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Analysis of Agricultural Food Crop Productivity Planning District-District in East Java Province of Indonesia with A Non-Parametric Approach

Abid Muhtarom[1*], Tri Haryanto[2], Nurul Istifadah[3]

[1,2'3] Universitas Airlangga, Depatermen Ilmu Ekonomi

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A B S T R A C T

The importance of food crop agriculture efficiency could be used today. Because we know that more inefficiencies in the agricultural sector of food crops illustrate that productivity has not run maximally. DEA is used in this study as an appropriate approach by using a non-parametric method. The production unit is in the form of a decision making unit (DMU) in which the DMU in this study is a food crop agricultural sub-sector in 29 districts in East Java. There occurred inefficiency of as many as 44.8 percent (29 districts) in East Java in 2017 for having the average efficiency score of less than 0.69, while the rest achieved the average technical efficiency of more than 0.31.

Penulis korespondensi:
E-mail: abid.muhtarom-2016@feb.unair.ac.id

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INTRODUCTION

Indonesia is the largest archipelago in the world around 17,504 Islands with the livelihood of the majority of the people in the agricultural sector. Agriculture is a sector that very important for the people of Indonesia. East Java is the most important part for Indonesia. East Java province had potential in the agricultural sector since the second largest GDP contributor after industry sectors. The sub sectors of farming food is part of the agricultural sector which accounts for the largest GDP among the other sub sectors, with the share as follows:

Table 1
Gross Regional domestic product on the basis of Constant Prices 2010 according to Court business in the province of East Java (billion rupiah) 2017

Business field	2017
1. Agriculture, livestock, hunting and service	127603.8
a. Food Plants	**51001.7**
b. Plant Horticulture	16567.7
c. Crop Plantation	25534.2
d. Farm	32579.1
e. Services of agriculture and Hunting	1921.0
2. Forestry and logging	6122.5
3. Fisheries	33471.3

Source: BPS East Java in numbers, 2018

Table 1 description of the magnitude on the value of GDP in agricultural food crops compared to other sectors. The magnitude of this value of the extent of the existing farmland in East Java province so that it can increase the productivity of the food crops sector seen from the GDP, the land area is closely related to the agricultural productivity of food crops for increase productivity of agricultural crops. Increase in agricultural productivity of food crops can be seen with how to view the efficiency of agricultural input food crops. Many kind of Agricultural inputs in East Java, however there are some that are considered essential, namely agricultural land and labor (Giannakis, Elias, et al (2018); Gong, Binlei (2017); Song, Wei (2016) and Toma, Pierluigi, et al (2017)).

Agricultural land and something can not separate from each other, the needs of the farmers it is extremely high. Farmland food crops is very important in the development of productivity. Spacious food crop land can improve agricultural productivity of food crops. But not necessarily happen peasants farming food crops could even happen inefesiensi Song, Wei (2016); Shahe Emran, et al. (2018) and Gong, Binlei (2017). In addition to agricultural lands food crops needed labor to enhance agricultural productivity of food crops. According to Emran, Shahe, et al (2016) and Li Nan, et al (2017) the higher the productivity of farming food crops then labour will decline. But it should be with the use of the most efficient machines.

The importance of effeciency farm food crops can be used in ripe. Because we know more and ineficiency on the agricultural sector productivity has yet to describe food plants running maximum. The DEA used in this research as a proper method of non-parametric approach Kheir-El-Din, Hanaa, et al (2008); Bayyurta, Nizamettin, et al (2012) and Nomaan Majid, (2004). Agricultural food crops East Java could be a description of the agricultural food crops in Indonesia by looking at the 29 Counties

of the year 2017 as a case study in this research.

REVIEW LITERATURE

NO	Author	Research	Method	Results
1	Li, Nan,et al (2017)	Analysis of Agriculture Total-Factor Energy Efficiency in China Based on DEA and Malmquist indices	- Malmquist DEA -Data: 30 Provinces in China 1997-2014 -Output: GDP -Input: engine technology, the primary raw material irreplaceable, fertilizer, labor	All inefesiensi with an average of 0.79
2	Emran, Shahe, et al (2016)	Agricultural Productivity, Hired Labor, Wages, and Poverty: Evidence from Bangladesh	-OLS -data: bangladesh Varibel X: home products, wages, labor, the demand for good Y = agricultural productivity, poverty	Varibel X: home products (+), wages (+), (-) labor, demand for goods (-) Varibel Y=Agricultural productivity (+), (-) poverty
3	Emran, M. Shahe,et al (2018)	Beyond dualism: Agricultural productivity, small towns, and structural change in Bangladesh	-OLS -Data: Bangladesh Y= Agricultural productivity X= Small town economy, Dualism, Employment in large firms, Employment growth, Structural transformation	Y= Agricultural productivity (+) X= Small town economy (+), Dualism (+), Employment in large firms (+), Employment growth (+), Structural transformation (+).
4	Giannakis, Elias, et al (2018)	Exploring the labour productivity of agricultural systems across European regions: A multilevel approach	-OLS Data: 238 European NUTS2 regions X= Age, training, diversity of ownership, farming systems, land area, water potential and soil erosion, the ratio of yields, crops, Y= population density, the GDP of the workforce	X = age (+), training, ownership (+), the diversity of farming systems (+), land area (+), the potential for water and soil erosion (+), the ratio of the crops (+), crops (+), Y: population density GDP (+), labor (+).
5	Gong, Binlei (2017)	Agricultural reforms and production in China: Changes in provincial production function and productivity in 1978–2015	- SFA -Input: labour, land, fertilizer, machine. -Output: produktivity (GDP)	-Input: Labor (inefesien), land (inefesien), fertilizers (inefesien), (inefesien). -Output: produktivity (GDP) (inefesien)

6	Song, Wei (2016)	Changes in productivity, efficiency and technology of China's crop production under rural restructuring	-SFA-Bootstrap-Malmquist -Output: agricultural productivity -Input: land, production, machinery, irrigation, fertilizer, labor -External: Displacement of population, income per capital per year, education, land area affected.	Output: agricultural productivity -Input: land (inefesien), production (inefesien), (nefesien), irrigation (inefesien), fertilizers (inefesien), labor (inefesien) -External: Population Displacement (efficiently), GDP per capital (efficiently), education annually (efficiently), the land area affected (efficiently).
7	Toma, Pierluigi,et al (2017)	A non-parametric bootstrap-data envelopment analysis approach for environmental policy planning and management of agricultural efficiency in EU countries	-Bootstrap-DEA -input: labour, land, average stock, fertilisers, irrigation -Output: agricultural productivity	-input: Labor (inefesien), land (inefesien), average inventory (inefesien), fertilizers (inefesien), irrigation (inefesien) -Output: agricultural productivity (inefesien)

Source: sincedirect, processed

METODE PENELITIAN

This research method using Data Envelopment Analysis i.e. (DEA) to measure technical efficiencies. DEA method of non parametric analysis is a method that aims to measure the relative level of technical efficiency compared with other production units which have the same purpose. Production unit here in the form of decision making unit (DMU) DMU in this research is the agricultural food crops Sub 29 regencies in East Java.

This research focus for 1 year in the year 2017. The input variables used in this study are land area and labor (labor), whereas the variable output into Productivity. Function of Linear Programming (LP) that is run in this approach using the assumptions of output oriented, so the purpose of the function is a function that applies the maximum output level of input that is ceteris paribus. The DEA analysis one stage uses a software MaxDEA 7 Basic.

In this technical efficiency measurement will use measurements oriented output (output oriented) with a measurement scale assumptions, i.e., Variable Return to Scale (VRS) and DEA approach one stage. That assumption is needed to be able to generate the value of the technical efficiency of each district in East Java, based on the assumption of VRS, it also aimed to mengestimasi the value of the score of the efficiency of each district in East Java from the year 2017.

Model DEA

There are technical efficiency analysis model assuming VRS with DEA approach one stage: Technical Efficiency Measurement VRS Model oriented Output (Output Oriented)

$$\begin{aligned} &\text{Max } \Phi,\lambda\Phi, \\ &\text{s.t} \quad -\Phi yi + Q\lambda \geq 0 \\ &xi - X\lambda \geq 0 \\ &I1'\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \qquad \text{.....(3.1)}$$

where Φ = score efficiency, λ = constant vector or vector Ix1 constraints, Yi = a vector of output i, XI = the input vector i, Q = output matrix i overall, X = the input matrix i overall

The he above model is a model-

oriented approach with the VRS in the output where the variable Φ show technical efficiency calculations (Coelli, T.J., et al (2005)) with a value of Φ between 1 to ∞ (infinity), and Φ – 1 is increased output in proportional which could be achieved by DMU input quantity constant. λ is the vector of constants and Ix1 I1 ' λ = 1 is a constraint, with the convexity I1 be the Ix1 vector from one. The convexity constraint indicates that the variable return to scale (VRS) which ensure the company that inefisien will only be compared to companies that have the same scale. There is a note that 1/Φ indicates a value of technical efficiency assumes the value at the level of the interval 0 to 1.

Discussion

Results of estimation of efficiency of agricultural productivity of food crops

The results of the estimation of technical efficiency of agricultural food crop use describe the method of DEA can be seen in Figure i. technical efficiency Score ranges from 0 to 1. The assessment score 1 meperlihatkan that agriculture food plants that achieve an efficient condition. While agriculture food plants on condition that ineferent has a score of technical efficiency of less than 1. Based on the images i can note that as much as 44.8 percent (29 of the County) in the province of East Java in the 2017 timeframe occurs inefficiency, has an average score of 0.69 less efficiency, while the rest have reached an average efficiency of technical more than 0.31.

In the year 2017 technical efficiency values occur under 1 lyrics that counties in East Java has not yet reached the point of technical efficiency. So that it can be explained in picture 1

Figure I explains that the inefficiency area farm food crops on County-District in East Java. In the picture I can see that being a DMU Pacitan district has the least efficient areas (inefesien) and acquisition value under 0.340035 efficiency score score 1. Probolinggo district became an almost DMU efficiently with a score of 0.991713. The occurrence of the DMU inefficiency in the 13th district in East Java in the aggregate can be caused due to the presence of experts the first function of land from agriculture to residential sector and the industrial sector. Both the existence of a number of workforce that continues to increase in agriculture food crops. So that agricultural productivity directly affects food crops (Toma, Pierluigi, et al (2017); Song, Wei (2016) and Giannakis, Elias, et

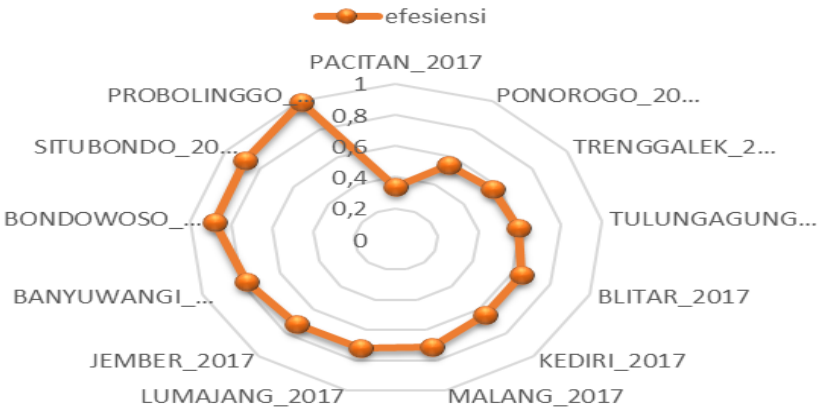

Figure 1
Estimation of Inefficiencies of Food Crop Agriculture in Province Jawa Timur

al (2018)). The success of the agricultural food crops East Java of existing problems. As for the problems of productivity continues to decline from the agricultural sector.

The second issue ownership will farmland crops by small farmers so that the impact on small farmers ' welfare, in accordance with (El-Din, et al. 2008). However declined from (Dhrifi, 2013); (Irz, et al. 2001); (Ogundipe, et al. 2015); (Narayanamoorth, 2003); (Travers, Lee, et al. 1994); Nomaan Majid, (2004). and (Song, Wei, et al, 2015). The existence of the third most classic problems that continue to occur throughout the year, namely human resources that low educational level is the least. The existence of a pattern of farming food crops that are still subsistence food crop farming where self-sufficiency (self-sufficiency) farmers focus on cultivating food in sufficient amounts for their own and family (Bayyurt, et al. 2012).

Figure II shows the DMU which is most efficient on Agriculture crops 29 regencies in East Java. It can be seen as follows:

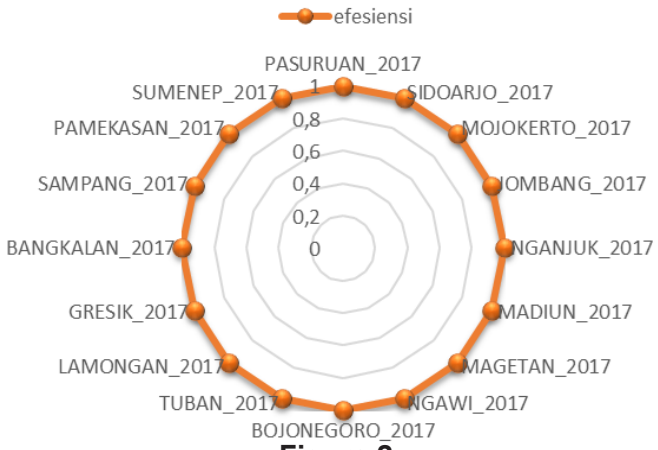

Figure 2
Estimation of Efficiencies of Food Crop Agriculture in Province Jawa Timur

The Figure II can be seen that the 16 Districts in East Java have already occurred efficiently agricultural crops with variable input land area receive Emran, Shahe, et al (2016) reject Li, Nan, et al (2017); Gong, Binlei (2017); Song, Wei (2016); Toma, Pierluigi, et al (2017) and labor declined Gong, Binlei (2017); Toma, Pierluigi, et al (2017); Song, Wei (2016).

CONCLUSION

The problems of productivity continues to decline from the agriculture sector food crops (ton/Ha) that are caused due to the expert his function of farmland crops in East Java which led to the decline of farmland crops. The second issue ownership will farmland crops by small farmers so that the impact on small farmers ' welfare.

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