainty. Variety and standard deviation are used to measure the uncertainty of production, price, and income.

b) Coefficient of Variation (KV)
According to Kadarsa in Shinta (2011), the coefficient of variation, or the lowest level of risk, is a comparison between the risk that must be borne by farmers and the amount of income that will be obtained as a result of the amount of capital invested in the production process. The coefficient of variation is a measure of the relative risk obtained from a farm. The higher the value of the coefficient of variation, the higher the risk to a farm, and vice versa. So, it can be said that the farmer who has the highest coefficient of variation is the riskiest. According to Hernanto (1993), this shows that if the KV is > 0.5, the risk to farming borne by farmers is greater, while if the KV value is ≤ 0.5, farmers will always profit or break even. The coefficient of variation is a measure of variation that can be used to compare a distribution of data that has different units.

$$KV = \frac{S}{Qi}$$

Information:
KV : Coefficient of Variation
S : Baku Junction
Qi : Average Production Yield (Kg/year) or Average Price (Rp/Kg) or Average Income (Rp/year)

c) Lower Limit of Highest Yield (L)
The lower limit of the highest yield or the upper limit of income according to Hernanto in Shinta (2011), is to indicate the nominal value of the lowest income that may be received by farmers. If the value is less than zero, then it is likely to suffer losses. The lower limit of the highest yield can be calculated by the formula:

$$L = Qi - 2.S$$

Information:
L : Lower Limit of Highest Yield
Qi : Average Production Yield (Kg/year) or Average Price (Rp/Kg) or Average Income (Rp/year)
S : Baku Junction

3 Results and Discussions

One of the agricultural sectors that is prioritized is the food crop sector, such as rice, corn, and soybeans. However, until now, the popularity of rice as a staple food ingredient for the Indonesian population is still undefeated. Therefore, farmers in rice farming continue to try innovations to obtain the desired results and avoid losses that may occur. In rice farming, farmers are often faced with various kinds of uncertainties. This uncertainty can occur due to natural factors that affect crop yields and price fluctuations that affect farmers' incomes. The impact of crop uncertainty will result in producers being reluctant to enter the production market (Magfira et al., 2023). This uncertainty will be a risk or an opportunity for loss for farmers. Risks can be divided into three, namely production risk, price risk, and revenue risk. Farmers will try to avoid failure and not make big profits by taking risks (Sriyadi, 2010).

The narrower the land that is cultivated, the higher the production risk faced. When viewed from the value of the coefficient of variation in planting seasons one and two, farmers with narrow plots have a higher risk compared to farmers with medium and large plots. The greater the standard deviation value, the greater the deviation that causes greater risk and vice versa (Rama et al., 2016). Price risk in agricultural production is caused by market prices that farmers cannot control (Magfira et al., 2023). The low-price risk for small-land farmers is because the selling price received by farmers is relatively higher than that of medium- and large-scale farmers. The higher price is because smallholder farmers prefer to join farmer groups when selling their produce at a relatively the same price. Farmers with medium and large land sell their products to local middlemen, so that the selling price received is lower. The high-income risk for farmers with narrow plots is caused by low production, narrow cultivated land, as well as production products that are partially not sold (Frimawaty et al., 2013). Small-land farmers prefer to consume the produce or store it as a reserve for their food to avoid risks. Low income also results in farmers with narrow plots having no other choice but to consume the products of their farming, and is supported by a decline in production during drought. Meanwhile, farmers with large plots of land have a higher risk in the second planting season, caused by a drastic decrease in production, and some cultivated land is planted with crops or left alone. This is in line with the results of research conducted by Prihtanti (2014), namely, the higher the area of land cultivated, the smaller the risk faced, judging from the coefficient of income variation.

The average income of rice monoculture farming is Rp. 43,651,451.26. In rice cultivation, it requires costs (inputs) to generate revenue (output) so that farmers get net income from the entire rice cultivation business. However, in farming carried out by farmers, there must be risks, both production risks and income risks.

Analyzing the level of risk in rice farming aims to enable rice farmers to know and handle the risks of rice farming so that production in rice cultivation in Bangli Regency can be more optimal and reduce the impact of losses that will occur. The results of the study show that the value of the coefficient of variation (CV) of income risk from rice in Bangli District is 0.49 and the lower limit (L) of income is Rp 39,290,583.15 where if the CV value is ≤ 0.5, then the value of L ≥ 0 shows that farmers are avoided from risk with an income of Rp 39,290,583.15.

Although in this case farmers are protected from risk, the CV value is almost close to 0.5, which means that rice farmers of this monoculture pattern have the opportunity of losses that will be borne by farmers. Monoculture patterns are susceptible to disease attacks because they do not provide additional yields, and soil fertility tends to decline rapidly, which requires high fertilization intensity, resulting in quite high production costs. This problem greatly affects farmers' income because production is highly determined by production factors (Parining et al., 2024).

In addition, the lives of farmers in the countryside are quite close to the boundaries of the subsystem and always experience weather uncertainty, so farmers do not have the opportunity to apply the calculation of

maximum profits in farming. Farmers will try to avoid failure and not make big profits by taking risks (Sriyadi, 2010).

4 Conclusion

It can be concluded that farmers in rice farming continue to try innovations to obtain the desired results and avoid losses that may occur. In rice farming, farmers are often faced with various kinds of uncertainties. This uncertainty can occur due to natural factors that affect crop yields and price fluctuations that affect farmers' incomes. The impact of crop uncertainty will result in producers being reluctant to enter the production market (Magfira et al., 2023). The narrower the land that is cultivated, the higher the production risk faced. Risk is divided into 3, namely, production, price risk, and revenue risk. The risk of production is higher for smallholder farmers because the limited land area causes low production volume and high crop variation. The price risk is lower in smallholder farmers because they tend to sell their produce through farmer groups, which allows for more stable prices. Nevertheless, income risks remain high as part of the proceeds are used for personal consumption, and production constraints are exacerbated by the dry season. Monoculture farming patterns also increase susceptibility to diseases and reduce soil fertility, thus requiring higher production costs. Although the coefficient of variation (CV) value of 0.49 indicates that farmers are still technically immune to the risk of loss, this value is close to the threshold (0.5), which means that the chance of loss is still quite large.

Suggestion

Farming is one of the activities that organizes agricultural production facilities and technology in a business related to agriculture. In carrying out farming activities, farmers always experience uncertainty due to various risks. The farming that is carried out is considered profitable if the total revenue is greater than the total expenditure of farming; on the other hand, if the total income is smaller than the total expenditure of farming, then the farming is said to be a loss. Based on the results of the study, it was found that several things can still be developed to increase farmers' income through risk mitigation efforts in Subak Munggu, Cempaga Village, Mengwi Regency.

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