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SUSTAINABILITY OF RICE FARMING REVIEWED OF THE ECONOMIC SIDE: A CASE RESEARCH OF CENTRAL SULAWESI INDONESIA

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Abstract: *Because of population pressure and change in climatic conditions, rice farming faced a significant threat to its productivity and production stability. In addition, the lack of appropriate innovation, adequate input, limited education of farmers, and a weak financial base forced the unsustainability of agriculture in the region. This research aimed to verify the sustainability of rice farming and took for its case research the irrigation area of Central Sulawesi, Indonesia. The research used a Multi Stage Random Sampling method to select 120 respondents. Analysis of a break-even point assisted in finding out existing rice farming income at states of no-profit and no-loss. This research also meant to find out the relationship between variable cost, production volume, price level, as well and revenue of rice farming. Results showed that profitability of rice farming was still low due to poor production and a drop in rice selling price. These factors tended to cause a loss for farmers. This situation occurred due to lack of business strategies and policies aiming to improve the product and its plenitude. Such factors contribute substantially to the unsustainability of rice farming. Sustainability of rice farming might be achieved with new innovations to increase production, as well as government protection policies that determine the base price of grain for farmers' welfare.*

Keywords: ***P****roduction, Rice farming, Economic, Sustainability*

INTRODUCTION

The years between 1980 and 2011 saw agriculture around the world experience dramatic change, increasing rice production almost threefold (IRRI., 2012). A large number of natural lands had been converted into a fertile and productive region. Rice production increased with the introduction of high yield varieties, as well as mechanization of agriculture and various types of chemical fertilizers and pesticides (Barrow *et al.* 2008). It was known as a sustainable agricultural system using agriculture intensification (Dahal *et al.* 2007; Perfecto and Vandermeer, 2008; Raut *et al.* 2010).

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Indonesia has an agriculturally based economy and culture. Agriculture is very important because of its role as a major food source, employment for most of population, and industry of material suppliers supporting the practice. The success of development in this sector guarantees food security, institutional and local culture, and increases the welfare of farmers (Masyhuri, 2007).

Outside, Indonesia, rice is the staple food for more than half of the world's population (Cantral and Reeves, 2002; Davidson *et al.* 1979). In Indonesia, rice is a food crop commodity of prime significance to keeping the population healthy. Rice serves as the staple food for most of Indonesian society and contributes more than 55% to the average citizen's energy consumption and protein.

Rice is a strategic commodity because it is the staple food of Indonesia. If there is an increase in the cost of rice, the first concern is inflation; as a result, the government is very concerned with maintaining stability in rice prices. High inflation poses a potential scourge for governments, including Indonesia, as it causes a rise in interest rates and quickly destroys a variety of industries.

Rice farming in Indonesia involves 25.4 million households, or more than half of the population in the country (Kuhdori, 2014). This makes the plant essential in maintaining the three pillars of the system: food, economy, and national. Rice farming is related closely to household and national food security, reducing poverty and hunger, maintaining nutrition and health, political and economic stability, and overall growth and development.

Because of population pressure and change in climate conditions, rice farming faced a major threat to productivity and production stability. Normally, rice production is dependent on chemical fertilizers, pesticides, and irrigation. Excessive input usage causes farming inefficiencies (Umanath and Rajasekar, 2013). In addition, the lack of appropriate innovation and adequate inputs, limited education of farmers, and the weakness of the financial base are the main drivers forcing unsustainable agriculture.

In this scenario, considering farmers produced rice under free market conditions, the price would be subject to the market price. This research aimed to determine the market price, which allowed farmers to cover the cost of production and verify the sustainability of rice farming.

RESEARCH METHOD

Central Sulawesi, Indonesia provided the area for case research. The research location was determined by using the Multi Stage Random Sampling method. Based on the data presented on Table 1, as well as the region's status as a central area of rice production, the regencies selected as sample locations were (1) Parigi Moutong, (2) Sigi, and (3) Donggala. Furthermore, in those regencies the research selected six districts, namely South Parigi, Torue, Palolo, Dolo, Balaesang and Damsol. The research used the villages of Tolai, West Tolai, Nambaru, Dolago, Sidondo 1, Sidondo 3,

Table 1
Harvested Area, Production and Productivity of Rice by Regency in Central Sulawesi, 2011

No	*Regency*	*Harvested Area (ha)*	*Production (ton) *)*	*Production (ton) **)*	*Productivity (ton/ha) *)*	*Productivity (ton/ha) **)*
1	Banggai Kepulauan	640	2,512	1,583	3.92	2.47
2	Banggai	40,410	185,478	116,851	4.59	2.89
3	Morowali	14,613	61,407	38,686	4.20	2.65
4	Poso	23,805	101,055	63,665	4.24	2.67
5	Donggala	23,893	111,961	70,535	4.69	2.95
6	Tolitoli	20,255	89,799	56,573	4.43	2.79
7	Buol	5,684	23,255	14,651	4.09	2.58
8	Parigi Moutong	49,500	259,474	163,469	5.24	3.30
9	Tojo Una-Una	2,062	7,006	4,414	3.39	2.14
10	Sigi	39,515	194,199	122,346	4.91	3.10
11	Palu	754	3,482	2,194	4.61	2.91
	Total	221,846	1,039,628	654,967	-	-
	Average	20,168	94,511	59,542	4.68	2.95

Source: BPS Central Sulawesi Province, 2012
*) In the form of Milled Dry Grain (MDG)
**) The conversion in the form of rice

Ranteleda, Sejahtera, Malonas, Ponggerang, Sibayu and Kampung Baru as its research locations.

The population in this research consisted of rice farmers settled in the region of Central Sulawesi Indonesia. Those villages used were ones known as rice production centers in each district and regency. Considering the diversity in each sample, villages were relatively homogeneous in terms of rice acreage; the number of samples from each village was 10 household heads (HH), so that the number of samples originating from 12 villages as a whole were 120 HH. A simple random sampling method determined respondents from each sample village.

Analysis of the break-even point helped determine rice farming income, at the state of no-profit and no-loss. This also meant to find out the relationship between variable cost, production volume and price level, as well as revenues of rice farming. Mathematically, this break-even point analysis can be formulated as following:

$$TR = TC \quad (1)$$

$$TR = P \times Q \quad (2)$$

$$TC = FC + VC \quad (3)$$

$$TC = FC + (AVC \times Q) \quad (4)$$

The equation can be simplified to

$$P \times Q = FC + (AVC \times Q)$$

$$P \times Q -- (AVC \times Q) = FC$$

$$Q\ (P - AVC) = FC$$

In order to be obtained TPP formula as following:

$$BEP\ production\ (Q) = \frac{FC}{P - AVC} \tag{5}$$

Furthermore, to calculate the price of rice at the time of BEP used the equation:

$$BEP\ rice\ price\ (P) = \frac{FC}{Q} + AVC \tag{6}$$

where:

BEP = Break-Even Point
FC = *Fixed Cost* (IDR)
VC = *Variable Cost* (IDR)
AVC = *Average Variable Cost* (IDR)
P = Rice Price (IDR/kg)
R = Revenue (IDR)
Q = Production (kg)

RESULT AND DISCUSSION

Analysis of rice income appears on Table 2, where the total cost of production is IDR9,677,640 / ha. Variable cost was the category with the biggest impact, namely 75.50% of the total cost of production. Based on the analysis results of rice farming in all of research locations, the calculation results of the break-even point (BEP) are as follows:

- Production (rice): 2,253 kg / ha
- Price (P): IDR 6,830 / kg
- Fixed Cost (FC): IDR 2,371,290
- Variable Cost (VC): IDR 7,306,349
- Average of Variable Cost (AVC): IDR 3,243

(a) The volume of production at break-even point may be calculated by the formula:

$$Q = \frac{FC}{P - AVC}$$

$$Q = \frac{2{,}371{,}290}{6{,}830 - 3{,}243}$$

Table 2
Income Average of Rice Farming

No.	*Commentary*	*Value*
1.	Rice production (kg/ha)	2,253
2.	Average of rice price (IDR/kg)	6,830
3.	Revenue (IDR)	15,387,990
	Fixed Cost	
	- Rental value of land (IDR)	2,242,188
	- Land tax (IDR)	23,438
	- Depreciation (IDR)	105,664
4.	Total Fixed Cost (IDR)	2,371,290
	Variable Cost	
	- Seeds (IDR)	276,919
	- Fertilizers (IDR)	884,526
	- Pesticides (IDR)	107,724
	- Labors (IDR)	4,500,000
	- Milling Cost (IDR)	1,537,180
5.	Total Variable Cost (IDR)	7,306,349
6.	Total Production Cost (4 + 5) (IDR)	9,677,639
7.	Farming Income (3 – 6) (IDR)	5,710,351

Source: Adapted from primary data

$$Q = \frac{2{,}371{,}290}{3{,}587}$$

$$Q = 661\ kg$$

So the sales volume at the break-even point for rice production (in the form of rice) in all of research locations was 661 kg, with the selling price of IDR 6,830 / kg.

(b) Rice price during the break-even point may be calculated by the formula:

$$P = \frac{FC}{Q} + AVC$$

$$P = \frac{2{,}371{,}290}{2{,}253} + 3{,}243$$

$$P = 1{,}053 + 3{,}243$$

$$P = IDR\,4{,}296 / kg$$

The selling price of rice during the break-even point was IDR 4,296 / kg, with the rice production at about 2,253 kg / ha.

Variable cost in rice farming was high due to its high labor cost (61.59% of variable cost). Rice farming used a great deal of labor during times of land preparation and

harvest, due to the manual nature of rice harvesting. Labor cost was thereby the main cost in rice farming (Tudisca *et al.* 2011).

Table 2 shows income of rice farming amounted to IDR5,710,351/ha with the selling price of IDR6,830 / kg. This result showed profitability (measured by Return on Equity) of rice farming was still low (0.78). Profitability was the ability of a company to cover the cost by achieving adequate income (Sgroi *et al.* 2014b). The comparison of income and cost was essential in the production process; the process only continues when the cost provides a higher rate of returned than that invested (Santeramo *et al.* 2012).

In particular, if the price dropped to IDR 4,296 / kg, income of rice farming was equal to zero. Selling price changes at the time of a harvest could result in this phenomenon. To accommodate, sensitivity of analysis was conducted to analyze how farming income would change with the change of the selling price (Tudisca *et al.* 2014). The performance of the market influenced the change of farming income, but also affected productivity limitations of farmers (Sgroi *et al.* 2014a). This constraint is related with structures of farming and external environments. This means factors like the quality and quantity, financial ability, and organization ability in the industry.

Profitability of rice farming was still low due to poor selling prices. Indeed, rice is considered a strategic commodity because it is the staple food of Indonesia. If rice costs increase, the first concern is inflation, so the government is very concerned with maintaining stability in the rice market.

High inflation is a serious concern in every country, including Indonesia. Inflation causes a rise in interest rates, and negatively affects all sectors. In Indonesia, there are strong pressures on the agricultural sector to provide rice at low prices to secure the macro variables (inflation, interest rate, economic growth, and trade balance). The agricultural sector is also required to support the industrial sector by providing rice at the low price for laborers in urban centers (Kuhdori, 2014). This means that a decrease in rice farming production or selling prices will cause a loss for farmers. This situation occurs due to a lack of business strategies and policies aiming to improve the bountifulness of production. This will cause the stagnation of agricultural activities, lower income and reduce employment opportunities (Testa *et al.* 2014). Sustainability of rice farming can be achieved by increasing production, reducing production cost and increasing farmer income by shortening the supply chain (Chinnici *et al.* 2014; George *et al.* 2008; Lanfranchi and Giannetto, 2013).

CONCLUSION

The sales volume at the break-even point for rice production in all research locations was 661 kg, with a selling price of IDR 6,830/kg. The selling price of rice during the break-even point was IDR 4,296/kg, and rice production about 2,253 kg/ ha. Profitability of rice farming was still low due to poor production and rice selling prices. If there was a decrease of rice farming production or selling price, this guaranteed a loss for farmers. This situation occurred due to a lack of business strategies and policies

which aimed to improve production of the commodity, causing unsustainability in rice farming. Sustainability of rice farming could be achieved with new innovations to increase production and government policies in determining the base price of grain for farmers' welfare.

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