

Conference Paper

The Efficiency Analysis of Food Crop Commodities

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Abstract

Grobogan is one of the main agricultural district, especially for food crops in Central Java. Paddy, corn and soybeans are potential agricultural commodities of Grobogan. The demand of these commodities is quite large. However, the productivity of paddy, corn, and soybeans in Grobogan turned out to be below the target set by the Government of Grobogan. It is required a means of identifying inefficiencies in paddy, corn, and soybeans which causes the production is under the target achievement. This study has a purpose is to look at how the level of efficiency of the use of factors of production in rice farming, corn, and soybeans in Grobogan. With the evaluation of the efficiency of some agricultural commodities in Grobogan, it is expected to be a basis of policy formulation in order to improve the agricultural sector in general and the welfare of farmers in particular. Food crop commodities where consist of paddy, corn, and soybeans are inefficient. In the calculation of technical efficiency, allocative efficiency and economics efficiency, all of that commodities have not efficient. These result have a recommendation to the farmers and stakeholders that the using of production factors should be decreased. Because, and inefficient of these commodities caused by over allocated of production factors. And also, inefficient condition assumed makes the government target of food crop commodities production could not been fulfilled

Keywords: Food Crop, Paddy, Corn, Soybeans, Efficiency, Grobogan

Type of Paper: Empirical/ Review

1. Introduction

Agriculture is a one of the economics most important factor. Because, the basic needs of consumers toward food crop commodity are very high. Tun (2015). A majority of Indonesian peoples livelihood also derived from the agricultural sector. In the globalization era, it is necessary to develop the agricultural sector. Agricultural commodities not only use for consumption product but also for raw material of industrial activities.

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Agricultural sector in Indonesia gave a large contribution toward the Gross Domestic Product. This is evidenced with the contribution of agricultural sectors is the number two largest after industries sector. In fact, agricultural sector still concentrate in Java Island, especially for food crop commodities such as paddy, corn, and soybeans. So, the Java Island become the upholder of agricultural sector in Indonesia. And the Central Java Provinces is one of the main region in Java Island.

Central Java provinces is a one of the main producers of food crop commodities. The contribution turns 16% from the total amount of national rice production. Soekartawi (2003). A several commodities of food crop such as corn, paddy, soybeans, peanuts, wheat, potatoes etc have a great potential to be an alternatives of food crop commodities and raw material for industry sector.

Grobogan District is a third largest area districts in Central Java Provinces. It is consist of 18 sub-district. With a big potential of agricultural land, that is makes Grobogan District to be a main food crop producers in the Provinces even nationally. Agricultural sector contributes more than 43% toward domestic GDP. (Central Statistics Bureau: 2013).

Paddy, corn, and soybeans is a superior product in Grobogan District. The consumers demand towards these product are rose dramatically every years. But, unfortunately the productivity of that commodities still lower that the government target. That's fact also happened in many developing countries such South Asia Countries. Dhakal (2015).

The government target for paddy production that cultivated by the farmers is 10 tons per hectares, but the realization is no more than 6,33 tons per hectares. For the corn commodities, the government target is 5,5 tons per hectares, then the realization is 5,3 tons/ hectares. The same condition also happen to the soybeans commodity, the government target is 3 tons per hectares, unfortunately the realization is 2,5 tons per hectares. Setiawan (2011). The low productivity cause the target is not fulfilled. This is the main problem for this research. Allegedly happen an inefficiency in food crops. Efficiency is a relationship between input and output. Whether the farmers use a proportional input for commodities. Because of the output below the target, that is caused by there was any problem with the using of production factors as an inputs. Dhakal (2015). That is make this research focusing on the efficiency for the using of production factors.

This research aims to measure the efficiency analysis between food crop commodities that cultivated by the farmers. After knowing the efficiency level, the efficiency comparison between commodities could inform the government and for those whose

concerned to know which commodities who most and less efficient. The farmers usually cultivating their field with common commodities. They never know the information what commodities are most efficient to cultivated.

Previous research only capturing the efficiency analysis in certain commodities. There is no research that try to calculate the efficiency analysis in all of food crop commodities then compare it. This research try to fill that gap. Whereas, the research result not only inform the efficiency analysis. But also, compare the efficiency analysis of each commodities.

2. Literature Review

2.1. Efficiency

The definition of efficiency can be separated by three interpretation: technical efficiency, allocative efficiency and economic efficiency. Soekartawi (2003) and Hasan (2015). The using of production factor would be efficient technically if the inputs can results maximum outputs. In it would be efficient allocatively if the value of marginal product as same as the price of production factors. Manning (2015). And it has been efficient economically if that farms commodities achieved technical efficiency and allovative efficiency in a same time.

2.2. Cobb-Douglass production function

The Cobb–Douglas production function is a functional of the production function. This formula used to explain the interaction between technology and the amounts of two or more inputs. Usually raw material and labor. This formula estimates the amount of output who could be produced by all of the inputs. Arsyad (2004). Statistically, there was a positive relationship between the using of inputs and the output. If the input increase the output should be increase directly. Sukirno (2005).

2.3. Law of diminishing return

This law starts if one input variables in the production factors of a commodity is improve when the other inputs are unchanged. A condition would be achieved in additions of the input result become smaller, increases in output, or diminishing. Sukirno (2005).

In the real case, a farmer who owns of cultivation land will find a formula how to employ number of workers then will earn a maximum output. The more they employ workers, the less efficient combination of workers and output. Setiawan (2011). This condition happened due to the increasing of the total output is less than the mobilization of workers. This rule happened in a majority of production formula except there will be change in production activity.

In the stuck economics condition, when the production technique still traditionally or unchanged, the law of diminishing return effect clearly seen. Dhakal (2015). However, in the rapid economics condition, technical advances have succeeded in more than offsetting this factor to increase the standard of living.

3. Research Methodology

3.1. Sampling methods

The sampling methods that used in this research was a purposive area random sampling. In the sampling method, to measure the efficiency for using of production factors in paddy, corn and soybeans commodities, there was used 90 samples. The samples is a farmers that cultivate neither various of commodities. 90 samples had been divide to a several area of research. 90 samples was picked because of some reason. First, the farmers characters in Grobogan District are very homogeneity. So, the using of large samples did not guarantee the information that compiled was better than small samples. Arikunto (2002). Second, the farmers were agglomerate in a several subdistrict.

This research classified the samples by the agricultural agglomeration area of commodities. The classification refers to the subdistrict base agricultural production. The sub-district has been picked as a research location is a largest production of each commodities. The areas consist of:

1. For paddy commodities there was picked Godong subdistrict. This subdistrict is a largest area of paddy's commodities in the Grobogan District. The large of paddy's commodities are 12.904 hectares and resulting 85.027 tons of paddy's last year.
2. For corn commodities there was picked Geyer Subdistrict. Geyer subdistrict is the largest areas of corn's commodities with 23.247 corn field. And Geyer subdistrict produced 23.247 Tons in last harvest time.
3. And the last, Pulokulon subdistrict was picked as a research location of soybean commodities. That is the most famous major producers of soybeans in the District

even Provinces and Nationally. The commodities areas is 5.744 hectares and produces 16.038 Tons. Pulokulon subdistrict is the highest soybeans producers in Grobogan District.

3.2. Production function models for paddy, corn and soybeans commodities with frontier stochastic production approach

The models that used in this research is a production function models with frontier stochastic production approach with 8 variables. The mathematic models in production function of paddy, corn and soybeans commodities can be visualized on the formulas below:

Paddy commodities:

$$\begin{aligned} \ln Y &= b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 \\ &+ b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 (V_1 - U_1) \end{aligned}$$

Corn commodities:

$$\begin{aligned} \ln Y &= b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 \\ &+ b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 (V_1 - U_1) \end{aligned}$$

Soybean commodities:

$$\begin{aligned} \ln Y &= b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 \\ &+ b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 (V_1 - U_1) \end{aligned}$$

4. Results

According to the quantitative analysis result. The cultivations of paddy, corn and soybeans still not efficient, despite technical, allocative and economics efficiency. In which, corn commodities efficiency is the lowest of all. An inefficiency in the using of production factors describe the real condition of agricultural sector. There was a big problem in a food crops cultivation in Grobogan District.

4.1. Technical efficiency of paddy, corn and soybeans commodities

Technical efficiency means the relationship between the using of production factors and outputs that produced. According to the quantitative analysis with frontier 4.1

TABLE 1: The definition of each variables.

No	Variables	Code	Definition	Proxy Variables	Measurement Scale
Paddy, Corn, and Soybeans Commodities					
1	Dependent	Y	Production	Total production of commodities each harvest time	Rp (revenue), Kg (volume)
2	Independent	X ₁	Large Areas	A number of farm area that cultivated by the farmers	Rp (expense), Hectares
		X ₂	Seeds	A number of seed that used during planting time	Rp (expense), Kg (volume)
		X ₃	UREA fertilizers	A number of UREA fertilizer that used during cultivation time	Rp (expense), Kg (volume)
		X ₄	TSP fertilizers	A number of TSP fertilizer that used during cultivation time	Rp (expense), Kg (volume)
		X ₅	Phonska fertilizers	A number of Phonska fertilizer that used during cultivation time	Rp (expense), Kg (volume)
		X ₆	Labour	A number of labour work hour during cultivation time	Rp (expense), Work hours
		X ₇	Insecticide type 1 (regent)	A number of insecticide type 1 that used during cultivation time	Rp (expense), Litres
		X ₈	Insecticide type 2 (saprodap)	A number of insecticide type 2 that used during cultivation time	Rp (expense), Litres
			b ₀	Intercept	
		b ₁ -b ₈	Regression coefficients		

software, there was a result that all of food crop commodities in Grobogan District still inefficient. Because the technical efficiencies result are less than 1. Technical efficiencies value of paddy's commodity is 0,8789. While, the technical efficiency of corn's commodity is 0,7634. Corn's efficiencies value is lower than paddy's commodity. But, both of commodities are not efficient technically. Refers on that result, there was any information that the using of production factors in paddy and corn commodities are have not optimal yet. So, there must be optimize again to increase the efficiencies level in both commodities.

Obviously, the soybeans cultivation also inefficient same with the other food crop commodities. According to the quantitative analysis, soybeans efficiency level is 0,9619. It still less than 1 so the result is inefficient. However, if the technical efficiencies result compiled one commodities with the others. Soybeans commodities still more

efficient than paddy and corn commodities. And corn cultivation is the most inefficient rather than the other food crop commodities cultivation.

4.2. Allocative efficiency of paddy, corn, and soybean commodities

Allocative efficiency represents the marginal productivity value or net profit margin (NPM) of each inputs as a variables compared with the price of inputs is same with 1. It is means explain how the producers can be optimize their provision. According to the NPM result for each variables, there was a result that paddy, corn and soybeans cultivations have not efficient allocatively.

The table below will show the result, where every NPM value of each variables is more than 1. It means all of production factors in food crop cultivation are inefficient. An average values of NPM is 1,08 for paddy's commodity. While, for corn's commodity the NPM average is 0,674. In the other case, the NPM values of soybeans commodities is 1,7343. Refers on these calculation, the NPM result shows that farmers in Grobogan District still could not maximize their provision were obtained. It could be happen because they have not achieve allocative efficiencies indicator, theusing of production factors still not efficient allocatively.

TABLE 2: Allocative Efficiency of Paddy, Corn, and Soybeans Commodities.

No.	Variabel	NPM (paddy)	NPM (corn)	NPM (soybeans)
1	Land area	-256,405	-20,82	2,83
2	Seeds	56,48	3,21	-4,03
3	Urea fertilizer	3,84	3,69	6,08
4	TSP fertilizer	27,85	8,28	-13,03
5	Phonska fertilizer	4,56	-19,28	5,01
6	Labour	-14,64	22,62	2,17
7	Insecticides type 1	-75,26	33,66	-111,42
8	Insecticides type 2	266,131	-35,686	126,265
Allocative efficiencies		1,08	0,674	1,7343

Sources: Primary data

4.3. Economic efficiency of paddy, corn and soybeans commodities

Economics efficiency is the multiply of technical and allocative efficiency. Economics efficiency level represents efficiencies condition comprehensively. Herewith the table of economics efficiency below:

TABLE 3: Economics Efficiency of Paddy, Corn, and Soybeans Commodities.

Commodities	Efficiencies Level
Paddy	0,94
Corn	0,513
Soybeans	1,66
Sources: Primary Data	

The economics efficiency from paddy commodity is 0,94. This result indicates that paddy commodity still not efficient, these result still in line with technical and allocative efficiencies level toward paddy commodity. So, if the farmers wanna be efficient economically, they have to decrease the using of production factors to achieve efficient condition.

Describing from the previous result. Economic efficiencies level of corn commodities is 0,513. These result also indicates and in line with the technical and allocative efficiency measurement. Corn commodity have not efficient economically. The corn farmers also should be decreasing their allocation of production factors, because the efficiency level is less than 1.

Soybeans commodity also had a same condition. The economics efficiency level is 1,66. This result represents that soybeans commodity still inefficient economically. And still in line with the result of technical efficiency. The farmers must increase their production factor allocation in the cultivation process because the efficiencies level is more than 1.

5. Discussion

5.1. Technical efficiency of food crop commodities

The farmers of food crop commodities such as paddy, corn and soybeans could not optimize for the using of production factors. So they can not achieve efficient level and it has not full employment. The using of production factors such as fertilizer, seeds, and insecticides is over using. It is causing production activities were not optimal and finally harvest failed potentially happened. Nicholson (2005) states that the over using of production factors will decrease the land quality.

This condition happens due to lack of knowledge for the farmers suppose to be a reasons. Bayyurt (2015). They do not know how much they have to spent the fertilizers and seeds for their field. They have a philosophy, "more is better". If they fertile more, seeds more, the harvest will be more than their expectation. But, their philosophy is

not really true. In reality, if they spent more production factors, the result is different. Farmers can not achieve a more output because of lack land quality. The ingredients of soil were decrease due to over cultivation. And it could not change by the using of more artificial fertilizer to recover the soil ingredients that disappear.

Due to the less quality of land and high expectation of harvest. Farmers exploitate their field to achieve the output more than. They disperse more fertilizers to increase the soil quality. So that is why they are use UREA, TSP, and Phonska Fertilizers. A various of fertilizers can increase the productivity. The farmers also cultivated a seeds rapidly just for arise the productivity. during the cultivation, they also spread more insecticide to decrease diseases impacts in the plants. All of that activities needs a labours. The farmers spend more labour to fertile rapidly. The cultivation process also more complicated, it needs more labour.

However, the using of production factors could not make the harvest increasingly. That is beyond the farmers expectations. Agricultural field should not been exploited to improve the productivity. over exploitation and over fertilization will make the land quality decrease slightly. In the other side, Setiawan (2011) argues farmers spent more production factors without knowledge. They only use a feeling to finds best composition of fertilizers to fertile their plants. Whereas, there must be any ideal comparation between production factors and land area to resulting an optimal output. That is need an agricultural knowledge. Farmers could not rely on their felt. lack of education and base knowledge is the main problems of it.

This research result are consistent with the law of diminishing return that introduced by David Ricardo. Ricardian believes that the land support will be decrease in the long term due to declining of land fertile. That is why the production would decrease slightly or sharply. In the other hands, the farmers must meet the market demand of food crop commodities and fulfil their needs. They tend to exploitate their land, cultivate three time per year, give more fertilizer and expect the result will be more. However, the efficiency result did not indicate farmers expectation. The more farmers add production factors like fertilizer, seeds, etc. the less they earn the harvest. That is because of law of diminishing result. The farmland loose it fertile due to over exploitation farming methods. And finally, to regain the harvest the farmers perforced to add the using of fertilizer to maintain the soil fertilization or at least to make it slowly decreasing. That condition would make the farmers remain in inneficient condition.

Base on that condition. Farmers needs to supervise by the extensions and academi-sion. Their knowledge must be increase. Applied science should be taught with an

informal education approach. Besides to ensure for the farmers to change their traditional cultivation methods. Because it makes inefficient condition.

5.2. Allocative efficiency of food crop commodities

If the NPM result would be compared between food crop commodities. Paddy and corn commodities are more efficient allocatively than soybeans. This condition is totally different with the technical efficiencies result previously, that shows soybeans commodity is more efficient than paddy and corn commodities. Eventough, all commodities are not efficient. These result represents that paddy and corn farmers could use the inputs more optimal to achieve better harvest than soybeans farmers. So, if it is compared with paddy and corn farmers, soybeans farmers still have not optimalizate their provision although they are the most efficient in technical efficiencies level.

There are any several hypothesis that make soybeans commodity are less efficient allocatively than paddy and corn commodities. First, the farmers in soybeans paid their production factors are more expensive than the other farmers that cultivate paddy and corn commodities especially in the insecticides and fertilizers. That is make their total cost is higher. Second, the profits that resulted from soybeans commodities is less than paddy and corn commodities. That is make the soybeans farmers could not achieve a better provision.

According to the research result, there are inconsistency with the Cobb-Douglass Theory. Normally, the production theory indicates that the increasing of production factors would arise the output. However, that condition does not happen in this research. If the farmers add the expenses to increase the using of production factors, the output will be decrease. That is shows by the efficiency analysis for all of food comodities. It means if the marginal cost increase, the marginal revenue precisely would be decrease. The more farmers add the cost, the less they would gain the revenue. According to the previus research, that condition happen due to the law of diminishing return theory that introduced by David Ricardo. The decreasing return to scale condition happened because the farmers misses the moment of increasing return to scale moment. They should calculate how much the production factors are needed to get the most optimum output.

5.3. Economic efficiency of food crop commodities

Refers on the analysis. The economics efficiency of soybeans commodity is the lowest than paddy and corn commodities. That condition indicates that, although soybeans farmers is the most efficient in technical efficiency. Where the farmers allocate better ingredients of production factors in the cultivation process. But, the soybeans farmers could not maximize their profit. That is why in economic efficiency estimates, their efficiency is the lowest than the other commodities.

6. Conclusion

Food crop commodities where consist of paddy, corn, and soybeans are inefficient. In the calculation of technical efficiency, allocative efficiency and economics efficiency, all of that commodities have not efficient. That is represents with the technical efficiencies rate of paddy is 0,8789; corn 0,7634; and soybeans 0,9619. While for the allocative efficiencies of paddy is 1,08; corn is 0,674; and soybeans is 1,7343. The economics efficiency of paddy is 0,94; corn is 0,513; and soybeans is 1,66.

These result have a recommendation to the farmers and stakeholders that the using of production factors should be decreased. Because, and inefficient of these commodities caused by over allocated of production factors. And also, inefficient condition assumed makes the government target of food crop commodities production could not been fulfilled.

Base on the research result, we knows that all of the food crop commodities that cultivated are innefecient. That result indicates that the farmers need to reform their cultivation management system and habits. At least they have to decrease the using of production factors to maintain the technical efficiency level. In the other hads, they have to decrease the marginal cost to minimize the total cost. Allocatively, that will makes the farmers more efficient.

References

- [1] Arikunto, S. (2002). *Research Prochedure: An Empirical Approach*. Jakarta. Rineka Cipta.
- [2] Arsyad, L. (2004). *Economics of Development*. Yogyakarta. STIE YKPN.
- [3] Bayyurt, N (2015). Good Governance and Agricultural Efficiency. *Journal of Social and Development Sciences*. 6, 14-23

- [4] Central Statistic Bureau. (2013). Central Java in Figure: Semarang. *Central Java Statistic Office*.
- [5] Central Statistic Bureau. (2013). Grobogan in Figure: Grobogan. *Grobogan Regency Statistic Office*
- [6] Dhakal, S (2015). Productivity and profitability of maize-pumpkin mix cropping in Chitwan, Nepal. *Journal of Maize Research and Development*. 1,112-122
- [7] Hasan, M. (2015). Corruption And The Agricultural Production Efficiency Of The European Countries During The Recent Economic Crisis. *Research in Agriculture, Livestock and Fisheries*. 2, 427-437
- [8] Manning, D. (2015). Agricultural Efficiency and Labor Supply to Common Property Resource Collection: Lessons from Rural Mexico. *Journal of Agricultural and Resource Economics*. 40, 365-386
- [9] Nicholson, W (2002). *Mikro Ekonomi Intermediate*. Jakarta. Erlangga.
- [10] Setiawan, AB. (2011). The Efficiency Analysis of Corn Commodity in Grobogan Regency. *JEJAK Journal*. 2, 69-75
- [11] Soekartawi (2003). *Theory of Production Economics with Special Discussion on Cobb-Douglas Production Function: 3rd Edition*. Jakarta. Raja Grafindo Persada.
- [12] Sukirno, S (2005). *Introduction into Micro Economics*. Jakarta. Raja Grafindo Persada.
- [13] Tun, Y Y (2015). An Analysis on the Factors Affecting Rice Production Efficiency in Myanmar. *Journal of East Asian Economic Integration*. 19, 167-188