

Prospect of Low Land Rice Sustainability in South Sumatera, Indonesia

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Submission date: 20-Jul-2022 09:01PM (UTC+0700)

Submission ID: 1873017841

File name: Antoni_2021_IOP_Conf._Ser._Earth_Environ._Sci._810_012046.pdf (458.92K)

Word count: 3589

Character count: 17777

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To cite this article: M Antoni *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **810** 012046

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Prospect of Low Land Rice Sustainability in South Sumatera, Indonesia

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Abstract. This study aims to determine the factual conditions regarding the scale of business and technology adoption related to the need for rice agricultural labor, the amount of production and productivity that have an impact on meeting the living needs of farmers and their families. The research method used for primary data collection with Multi Stage Random Sampling. Research areas are Musi Rawas Regency and Banyuasin Regency, which respectively represent agricultural areas with technical irrigation and tidal swamps. In each district, two villages were selected, so that there were four sample villages, and 50 farmers in each village were selected, so there were 200 respondent farmers. The results showed rice farming in tidal areas use less labor but wider cultivated area, higher productivity and welfare than farmers in irrigated areas. Potential labor transition from one sector to others in irrigated areas is greater than the tidal area, so rice farming sustainability in tidal land is than technical irrigation area.

1. Introduction

Indonesia Central Statistics Agency stated that in 2019 rice production in Indonesia reached 31,31 million tons, decrease from production by 2018 as many as 33.94 million tons. The average rice consumption is 111.58 kilograms percapita peryear, so that the annual consumption needs are 29.6 million tons and there is a surplus of 1.53 million tons at all. The need for rice in Indonesia continues to increase along with the increasing population. Therefore rice production needs to be increased through intensification and extensification programs. The extensification program is still possible to do in tidal land, while in irrigation areas it is no longer possible to expand them.

The phenomenon that occurs in rice farming in Indonesia within two last decade are [1] conversion of paddy fields, many rice fields in Indonesia transformed from agriculture to property projects. The area of rice fields throughout Indonesia in 2013 was 7.75 million hectares, and in 2019 it was decreasing to 7.1 million hectares. Every year, the conversion of paddy fields to non-rice fields is estimated at 150 thousand to 200 thousand ha. [2] The number of small farmers who organize the land under 0, 5 ha was decreasing by 4.77 million people in the period 2003-2013. The reason for small farmers to sell their land to the more capable of working related to the higher of cost for the production (including labor) and the lower profit [3] The decline in the labor force in the agricultural sector. In the year 2012 the number of workers in the sector is still 42.36 million people, and in the year 2013 the number decreased to 41.11 million people and by 2014 as many as 40,74 million people. A decrease in agricultural acreage and a decrease in the workforce in the agricultural sector can jeopardize sustainable rice production.

The decline in the labor force in agriculture can occur because [1] some farmers give up agricultural land, which has changed function, and they are no longer farmers. Small farmers with narrow land ownership sell their cultivated land because it is no longer sufficient to meet their daily



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needs, and they switch to other types of work [2]. There are farmers who are old and some have died, while their business has not been continued by their offspring [3]. Farmers are absent from farming because they are tired of working on their land which requires a lot of labour, they take up other jobs, then their land is abandoned or leased to someone else [4].

The Indonesian government every year creates new rice fields even though the number has not been able to compensate for the reduction in land conversion. Besides that the government has made regulations to inhibit the rate of land conversion. At the farm level, the sustainability of rice farming is determined by the incentives that farmers receive from their farming. Rice farmers in tidal land areas have adopted location-specific technology, namely the planting stem with TABELA (direct seed distribution), use of tractors for soil processing and harvesting machines (combine *harvester*), and increasing the cropping index (IP) from IP 100 to IP 200 [5]. The adoption of such technology has made rice-farming change from labor intensive to capital intensive and provides sufficient incentives to farmers.

This research was to determine the conditions factual about the scale of business and the adoption of technology related to the labor requirements of rice agriculture, that have an impact on living needs of farmers and their families. The amount of production and productivity, rice farmers' income who can meet the needs of a decent life is an indicator realization of the sustainability of rice farming.

2. Methodology

The data were collected by Multi Stage Random Sampling. This research was conducted in South Sumatra Province, which is the sixth largest rice-producing province of 34 provinces in Indonesia. South Sumatra province has a rice field area with the presence of typology complete, the typology of technical irrigated land, irrigated land villages, swamp tide, rainfed and swamp swampy. This research location was Musi Rawas Regency and Banyuasin Regency, which respectively represent agricultural areas with technical irrigation and tidal swamps. In each district two villages were selected, so that there were four sample villages, and 50 maps for each village were selected, so that there were 200 respondent farmers.

Rice farming land size is the size scale and we can be seen the number of small farmers (the land is less than 0,50 hectares) and determine labor requirements. The labor used in rice farming consists of internal and external labor family. In small-scale rice farming, there is a culture of using labor from their families who are not given wages. Labor for rice farming consists of family and wage labor, which in the analysis is unified as labor used in rice farming. Magnitude and continuity of productivity are the factors that determine sustainable rice farming. Productivity is the production which calculated from the production divided by the area of the farmer's arable. Productivity (Y) is influenced by the use of production inputs X_1 (land area), X_2 (Urea fertilizer), X_3 (TSP / SP36 fertilizer), X_4 (KCl fertilizer), X_5 (NPK fertilizer) and D (Dummy variable). With a value of 1 = tidal area, and 0 = technical irrigation area) which is described in the multiple regression model as follows.

$$Y_{ij} = \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 D + \epsilon_{ij} \quad (1)$$

Having obtained the equation estimators, it will be the amount of R^2 , the sign and magnitude of regression coefficient, to find answers to empirical relationships between variable. The results of the analysis will be used as policy implication for establishment of *good agricultural practice* for sustainable rice farming. Farmers' income comes from rice farming income, non-rice agricultural income and non-agricultural income. Base on information farmer income can be considered decent subsistence farmer households, comparing between incomes per capita and revenue for the fulfillment of minimum necessities of life using Indicator of the Ministry of Labor and BPS.

3. Results and Discussion

The technical irrigation in Musi Rawas Regency is called the Kelingi Tugumulyo Irrigation Area, the water comes from the Kelingi River, built in 1940 and its inhabitants come from Java. In Kelingi Tugumulyo, included in the Kelingi watershed, it is estimated that it can irrigate more than 10,163 ha, consisting of 8,860 ha of technical irrigation and 1,401 ha of non-technical

irrigation. The management is under the authority of the government, and is rice bran in meeting the provincial food needs. Meanwhile, tidal rice farming was built in the 1980s; the population was immigrated from Java in the transmigration program. The results of field data collection in the two sample areas can be seen in the following description.

Table 1. Characteristics of respondents

Variables	All Sample (n = 200)		Technical Irrigation (n = 100)		Tidal (n = 100)		t-siq
	Mean	Sd	Mean	Sd	Mean	Sd	
Husband's age (years)	45.67	11.91	43.57	10.23	47.76	11.91	0.0012 ^a
Family members (persons)	3.25	1.11	3.49	1.02	3.35	0.54	0.0017 ^a
Active male workers (persons)	1.26	0.53	1.16	0.51	1.26	0.53	0.0360 ^b
Active female workers (persons)	1.05	0.37	0.85	0.24	1.05	0.27	1.9720
Average education (years)	8.73	3.61	9.63	3.72	7.83	3.27	0.0003 ^a

Note: a and b are significant at $\alpha = 1\%$ and 5% , respectively.

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In Table 1, it can be seen that farmers' demographic characteristics are different between irrigation land and tidal swamp. The education of farmers in technical irrigation areas (9.63 years) is higher than the education of farmers in tidal areas (7.83 years). Most of the farmers in the technical irrigation area have junior high school education. Some have high school education and even bachelor degrees. Meanwhile, most of the farmers in the tidal areas still have primary school education. And some of them are junior and senior high school students. Educated higher usually have the opportunity to switch to a job other than farming. So farmers in technical irrigation areas have a greater potential to switch to other jobs than farmers in tidal swamp areas.

In Table 2 it can be seen the characteristics of agriculture in the two sample areas of the study. The average area of farmers in these two locations is 1.67 hectares. And the cultivated area of farmers in tidal areas (2.76 hectares) is wider than farmers in technical irrigation areas (0.59 hectares). Most of the farmers in technical irrigation areas (71%) are smallholders with an area less than 0.50 hectares. This situation is close to the conditions in Java. Because about 75% of lowland rice farmers are classified as small farmers. The increasing number of smallholders is due to the fragmentation of wetland agricultural land caused by the land inheritance system and the sale and purchase of land. Whereas in the tidal swamp area, smallholders are not found, even until recently there has been an increase in land ownership. At the beginning of their arrival, transmigrant farmers in the tidal swamp area were given a business area of 2.0 hectares, and ownership now becomes 2.76 hectares. The addition of arable land is due to the farmers who live at the location at the beginning of his arrival. Not all migrant farmers manage to manage rice farming in new areas and some of their lives are hit by poverty [1], [2], [3].

Judging from the use of labor for rice farming, it turns out that there are differences in the use of labor, farmers in technical irrigation areas use 43.19 HOK of labor per season for an average arable area of 0.59 hectares, while farmers in tidal areas use labor 20.97 HOK for an average area of 2.76 hectares. This difference occurs because farmers in tidal areas have adopted several technologies that reduce the use of labor, such as planting rice using the TABELA system without re-planting, cultivating land using four-wheeled tractors, and harvesting using a *combine harvester*. Farmers in irrigated areas still do rice nurseries, which take about 20 days, some of them still cultivate the land.

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Table 2. Characteristics of farmer agriculture

Variables	All Sample (n = 200)		Technical Irrigation (n = 100)		Tidal (n = 100)		t-siq
	Mean	Sd	Mean	Sd	Mean	Sd	
Land size (ha)	1.67	1.57	0.59	0.40	2.76	1.47	0.0000 ^a
Smallholder (%)	36.00		71.00		0.00		
Labors (working days, HOK)							
a. Preparation for planting	2.67	0.94	3.12	0.68	2.22	0.94	
b. Planting	5.15	4.62	7.66	5.39	2.75	1.52	

c. Maintenance	3.02	3.01	2.60	3.12	3.44	2.86	
d. Harvest	17.71	17.15	28.1	17.08	7.71	9.55	
e. Post-harvest	1.04	1.50	0.42	1.23	1.66	1.50	
f. Others	2.30	3.91	1.38	3.14	3.19	4.39	
g. Amount	31.89	22.11	43.19	21.49	20.97	16.42	0.000 ^a
Rice productivity (ton)	4.56	2.72	3.28	2,516	5.87	2.62	0.000 ^a

Note: Smallholders or gurem farmers is defined as small farmer having land of less 0.50 ha or not having, a is significant at $\alpha = 1\%$

Manually using human labor, and the harvest system is done manually. Farmers do not want to use a *combine harvester-harvesting* machine because they do not want to eliminate the habit of harvesting with the mutual cooperation system or harvesting with a 6:1 profit sharing system that can be managed using conventional technology. The adoption of technology by farmers in tidal areas who use less labor has resulted in their ability to cultivate larger areas of land. If tidal farmers do not adopt this pressure, then the area they can cultivate is not more than 1 hectare. So the use of labor for agricultural land in technical irrigation areas is still as before, while the use of labor for farmers in tidal areas is much reduced, and this can lead to a shift in labor from the rice farming sector with greater potential to occur in technical irrigation areas.

With the use of technology and manpower, it turns out that the productivity of rice farming in tidal areas (5.87 tons per hectare) is greater than the productivity of rice in technically irrigated areas (3.28 tons per hectare). In order to see the factors that influence (Xi) on the productivity of lowland rice (Y) in these two areas, multiple linear regression analysis can be used and the estimation equation is obtained as follows.

$$Y = 30.89 - 9.34X_1 + 5.15X_2 - 1.04\beta_3X_3 - 1.84X_4 - 0.152X_5 + 46.35D_j \quad (2)$$

$$R^2 = 0.401$$

Table 3. Regression coefficients

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients Beta		
1	(Constant)	30.989	3.237		9.574	0.000
	X1	-9.349	1.389	-0.535	-6.732	0.000
	X2	5.153	1.391	0.223	3.704	0.000
	X3	-1.040	2.190	-0.044	-0.475	0.636
	X4	-1.842	4.111	-0.025	-0.448	0.655
	D	46.358	5.799	0.873	7.994	0.000
	X5	-0.152	0.200	-0.048	-0.760	0.448

The coefficient of determination (R^2) of 0.401, which means that the model is built to see the relationship between these variables are less good. In Table 3, it can be seen that the variable X1 (arable area) has a very significant negative effect, while the variables X2 and D (land typology) have a very significant positive effect on productivity. It can be proven that the more acreage productivity lower and lower, it is in line with several researchers [6]. Analysis of the household income of farmers in the study area can be seen in Table 4.

Table 4. Income of farmer households

	Unit	All Sample (N = 200)		Technical Irrigation (n = 100)		Tidal (n = 100)		t-siq
		Mean	Sd	Mean	Sd	Mean	Sd	
Total income	Mill Rp.	62.93	83.04	59.70	97.92	66.16	62.40	0583

Unit	All Sample (N = 2 00)		Technical Irrigation (n = 10 0)		Tidal (n = 10 0)		t-siq
	Mean	Sd	Mean	Sd	Mean	Sd	
/ year							
Source (%)							
a. Rice farming	%	60		31		93	
b. Other Agriculture	%	31		57		2	
c. Outside Agriculture	%	9		12		5	
Poor family	%	15		23		7	
The family lived a decent life	%	66		63		87	

Income's farmers in technical irrigation areas is IDR 57,70 million, sourced from rice farming 31%, other agriculture (especially fish by 57%, and 12% outside agriculture. Meanwhile, the household income of farmers in tidal areas averages IDR 6.16 million per year, derived from rice agriculture 93%, other agriculture 2% and non-agriculture 5%. These conditions indicate a household income of farmers in tidal areas larger than the map in the area of technical irrigation. If we used the level of poverty Rp. 440,000 per person per month, then as much as \$ 23 of farmers in irrigated areas are classified as poor, while farmers in tidal areas are 7%.

If an income of Rp.640,000 per person per month is used as a basic need, then 63% of farmers in irrigated areas technically have been able to meet the needs of a decent, while farmers in tidal areas as many as 87% have been able to meet the needs of a decent life. Incentives need Farming rice that is quite good will affect the sustainability of farmers' livelihoods [4]. And the incentives received by farmers in tidal areas are higher than in technical irrigation areas, which can cause a shift in labor in technical irrigation areas that have the potential to be greater than in tidal areas. This factual condition shows that farmers in tidal areas are more prosperous than farmers in technical irrigation areas. And this condition illustrates that the potential for labor shift of farmers in technical irrigation areas is greater when compared to farmers in tidal areas.

4. Conclusion

The sustainability of rice farming in tidal areas is better than in technical irrigation areas. This condition is because rice farming in tidal areas uses less labor of family farmers, wider arable areas, higher productivity, and higher welfare of farmers compared to farmers in technically irrigated areas. But farmers in irrigated areas have a good diversity of livelihood sources compared to farmers in tidal areas. Therefore, it is necessary to have efforts to develop the diversification of farmers' businesses in tidal areas, especially the development of horizontal diversification, namely adding business branches to increase farmers' income. With sufficient production and productivity, it is also necessary to develop vertical diversification, particularly improving processing and marketing of products.

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