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ANALYSIS OF RICE PRODUCTION APPROACH TO COBB DOUGLAS PRODUCTION FUNCTION IN TAMBAKDAHAN SUB-DISTRICT SUBANG DISTRICT

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Abstract: Rice production is still the primary source of livelihood for rural communities in Tambakdahan Sub-district, Subang Regency. One harvest of every hectare can produce an average rice production of 8.5 to 9 tons. This study aims to determine the effect of land area ownership, use of labor, use of seeds, fertilizers, and technical irrigation (irrigation) on rice production and the Scale of business results, using the Cobb Douglas production function equation. The results of this study indicate that the three input variables have significant influence, namely, ownership of land area, fertilizers used, and technical irrigation (irrigation) on rice production, for the use of seed input, and technical irrigation (irrigation) have a positive effect, while the input of land area ownership has a negative impact. Two input variables do not have a significant effect, namely the input use of labor and seeds. The Scale of the results of the rice production business shows a decreasing scale of business results

Keywords: *Rice Production, Land Area, Labor, Seeds, Fertilizers, and Technical Irrigation (Irrigation), Scale of business results, Cobb Douglas*

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INTRODUCTION

The activities of rural communities in Subang Regency are still dependent on the agricultural sector as the primary source of livelihood and income for farmers. The primary agricultural sector produced by farmers is rice, soybeans, peanuts, cassava, and various other types of phytase. Rice is the main and largest production produced by farmers in Subang Regency, so that Subang Regency is one of the rice barns in West Java after Karawang and Indramayu Regencies. When viewed from the area of rice fields which is the main input factor for rice production, Subang Regency has an area of 84,570 ha, or 41.21% of the total area of Subang Regency. (BPS, Subang Regency in Figures, 2017), while the land area of Karawang Regency is 95,506 ha, and Indramayu Regency is 116.

Subang Regency is currently building a mega-project for the Patimban International Seaport. This will undoubtedly affect rice production in Subang Regency, due to land conversion from the agricultural sector to the industrial sector. However, the construction of the mega project will not disturb agrarian land. Exists, because it has regulated industrial and agricultural zones in the Perda RTRW which Subang currently owns.

There are 30 sub-districts in Subang Regency, Tambakdahan Sub-district is one of them. Tambakdahan Sub-district is the fifth-largest contributor to rice production, the first is Ciasem District with a total rice production of 100,477.99 tons, the second is Patokbeusi District with a total rice production of 93,600.80 tons, the third is Cipunagara District with a total rice production of 87,789.65 tons , the four Blanakan Districts with rice production of 83,321.60 tons, and the fifth Tambakdahan Sub-district with 78,080.40 tons of rice production (Subang District Food Crops Agricultural Service, 2018). The average rice production in Tambakdahan Sub-district is 8.5 - 9 tons per hectare, while the average Subang Regency is 6.3 tons every hectare (UPTD Pertanian Tambakdahan, 2018).

The rice production management in Tambakdahan Subdistrict has led to agri-industry, while other sub-districts are still providing food. In

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addition, when the harvest season arrives, the farmers prefer to save their crops and sell them when rice prices are high. In contrast to farmers in other sub-districts who sell their produce to mediators when the harvest takes place, there is also a shortage of rice farmers in Tambakdahan Sub-district, namely, the majority of farmer families buy rice for their daily needs, they do not consume rice from the harvest itself.

The resulting rice production cannot be separated from the size of the production factors which are input materials. The production factors used include; quality of rice seeds, land area, labor experience in farming, fertilizers used, irrigation (irrigation, pesticides and other input factors, this is of course, the more input is used in the production process, the more it will produce (output) more and more rice production (Ricky and Arfida, 2018).

Seeds are rice seeds that are used as a source of plant propagation. Seed is an agricultural input that affects the level of output produced. Farmers in Tambakdahan Sub-district, on average, use rice seeds in one crop, which is around 25 kg per hectare (UPTD Pertanian, Tambakdahan Sub-district, 2018). The types of rice seeds planted, on average, by farmers, are 42 types of rice, which are one type of superior seed, also have a high selling price, and can be used as raw materials for making rice vermicelli, (UPTD Pertanian Tambakdahan, 2018)

Labor in farming or agriculture generally consists of several farm laborers, either family or outside workers, whom all play a role in agricultural business activities (Dwiyatmo, 2006). The labor force in rice farming in Tambakdahan Sub-district is 3,142 on average, consisting of 2,095 people as farm laborers or cultivators and 1,047 people as owners (UPTD Pertanian, Tambakdahan Sub-district, 2018).

Fertilizer is an essential and helpful factor of production in providing soil nutrients. If soil nutrients are unavailable, plant growth will be poor. According to Mulyani (1999), fertilizer is a material given to the soil, both organic and inorganic, to replace the loss of nutrients from the soil to increase plant production in suitable environmental conditions. In Tambakdahan Sub-district, fertilizers are divided into two, namely organic fertilizers and inorganic fertilizers. The organic fertilizer used is urea as 250 kg / ha, SP36 as much as 100 kg / ha, and NPK as much as 150 kg / ha.

Irrigation technically (irrigation) is an effort made to irrigate agricultural land. In today's modern world, many irrigation models can be used. The development of this irrigation can be done technically, and simply. Farming in Tambakdahan Sub-district, in its irrigation system, mainly uses technical irrigation originating from the Jatiluhur reservoir. The rice field irrigation network in Jatiluhur reservoir uses culverts for the rice fields. With an average water discharge of 0.86 m3 / second, this technical irrigation network can inundate 1 ha of land on average water flows into the rice fields (UPTD Pertanian Tambakdahan Sub-district, 2018).

RESEARCH METHODS

The method used in this research is a quantitative descriptive method with primary data collected from farmers in Tambakdahan Sub-district, Subang Regency. The data required include; land area, labor, rice seeds, fertilizer, and irrigation, as input variables and rice production as output variables. The model specification used is the Cobb-Douglas production function theory equation. The Cobb-Douglas production theory is a function or equation involving two or more variables, where one variable is called the dependent variable, which is described, (Y), and the other is called the independent variable, which explains, (X).

2.1. Population and Sample

The population is the total number of units or individuals whose characteristics are to be studied, and these units are called units of analysis, which can be people, institutions, and objects. (Djawranto, 1994: 420). In another sense, the population is a generalization area consisting of things or subjects with specific qualities and characteristics that the researcher determines to study and then concludes (Sugiyono, 2017: 80).

Samples are part of the population whose characteristics are to be studied (Djarwanto, 1994: 43). A good sample, whose conclusions can be imposed on the people, is a representative sample or that can describe the characteristics of the population. In other words, the sample is part of the total characteristics of the population (Sugiyono, 2017: 81).

There are 9 villages in Tambakdahan Subdistrict, with 3,142 farmers (UPTD Agriculture, Tambakdahan Sub-district, 2018). The number represents the population unit. As for sampling in the study using the Slovin formula with Quota Sampling technique, which was formulated by Slovin and Umar (2008) are as follows:

$n = \frac{N}{1+Ne^2}$ ..... (1.1)

Information:

n = Sample size

N = Population size

e = The level of error that can still be tolerated

Based on the Slovin method, a sample of 96 rice farmers was obtained. The most significant number of rice farmers is in Kertajaya Village with 476 farmers with a proportion of 14% of the sample taken is 14 farmers. Mariuk Village and Tanjungrasa Village, respectively, the number of farmers is 422 and 420 people with the proportion of 12% of the sample taken is 13 farmers. Gardumukti Village and Rancaudik Village are in third place with 417 and 388 farmers, respectively, with a proportion of 12%, the sample taken is 12 people. For Bojonegara and Wanajaya Villages the number of farmers is the same, namely 323 people in the fourth place, with a proportion of 10%, the sample of farmers taken is 10 farmers. Bojongkending Village and Tambakdahan Village are in the fifth and sixth ranks with the number of farmers is 223 and 150 people, respectively, with a proportion of 7% and 5%, with a sample of 7 and 5 people. For more details, see Table 1.

Table 1. Village and Number of Samples of Rice Farmers in Tambakdahan Sub-district

No	Name Of The Village	Number Of Farmers	Proportion (%)	Sample (Person)
1	Tambakdahan	150	0.05	7
2	Bojongkeding	223	0.07	7
3	Bojonegara	323	0.1	10
4	Rancaudik	388	0.12	12
5	Kertajaya	476	0.14	14
6	Mariuk	422	0.13	13
7	Gardumukti	417	1.12	12
8	Wanajaya	323	0.1	10
9	Tanjungrasa	420	0.13	13
	Total	**3.142**		**96**

Source: UPTD Agriculture, Tambakdahan Sub-district (processed data)

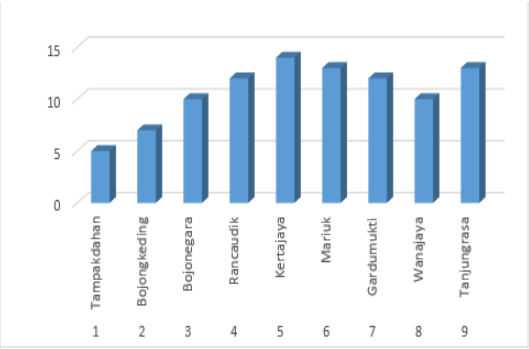

Figure 1. Research Sample of Rice Farmers in Tambakdahan Sub-district

2.2. The Cobb Douglas Theory of Production Functions

Production is creating, producing, or adding value to goods and services. Production activities will not be able to be carried out if there are no available inputs for the production process activities. Production process activities require human labor, natural resources, and capital in all their forms. All these elements are called the production (factors of production). Thus, all aspects that support the effort to create value or increase the value of goods are called production factors.

The production function shows the nature of the relationship between production's factors and the level of product is created. Sukirno (2000) and Adiningsih (1999) explained that the production level of a good depends on the amount of capital, the amount of labor, the amount of natural wealth, and the level of technology used. The production function explains the physical relationship between the number of inputs used and the amount of output produced (Mankiw, 2014). In Pindyck and Rubinfeld (2007), the production function shows the maximum possible production at a particular input level in each firm. Nicholson and Snyder (2011) state that the relationship between input and output is formulated in a function called the production function and is written in general form:

y = f (k, l) ……... (1.2)

where y is the number of products produced by a company based on capital (k) and the amount of labor (l) used in the production process. The Cobb-Douglas production function is a commonly encountered form of production function. This function consists of two or more inputs in producing output. The simplified form of the Cobb-Douglas production function is as follows:

y = Akα l β……. (1.3)

where y represents the total output or production of a company. y is a function of A which states technology, k represents capital or capital, l represents labor, and α and β are model parameters of the Cobb-Douglas production function. Specific values of k and l, A are also referred to as the efficiency parameter with A> 0.

The Cobb-Douglas Production Function used in this study is as follows:

$y = AX_1^{\alpha 1}, X_2^{\alpha 2}, X_3^{\alpha 3}, X_4^{\alpha 4}, X_5^{\alpha 5}$ …… (1.4)

of the Cobb-Douglas production function, it is transformed into a natural logarithm (ln), into a multiple linear regression equation, as follows:

$LnY = LnA + \alpha 1LnX1 + \alpha 2LnX2 + \alpha 3LnX3 + \alpha 4LnX4 + \alpha 5LnX5 + e$ … (1.5)

Where:

Y	= Rice Production (Ton)
A	= Constant
X1	= Land area (Ha)
X2	= Labor (Person)
X3	= Seed (Kg)
X4	= Fertilizer (Kg)
X5	= Technical irrigation (irrigation) (m3 / sec)
Ln	= Natural Logarithm
α1, ..., α5	= Parameters
e	= Error Term

2.3. Scale enterprises

In a production process, returns to scale describe output response to the proportional change of all inputs. By knowing the condition of the Scale of the business, farmers can consider whether or not a company should be developed further. In rice farming, it is deemed necessary to determine the condition of the Scale of the business, given the input factors that determine the size of the output produced.

Changes in output due to changes in the Scale of the use of input factors (Return to Scale) is a concept that wants to explain how much the output changes when the number of input factors is doubled (doubling). There are three possible relationships between production costs and the resulting output, namely:

1. *The constant return to scale (CRS)* when ($\alpha 1 + \alpha 2 + \ldots + \alpha n$) = 1, indicates when changes in all inputs cause an increase in output by the same amount.
2. *Increasing return to scale (IRS)* ($\alpha 1 + \alpha 2 + \ldots + \alpha n$)> 1, occurs when an increase in all inputs causes a larger increase in output.
3. *Decreasing return to Scale (DRS)* ($\alpha 1 + \alpha 2 + \ldots + \alpha n$) <1, occurs when an increase in all inputs by the same amount causes a less proportional increase in total output.

RESULTS AND DISCUSSION

The results of this study consist of two main parts, namely, the results of descriptive and quantitative analysis. The results of descriptive analysis describe the characteristics of farmers, rice production output, land area, number of workers, seeds, fertilizers, and irrigation in Tambakdahan Sub-district, Subang Regency, and the results of quantitative analysis discuss rice production yields and business scale using the Cobb-Douglas production function equation.

3.1. Characteristics of Farmers and Rice Production Factors in Tambakdahan Sub-district

The characteristics of rice farmers in Tambakdahan Sub-district, seen from gender, age, length of time as a farmer, and education level, from a sample of 96 people, are as follows, for sex it turns out that, on average the, most women are 87 people around 91%, men- only 9 men or about 9%. For the average age, the most number is over 40 years there are 73 people, around 76%, the average age between 31 to 40 years there are 16 people, around 17%, and the average age between 21 to 30 years there are 7 people around 7%. The average length of time to be a rice farmer in Tambakdahan Sub-district is about 71% over 10 years, around 71% between 5 and 10 years there are 19 people, and less than five years there are 9 people, around 9%. For the average education level of rice farmers in Tambakdahan Sub-district, there are 48 elementary school (SD) people, or about 50%, SMP there are 13 people, around 14%, SMA / SMK there are 25 people, about 26%, Diploma there are 2 people, about 2%, there are 6 graduates, about 6%, and 2 graduates, about 2%. Can be seen in table 1.2.

Table 2. Characteristics of Rice Farmers in Tambakdahan Sub-district, Subang District

Characteristics	total	Percentage
(1)	(2)	(3)
Gender		
• Male	9	9%
• Women	87	91%
Age		
• 21-30 Years	7	7%
• 31-40 Years	16	17%
• > 40 Years	73	76%
Long Become a Farmer	9	9%
• <5 years	19	20%
• 5-10 Years	68	71%
• > 10 Years		
Education		
• SD	48	50%
• Junior High	13	14%
• SMA / SMK	25	26%
• Diploma	2	2%
• Bachelor	6	6%
• Postgraduate	2	2%

Questionnaire Results (data processed)

The highest yield of rice in one harvest is 10 tonnes/ha, the least is 4.5 tonnes/ha, for the average value is 7.62 tonnes/ha. Judging from the land area ownership for each farmer, the average is 2.2 ha / m3, the largest is 7 ha / m3, and the least is 1 ha / m3. In view of the labor used by rice farmers in production activities, the most number is 95 people, while the minimum is only 20 people, while the average is 49 people. The highest number of seeds used by rice farmers was 70 kg, while the lowest was 6 kg, while the average seed was 20.13 kg. The most widely used fertilizer for rice farmers was 950 kg, while the lowest was 400 kg, and the average was 646.35 kg.

3.2. Results of Estimation of Rice Production in Tambakdahan Sub-district

The estimation results of rice production in Tambakdahan Sub-district with the Cobb-Douglas production function equation from five parameters, partially three parameters have a negative relationship, namely land area ownership (α1), use of total labor (α2), and the number of uses of seeds (α3). Two parameters have a positive relationship, namely the amount of fertilizer (α4), and technical irrigation (irrigation) (α5), on rice production in Tambakdahan Sub-district. When viewed from the effect for each parameter used with a significance level (α = 0.05), three parameters have a significant impact, namely ownership of land area, use of fertilizers, and technical irrigation (irrigation), and two parameters do not have a considerable effect, namely the use of the number of workers,

Table 3. Estimation Result of Cobb Douglas Production Function Equation for Rice Farmers In Tambakdahan Sub-district, Subang Regency

Parameter	Estimasi	Standard Error	t-statistik	P value
(1)	(2)	(3)	(4)	(5)
C	1.416597	0.799706	1.771398	0.0799
α_1	-1.756438	0.819407	- 2.143547	0.0348
α_2	-0.043590	0.097384	- 0.447609	0.6555
α_3	-0.085644	0.075991	-1.127030	0.2627
α_4	0.188897	0.097833	1.930813	0.0567
α_5	1.940392	0.824938	2.352168	0.0208
R-squared		0.188836		
Adjusted R-squared		0.143771		
F-statistic		4.190326		
Durbin-Watson stat		1.456254		

Source: Data Processing Results, 2020

Based on table 3.1, each parameter value is as follows: For land area ownership is -1.756438, meaning that if the average land area of the farmers increases by one percent, the amount of rice production in Tambakdahan Sub-district will decrease by -1, 756438 percent, the other production input is considered constant. The existence of a negative relationship between the average land area ownership of each farmer and the yield of rice production in Tambakdahan Sub-district is inseparable from each farmer's varying land area ownership. Some farmers have a land area of up to 7 ha / m3, this is the most extensive ownership, while some only have 1 ha / m2, while the average is 2.20 ha / m2. When viewed from the rice production of each farmer, the most average per hectare in one harvest is 10 tons, and the least is 4.5 tons, and for the average is 7.62 tons. When compared between the variation of land area ownership for each farmer with rice production, right of land area is closer to the smallest land area, namely 1ha / m2, while rice production is closer to the average value, namely 7.62 tonnes.

Ownership of land area in rice production is the main input in farming activities, in Tambakdahan Sub-district, the ownership of rice fields is getting narrower day by day, among others due to land conversion, from rice fields to housing for housing, and many of them are turned into factories. factories (industry), especially after Subang Regency opened a mega-project for the Patimban International seaport.

The parameter value of labor use is -0.043590, this means that if the average use of labor input per farmer increases by one percent, then the amount of rice production in Tambakdahan Sub-district will decrease by -0.043590, percent, other production inputs are considered constant / constant. The occurrence of a negative relationship between the use of labor input for each farmer and the yield of rice production in Tambakdahan Sub-district cannot be separated from the varied use of labor input from each farmer. some farmers use labor input as many as 95 people, this is the most, and there are also those who use only 20 people, this is the least, while for the average it is 49 people. When compared between variations in the use of labor inputs with variations in rice production,

The majority of farmers who work in Tambakdahan Subdistrict are elderly, although the longer they work, the more experience they have but in terms of the quality of work the lower they will be. Workers who are still productive do not want to work in the agricultural sector, preferring to work overseas (TKI), or become domestic servants.

The parameter value for rice seeds is -0.085644, which means, if the average use of rice seeds per farmer is added by one percent, then the amount of rice production in Tambakdahan Sub-district will decrease by -0.085644 percent, other

production inputs are considered constant. The existence of a negative relationship between the use of seed input for each farmer and the yield of rice production in Tambakdahan Sub-district cannot be separated from the varied use of seed input from each farmer. Some farmers use 70 kg of seed input, this is the most, and some only use 6 kg, this is the least, while the average is 20.13 kg. When compared between variations in the use of seed inputs with variations in rice production,

On average, rice farmers in Tambakdahan Sub-district, in the use of rice seed input, still use rice seed input from the previous year's harvest, so the quality is not guaranteed, even though there are quality seeds that are also used as superior seeds, namely the type of rice seeds. 42.

The parameter value of fertilizer use is 0.188897, this means that if the average fertilizer use for each farmer is increased by one percent, then the amount of rice production in Tambakdahan Sub-district will increase by 0.188897 percent, other production inputs are considered constant.

By the opinion of Palinggi & Atmomarsono (1988) and Padda & Mangampa (1993) efforts to increase rice production can be carried out through intensive cultivation with the application of agricultural business sapta as a whole comprehensively. One of them 96 is the provision of effective and efficient fertilizers. Proper fertilization and high quality are important factors determining rice production's success. In rice production activities, the availability of appropriate fertilizers will support its growth, which will impact increasing production.

The technical irrigation (irrigation) parameter is 1.940392, this means that if the average technical irrigation (irrigation) is increased by one percent, then the average rice production in Tambakdahan Sub-district will increase by 1.940392 percent, other production factors are considered constant. It is because the current need for irrigation water in Tambakdahan Sub-district is sufficient to irrigate agricultural land. There are 3 irrigation areas that support irrigation of agricultural land, namely the Salamdarma irrigation area (Bojongkeding and Bojonegara), Cigadung (Gardumukti, Mariuk, 98 Kertajaya, Rancaudik, and Tambakdahan, and the Tiger Dam (Tanjungrasa and Wanajaya). So that 3 irrigation areas flank it. This and at this time also supported by the rainy season, rice farming produces increased production

3.3. Estimation of Business Scale

By adding up all the parameters, the result is 0.243617, this can be predicted by adding one unit average parameter for each rice farmer, it will get an additional rice production yield in Tambakdahan Sub-district 0.243617. Thus, the yield scale of rice farming in Tampaktahan District shows that the results are decreasing. (diminishing return to Scale). The additional value of rice production that has decreased can not be separated from the use of input production factors that have been optimum, namely the average use of workers over 40 years old, so that the use of technology cannot be optimal, coupled with the ownership of the land area that is already narrower due to land use change.

CONCLUSION

The results of the analysis show that the results of rice production using the Cobb Douglas production function, from the five production input variables (land area ownership, labor use, seed use, fertilizer use, and technical irrigation), three input variables have a negative relationship, namely ownership of land area, use of labor, and use of seeds. Two input variables have a positive relationship, namely the use of fertilizers and technical irrigation (irrigation), with thre (labor, and seeds).The rice production business scale shows diminishing returns to scale.

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