

Factors Affecting Rice Production and Land Usages in Banten Province, Indonesia

Viktor Siagian

Ph.D. candidate, Study Program of Natural Resources,
Environmental Management, IPB University, Bogor, Indonesia

Hermanto Siregar

Faculty of Economics and Management,
IPB University, Darmaga Campus, Bogor, Indonesia

Anna Fariyanti

Faculty of Economics and Management,
IPB University, Darmaga Campus, Bogor, Indonesia

Kaman Nainggolan

College of Management and Computer Science,
Nusa Mandiri, South Jakarta City, Jakarta, Indonesia.

ABSTRACT

Banten Province has a harvested area of paddy fields on the 2017 year of 415,687 ha and production of 2,369,731 tons of unhusked rice. The objectives of this study are: 1) Knowing the priority of resources and agricultural inputs use for food production, 2) Knowing the factors that influence the productivity of rice in irrigated land in Banten Province, 3) Knowing the efficiency of the use of production inputs. The sampling method used purposive sampling with 90 respondents. The analytical method used the Analytical Hierarchy Process (AHP) and multiple linear regression of Cobb Douglas production functions. The results of the study are: 1) The priority strategy in increasing food production is to increase the use of irrigated rice fields, so that the goal is achieved by increasing the crop index, this can be done by prioritizing the optimization of agricultural machinery 2) Significant factors that affecting the production of paddy rice in the irrigated wetland paddy field in Rainy Season 2017/2018 are the use of urea fertilizer, the amount of use of solid organic fertilizer, the amount of use of human labor rent, and the arable land area, 3). The cumulative elasticity is 1.45, which is elastic, meaning that the addition of 1% of the production factor will increase production by 1.45% or increasing return to scale. So rice farming in irrigated land is relatively efficient. To increase production, it is necessary to increase rice productivity and crop index in irrigated paddy fields.

Keywords: Factors production, efficiency, priority analysis, rice, land usage.

INTRODUCTION

Background

Banten Province has an area of 9662.92 km², with a population of in 2015 there were 11,955,243 people, and the population density of Banten was 1,237 people km²⁻¹ and an average of four people per household (CBS 2016). According to CBS (2015), the area of agricultural land in Banten Province in 2015 was 716,324 ha in which the area of paddy land was 201,270 ha (28.1%) and non-paddy land area was 515,054 ha (71.9%). The area of paddy fields is 94.6% found in the four main paddy producing districts namely regency: Pandeglang, Lebak, Tangerang, and Serang. Based on the types of plants planted, 99.1% were planted with rice and the rest were non-paddy (CBS 2014; CBS 2015). If detailed according to irrigation, the area of irrigated rice fields is 103,767 ha (51.6% of the paddy fields) where the largest is in Serang Regency is 26,678 ha (25.7%), second in Tangerang Regency is 24,857 ha (24.0%), and the smallest in four other cities (CBS 2015).

The area of rainfed lowland in Banten Province is 97,469 ha (48.4%), the largest is in Pandeglang regency namely 32,102 ha (32.9%), second in Lebak regency is 25,603 ha (26.3%), the third in Serang Regency namely 22,247 ha (22.8%), fourth in Tangerang regency namely 12,207 ha (12.6%) and the rest (5.4%) in four other cities (CBS 2015).

Rice harvested area in 2017 is 428,628 ha with a production of 2,413,478 milled dry paddies (MDP) or with a productivity of 5.63 tons, MDP ha⁻¹. Other food crops, namely corn, harvested in the same year 16,018 ha with a production of 63,518 tons of dry shelled, while the soybean harvested area was 1,646 ha with a production of 2,126 tons (CBS 2018).

Besides land for agriculture, Banten Province also has a forest area countries with an area of 208,161.27 ha in 2013 consisted of conversion forests Protection Forest and Nature Conservation (PFNC) 61.4%, protection forests 4.6%, production forests 19.8% and limited production forests 14.2% (2015 CBS). This forest indirectly benefits agriculture as a water catchment area and cannot be utilized for agricultural business. The land that has been used for corn and beans crops is the State Industrial Timber Plantation Banten area of 78,487.64 ha in 2014. Land that can be used is replanting young plants.

The constraints in increasing production besides land resources are limited also not the optimal use of fertilizer, based on the results of the study (Siagian 2014) the average use of fertilizer per ha in the 2013 Dry Season in Banten Province is Urea of 145 kg, SP-36 of 57 kg, NPK Ponska of 71 kg, KCL of 0.4 kg, 402 kg manure, 121 kg organic fertilizer there are still opportunities for increased use of fertilizer, especially in SP-36 and KCL fertilizers.

To find out how the allocation of land use and farming inputs optimal so that food production can be increased it is necessary to do research. This research is useful to get land optimization and farming inputs to increase crop production and also useful to find ways to increase the production of lowland rice. The benefits can be used as input in policymaking to increase food production with limited land resource conditions.

METHODOLOGY

Research Method Data Collection Data

The method used in this study was the survey method. The survey method was conducted for primary data collection. Primary data were collected by interviews using a structured questionnaire to rice farmer respondents. Total farmers respondents amounted to 123 respondents farmers, consist of 90 respondent farmers in irrigation lowland, and 33 respondents in rainfed lowland. For AHP analysis, primary data were obtained through in-depth interviews and dissemination of Analytical Hierarchy Process (AHP) questionnaires to experts. Methode sampling for experts used purposive sampling with 11 experts.

The expert respondents were: 1. Head of Banten Provincial Agriculture Service, 2. Head of Food Crops Division of Banten Provincial Agriculture Service, 3. Head of Food Crops of Lebak Regency Agriculture Service, 4. Head of Infrastructure and Facilities of Pandeglang Regency Agriculture Service, 5. Section head of Fertilizer and Pesticides of Pandeglang Regency Agriculture Service, 6. Head of Agricultural Extension Center (AEC) Mandalawangi District, 7. Head of AEC Cimanuk, 8. Head of Agricultural Extension Center (AEC) Sajira District, 9. Field Agricultural Extension (FAE) in Kadu Madang Village, Cimanuk District, 10. Chief of Farmer Group of Karang Indah of Kadu Madang Village, Cimanuk District, 11. Senior Extension Agent of Banten AIAT.

Location and Time

The assessment was conducted in Banten Province. The location of this study was conducted in four districts of rice producer: 1) Tangerang Regency, 2) Serang Regency, 3) Pandeglang Regency, and 4) Lebak Regency. This study had been conducted since January 2018 - December 2018.

Methods Data Processing and Analysis

Strategy to increase food production in Banten province

The data analysis method uses the Process Hierarchy Analysis (AHP) to get policy priorities in increasing production. Using the AHP approach means simplifying complex problems and speeding up the decision making process in a multilevel diagram (hierarchy). The basic thinking of the AHP is the weighting process to rank each alternative decision based on how well the alternative meets the decision-making criteria. AHP can solve multi-criteria problems based on comparing the preference of elements in the hierarchy (Marimin and Maghfiroh 2011).

The AHP's working principle is to simplify a complex problem that is not structured, strategic, and dynamic into structured parts in a hierarchy (Marimin and Maghfiroh 2011). So there are three principles of AHP work in solving problems through explicit logical analysis, namely the preparation of the hierarchy, setting priorities, and logical consistency. According to Saaty (1980), hierarchy as a representation of a complex problem in a multilevel structure where the first level is the goal, the second level is the criteria factor, the third level is the sub-criteria and so on down to the last level from the alternative level. With a hierarchy, a complex problem can be arranged so that the problem is more structured and systematic. The AHP's work principles are:

- a. The preparation of the hierarchy is carried out by identifying the knowledge being observed, analyzing complex problems, and broken down into key elements and broken down into parts and their hierarchical succession.
- b. Assess the relative importance between the two elements presented in the form of a comparison matrix using a priority scale. If there are n elements, a pairwise comparison

matrix with $n \times n$ dimension will be obtained, and the number of judgments needed is $n(n-1)/2$. Evaluation of each level of the hierarchy is assessed by pairwise comparison with a scale of 1-9 which is carried out in the assessment of the elements compared as shown in Table 2.

- c. Priority determination process, in which paired comparisons are made to determine priority order starting from the top of the hierarchy (goal) then criteria (factors) and alternatives by performing a local matrix multiplication operation that starts by multiplying the combined priority from the lowest level with the level above it to the level of the hierarchy top. Based on the hierarchical structure above, it can be arranged a matrix table of each level.

The details are listed in Table 3. The hierarchical structure of increasing food production in Banten Province is shown in Figure 1.

Level 0: Goal

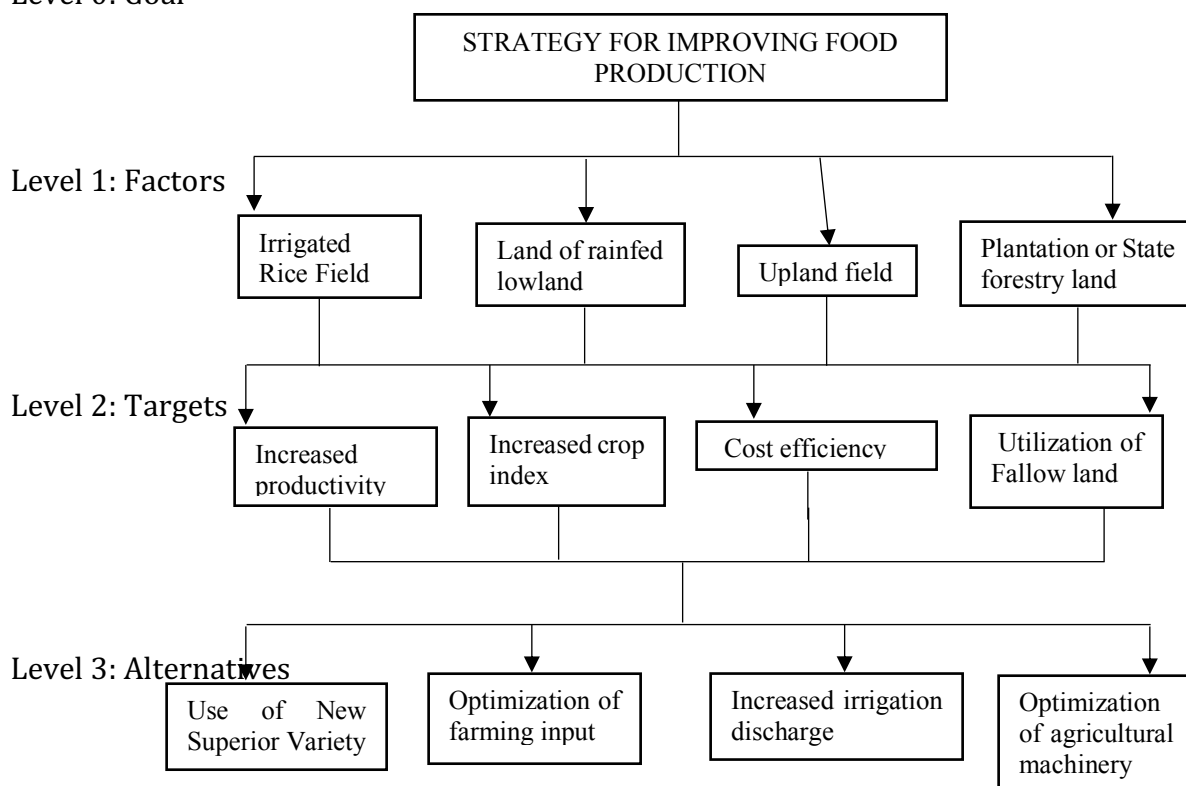


Figure 1 Hierarchical structure and strategy for increasing food production in Banten Province

Suhardi (2002) states that AHP is a model of decision making from a complex and unstructured problem to a structured one which is broken down into groups and then the groups are arranged in a hierarchy. The main equipment of the model is to use the main input that is human perception obtained from expert opinion. According to Suhardi (2002), experts are people who understand the problems raised and feel the consequences of such problems. Messer and Allen III (2010) state that the AHP process is a quantitative method for ranking alternative decisions by developing a numerical score for ranking each alternative decision based on how well each alternative meets the criteria of the decision-maker. Pecchia *et al.* (2013) stated that AHP is a multidimensional, multilevel, and multifactorial decision-making method based on ideas that allow prioritizing factors

based on groups. Calantone *et al.* (1999) state that AHP is the role of sophisticated scientific management that can determine multi-criteria, multiperson decisions that are complex in economics and business. After the compilation of the hierarchy through the graphic above, the next level of hierarchy comparisons is assessed by pairwise comparisons, which are generally used on a scale of 1 to 9 in expressing opinions. This scale is set as a consideration in comparing pairs of elements at each level of the hierarchy against an element that is above it (Saaty 1983). The following values and definitions of qualitative opinions from the Saaty comparison scale are listed in the above Table 1.

Table 1 Value and definition of qualitative opinion on the scale of Saaty comparison

Value	Description
1	Vertical Factors As important as horizontal factors
3	Vertical Factors are More Important than Horizontal Factors
5	Vertical Factors Obviously More Important Than Horizontal Factors
7	The Vertical Factor is Clearly More Important than the Horizontal Factor
9	Absolute Vertical Factors are More Important than Horizontal Factors
2,4,6,8	When in doubt between two values of adjacent elements.
1/(2-9)	Opposite of the description of values 2 - 9.

Sources: Marimin and Maghfiroh (2011).

Next is to create a matrix to determine the total number of matrices, the dimensions of the matrices at each level, the number of matrix cells at each level, and the number of questions. The details of the elaboration above from the example of the problem hierarchy in Figure 1 are listed in the following Table 2.

Table 2 Number of matrices, dimensions, number of cells and number of questions

Level Number of Matrices	Dimension	Matrix Number of cells	Number of Questions
Goal	0	0	$(n \times n - n)/2$
Criteria	1	3 x 3	$(3 \times 3 - 3)/2 = 3$
Alternative	3	4 x 4	$4 \times ((3 \times 3 - 3)/2) = 12$
Sum	4		

Then a matrix of comparison of importance level is drawn up between the elements of the factor based on the goal: increasing food production as Table 3.

Table 3 Matrix of comparison of importance between the elements of the factor based on the goal: increasing food production

Elements of a Factors	Elements of B Factors			
	Paddy fields irrigation	Paddy fields rain feeds	Dryland	Plantation/state forestry land
Paddy fields irrigation				
Paddy fields rain feeds				
Dryland				
Plantation/state forestry land				

Then make Table 4 which is a comparison matrix of the importance level of criteria on irrigated rice factors as shown in the following table.

Table 4: Matrix of comparison of importance between criterion elements based on irrigated field factors

Element of Purpose A	Element of Purpose B			
	Increasing productivity	Increasing of Cropping Index	Cost Efficiency	Utilization of fallow land
Increasing productivity				
Increasing of Cropping Index				
Cost Efficiency				
Utilization of fallow land				

After the above, a matrix table for comparison of the importance of criteria in the "rainfed lowland" factor is also made, and continue to dry land factor matrix table, and so on.

The next step is processing the matrix to determine the highest-ranking of factors, objectives, and alternatives, namely by determining the eigenvector of each level (hierarchy). The procedure is 1). Squaring the matrix. 2). Calculate the number of values from each row then do the normalization, 3) Stop this process if the difference between the sum of two successive calculations is smaller than a certain boundary value. Data is processed using Expert Choice 11 software.

According to Bachri *et al* (2017), the estimation of the consistency of the comparison process is done using a pairwise comparison matrix by calculating the maximum value of the principal eigenvector (max). In AHP, the consistency value is expressed in a consistency ratio (CR), which is obtained through the calculation of a consistency index (CI) and a consistency random index (RI), as equation follows:

$$CR = \frac{CI}{RI}$$

Where:

CI = Consistency Index

RI = Random Index

CR = Consistency Ratio

The values:

CR $\leq$ 0.1: consistent

CR $\geq$ 0.1: not consistent.

RI values are the average values of indexes that are randomly generated and obtained from experiments used up to 15. RI values are obtained from the division of CI values with RI values on the equivalent order matrix.

Factors Affected Productivity in Irrigated Wetland

This study also used multiple linier regression of Cobb Douglas function to know the factors that affected productivity of rice in irrigated wetland. The equation to guess production of rice on Rainy Season (RS) 2017/2018 (Soekartawi, 2002; Koutsoyiannis, 1977).) is:

$$\text{PRODKT1} = a_0 + a_1\text{JBES1} + a_2\text{JURE1} + a_3\text{JSP361} + a_4\text{JNPK1} + a_5\text{JKDG1} + a_6\text{JPOP1} + a_7\text{JPUDP1} + a_8\text{JPUDC1} + a_9\text{JPESP1} + a_{10}\text{JPESC1} + a_{11}\text{JHERBP1} + a_{12}\text{JHERBC1} + a_{13}\text{JTRDK1} + a_{14}\text{JTKMDK1} + a_{15}\text{JTKMSW1} + a_{16}\text{LGRP1} + e \dots\dots\dots 1)$$

Equation (1) is converted into the Cobb Douglas production function form by changing it in the form of logarithms (Soekartawi, 2002) namely:

$$\text{Log PRODKTj} = a_0 + a_1 \log \text{JBE1} + a_2 \log \text{JURE1} + a_3 \log \text{JSP361} + a_4 \log \text{JNPK1} + a_5 \log \text{JKDG1} + a_6 \log \text{JPOP1} + a_7 \log \text{JPUDP1} + a_8 \log \text{JPUDC1} + a_9 \log \text{JPESP1} + a_{10} \log \text{JPESC1} + a_{11} \log \text{JHERBP} + a_{12} \log \text{JHERBC} + a_{13} \log \text{JTRDK1} + a_{14} \log \text{JTKMDK1} + a_{15} \log \text{JTKMSW1} + a_{16} \log \text{LGRP} + e \dots\dots\dots 2)$$

Where:

PRDKT1	= Production of wetland rice on RS 2017/2018(kg/ha)
a ₀	= intercept
JBES1	= Total Use of Certified Seed (kg/ha)
JURE1	= Total Use of Urea Fertilizer (kg/ha)
JSP361	= Total Use of SP-36 Fertilizer (kg/ha)
JNPK1	= Total Use of NPK Fertilizer (kg/ha)
JKDG1	= Total use of Manure Fertilizer (kg/ha)
JPOP1	= Total Use of Solid Organic Fertilizer (kg/ha)
JPUDP1	= Total Use of Solid Leaf Fertilizer (kg/ha)
JPUDC1	= Total Use of Liquid Leaf Fertilizer (kg/ha)
JPESP1	= Total use of Solid Pesticide (kg/ha)
JPESC1	= Total use of Liquid Pesticide (liter/ha)
JHERBP1	= Total Use of Solid Herbicides (kg/ha)
JHERBC1	= Total Use of Liquid Herbicides (liter/ha)
JTRDK1	= Number Use of Family Tractor (Machine Work Day/ha)
JTKMDK1	= Number Use of Family Human Labour (Work Man Day/ha)
JTKMSW1	= Number Use of Lease Human Labour (Work Man Day/ha)
LGRP1	= Wide land of Cultivated (Ha).
e	= Disturbing Variable.

Expected parameter signals: a₁, a₂, a₃, a₄, a₅, a₆, a₇, a₈, a₉, a₁₀, a₁₁, a₁₂, a₁₃, a₁₄, a₁₅, > 0

RESULTS AND DISCUSSION

Result of AHP Weighting

The results of AHP weighting based on the existing hierarchical structure are presented in Figure 4.11. Based on Figure 4.11 at the level of criteria (goal) the highest eigenvalue is in the irrigated paddy land factor of 0.586 and the lowest of the dry land factor is 0.118. So the first priority for the criteria level is irrigated paddy fields. Details are presented in Table 4.19 - Table 4.21.

Level 0: Goal

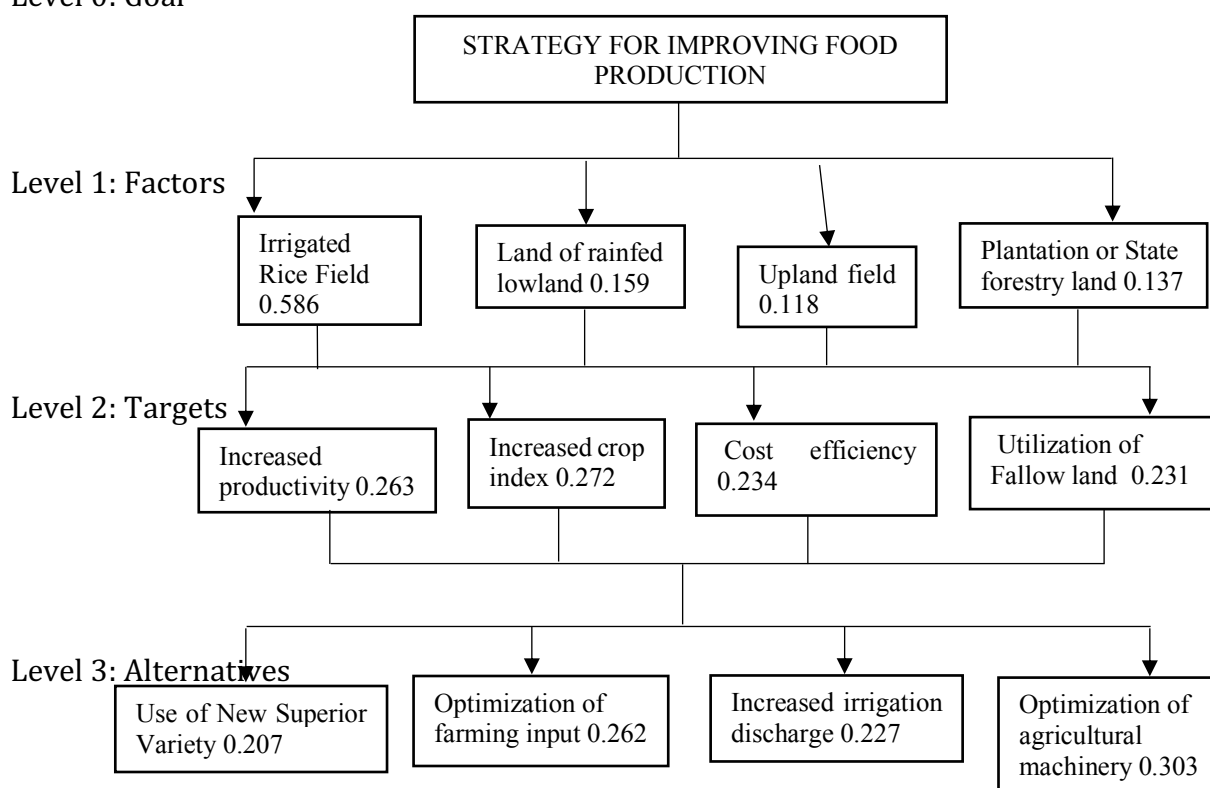


Figure 2 Hierarchical structure and strategy for increasing food production in Banten Province

The strategy to increase food production analyzed in this study consisted of several criteria. These criteria are irrigated paddy fields, rain-fed paddy fields, upland fields, and plantation or forest state lands. The results of processing the criteria data can be seen in Table 5.

Table 5 Criteria Weights of Strategy to increase food production

Criteria	Weights	Priority
Irrigated rice field	0.586	1
Rainfed lowland	0.159	2
Upland field	0.118	4
Plantation or forestry land	0.137	3

Table 5 shows the weights and priority criteria for increasing food production. If sorted, the priority criteria are as follows: irrigated wetland paddy fields (0.586), rain-fed wetlands (0.159), plantation or Perhutani lands (0.137), and upland wetlands (0.118). This sequence is based on the biggest

weight that will be the priority criteria regarding paddy fields that can be applied to increase food production.

Targets are things that must be achieved to achieve the goal of increasing food production. The targets analyzed in this study are as follows: increased productivity, increased cropping index, cost efficiency, and utilization of fallow land. The results of processing the target data can be seen in Table 6.

Table 6 Target weights of Strategy to increase food production

Target	Weights	Priority
Increased productivity	0.263	2
Increased crop index	0.272	1
Cost efficiency	0.234	3
Utilization of fallow land	0.231	4

Table 6 shows the weights and priority targets for increasing food production. If sorted, the target priorities are as follows: an increase in cropping index (0.272), increased productivity (0.263), cost efficiency (0.234), and fallow land use (0.231). This sequence is based on the biggest weight that will be the priority target that must be achieved to increase food production.

Table 7 Weight of alternative strategies

Alternative	Weight	Priority
Use of New Superior Variety	0.207	4
Optimization of farming input	0.262	2
Increased irrigation discharge	0.227	3
Optimization of agricultural machinery	0.303	1

Alternatives are things that must be done to achieve the goal of increasing food production. The alternatives analyzed in this study are as follows: the use of New Superior Variety (NSV), optimization of farming input, increasing irrigation discharge, and optimization of agricultural machinery. The results of processing the target data can be seen in Table 7. Table 7 shows alternative weights and priorities for increasing food production. If sorted, alternative priorities are as follows: optimization of agricultural machinery (0.303), optimization of farming inputs (0.262), increased irrigation discharge (0.227), and use of NSV (0.207). This sequence is based on the biggest weight that will be the priority of alternative strategies that can be taken to increase food production.

Priya and Ventakesh (2012) integrate AHP with multiple linear functions to determine an attractive location for the steel market expansion in rural India. The independent variable that statistically has a significant effect on multiple linear is used as an input to determine priority locations for steel market expansion. The results are sales variables in rural areas (RURRET) with an eigen coefficient value of 0.575, rural welfare (RURPROS) with a value of 0.239, rural public transportation (RURPTR) with a value of 0.094, rural social infrastructure (RURSINF) with a value of 0.091 as the most priority and relatively less priority.

Bachri *et al.* (2017) in his study of the analysis and optimization of the potential of agricultural land as a positive impact of the Mount Kelud eruption in 2014, using the AHP method found that the economic criteria with the highest weight value of 0.17 out of 15 land suitability criteria, became the most important parameter of its influence in the assessment land suitability. Second is the pH value with a weight value of 0.13 which represents the chemical properties of the soil, and third is a soil texture with a weight value of 0.11 which represents the physical properties of the soil.

Krismawati (2014) in her study of priority handling of roads in Demak Regency using the AHP method and Benefit-Cost Ratio (BCR) analysis. So there are two hierarchies, namely, the benefits (benefits) of the selected road section and the second hierarchy is the cost (cost) of the selected road section. Schiniederjans and Wilson (1991) use AHP and goal programming to select project information systems.

Based on the study of Susanti *et al.* (2015) for the development of tourist areas in Semarang, using the AHP method of five (5) alternative tourism objects, namely Goa Kreo, Maron Beach, Mangunharjo Beach, Tugurejo Beach, and Lele Park. Based on the processing of paired matrix data, the highest eigenvalue of Tugurejo Beach is 0.355, and the smallest Marina Beach is 0.125. So that was developed as a tourist attraction is Tugurejo Beach.

Based on the study of Pertama *et al.* (2014) on the analysis of key performance indicators of the supply chain of palm fresh fruit bunches (FFB) in PT. XYZ, with the AHP method, found that there are two key indicators with the highest weight value, namely the quality indicator of FFB and the time of sending FFB to Palm Oil Mill (POM) with a weight value of 0.46 and 0.39, respectively. This is due to the company prioritizing the importance of quality that is sent by the partner (supplier).

Based on the study of Fu Haw Ho *et al.* (2016) in Malaysia about analysis to determine the barriers to implementing a material efficiency strategy in electrical and electronics companies, with the AHP method. It was found that the biggest barriers namely customer requirement with eigenvector value 0.43, the second company technology availability (0.253), the third implementation cost (0.235), the fourth lack of external support (0.231).

The study of Garcia *et al.* (2014) in Mexico about the selection of sites for agricultural product warehouse by using AHP approach, found the attributes of accessibility to the area (0.397), security of the region (0.2), distance (0.19), local acceptance of the company (0.087), needs (0.073), and cost (0.053).

Factors Affected Paddy Productivity in Irrigated Wetland Fields

The results of the guess equation of irrigated land Rice Production at RS 2017/2018 (PRODKT1) are described in detail in Table 11. The explanatory variables that significantly affect rice paddy production in RS 2017/2018 are Total Use of Urea Fertilizer (JURE1), Total Use of Solid Organic Fertilizer (JPOP1), Number of Rent Human Labour (JTKMSW1), and Cultivated Land Area (LGRP1). The value of the coefficient of elasticity of paddy production on the number of solid organic fertilizer (EPRODKT1, JURE1) is 0.18165 (inelastic) means that any increase in the number of solid organic fertilizer 1% will increase rice production by 0.18% at the level trust 99%, meaning that Paddy production is unresponsive to the change in the number of urea fertilizer.

The value of the coefficient of elasticity of paddy production on the number of solid organic fertilizer (EPRODKT1, JPOP1) is 0.4744 (inelastic) means that any increase in the number of solid organic fertilizer 1% will increase rice production by 0.47% at the level trust 95%, meaning that Paddy production is unresponsive to the change in the number of solid organic fertilizer. The coefficient value of rice production elasticity to the amount of rent human labor (EPRODKT1, JTKMSW1) is 0.12512 meaning that any increase of 1% Rent Human Labour amount will increase the production of rice by 0.12%, meaning that Paddy Field Production is not responsive to changes in the amount of Rent Human Labour.

The value of the elasticity of paddy production to land area cultivated (EPRODKT1, LGRP1) is 0.72467 (inelastic) meaning that any increase in the amount of Land Area Cultivated by 1% will increase rice production by 0.76%, meaning that Rice Production is unresponsive to changes in the amount of Land Area Cultivated. Sembiring (2018) also conducted research in North Sumatra province, Indonesia it was found that factors that significantly affected the production of paddy namely paddy planted area with value of elasticity are 1.398, that's mean elastic.

The results of the study of Akbar *et al.* (2017) in Kesesi Subdistrict, Pekalongan Regency found that the factors that significantly affected rice productivity were land area, production, number of seed purchases, while the urea variable and planting system did not affect rice productivity. Asnawi (2013) in his research in Lampung Province, Indonesia, to find out the factors of production that affect inbred and hybrid rice production by using the Cobb Douglas function, found that the factors that significantly affected the area of cultivation and use of NPK fertilizer.

Lubis (2018) in her research in Langkat District, North Sumatra province, found that factors affected rice production are the area of land, the number of labor, the number of seed and fertilizer and significance at $\alpha = 5\%$. It was also found that the coefficient of elasticity was 1.671 (elastic), this implies that the production of paddy in Langkat, provides an increase in returns.

Arnanda *et al.* (2016) in their research on rice production efficiency in Riau Province-Indonesia by using the Cobb Douglas function, found that the factors that significantly affected rice production were land area, use of seed quantity, KCl fertilizer, SP36 fertilizer, fertilizer of NPK, labor, and dummy use of superior seeds.

Rahmawati *et al.* (2018) conducted research on organic rice farming in Karanganyar Regency, Central Java, Indonesia using the Cobb Douglass function. From the results of his study, it was found that the factors of production namely land area, labor, number of seeds and manure significantly affected the production of white rice. Land elasticity is 0.561, labor is 0.780, manure is 1.177 and seeds are -0.479.

Table 11. Result of Alleged Equation of Irrigated Wetland Rice Production at RS 2017/2018

Variable	Symbol	Elasticity (%)	t-count	Sig. level
Intercept	d ₁	7.57036	13.60	<0.001
Total Use of Certified Seed	JBES1	-0.05246	-0.71	0.4777
Total use of Urea	JURE1	0.18165	2.44	0.0171
Total use of SP-361 Fertilizer	JSP361	0.00117	0.29	0.7757
Total use of NPK Fertilizer	JNPK1	-0.00565	-1.29	0.2012
Total use of Manure Fertilizer	JKDG1	0.00376	0.72	0.4744
Total use of Solid Organic Fertilizer	JPOP1	0.4744	2.15	0.0346
Number Use of Solid leaf Fertilizer	JPUDP1	-0.00643	-1.10	0.2729
Number Use of Liquid Leaf Fertilizer	JPUDC1	0.00631	1.42	0.1595
Number of Solid Pesticide	JPESP1	0.00672	1.20	0.2334
Number of Liquid Pesticide	JPESC1	0.00077530	0.13	0.8960
Number of Solid Herbicide	JHERBP1	0.00430	0.58	0.5646
Number of Liquid Herbicide	JHERBC1	-0.00698	-1.44	0.1540
Number of Family Tractor	JTRDK1	-0.00142	-0.25	0.8021
Number of Family Human Labour	JTKMDK1	-0.00902	-1.58	0.1177
Number of Rent Human Labour	JTKMSW1	0.12512	1.67	0.0999
Land Area Cultivated	LGRP1	0.72467	5.07	<.0001
R ²	0.8653			
F Counted	29.31			

Explanation: n = 90 respondents.

Source: Primary data was processed in 2019.

Triyanto (2006) conducted research on rice farming in Central Java Province-Indonesia to determine the effect of production inputs on rice production using the Cobb Douglas production function. The results of the analysis showed that the variable area of land, labor, seeds and water pumps, had a significant influence on a 5% level of confidence in rice production. The production elasticity value is 1,089 (elastic).

Pudaka *et al.* (2018) in a study of rice production efficiency in Landak Regency, Central Kalimantan Province-Indonesia found that the factors affecting rice production were the land size, seeds, pesticides, and labors. Zulkarnain (2004) in his research on the production and profitability of lowland rice farming in Central Java Province, Indonesia by using the Cobb-Douglas production function, found that the factors that significantly affected production were fertilizer, insecticide, labor, land area, and type irrigation. Based on the study of Muhajirin *et al.* (2014), factors affected by wetland rice production significantly in Sarolangun district, province of Jambi are Land area, number of seed, number of KCL fertilizer, and number of Curater pesticide. Based on the study of Prabandari *et al.* (2013) in Mambal Subak, Badung Regency and Subak Pagutan in Denpasar City, Bali Province, it is known that the factors that influence rice production significantly are: Number of workers, fertilizer, and water at 99% confidence level.

Based on the results of the study of Onibala *et al.* (2017) in the District of South Tondano-Celebes, Indonesia, it is known that the factors that influence the production of rice fields significantly are: land area, seeds, and Urea fertilizer. Falatehan and Othman (2017) found that factors that influence

SRI rice production are TSP fertilizer use, NPK fertilizer use, labor use, Karawang regency dummy, SRI dummy, middle region dummy, dummy interaction between Karawang regency dummy and SRI dummy, dummy middle region interaction with SRI dummy.

Based on the study of Nwaobiala and Adesope (2014), where the study used the Cobb Douglas function in its analysis. in Bangian Ebonyi State, Nigeria found that the factors that significantly affect rice production on dry land were the age of farmers, farming experience, farm size, input variables, and farmer income. While the factors that significantly affect rice production in swamps were education level, labor costs, farm size, input variables, and farm income.

Research by Constantin *et al.* (2009) in Brazillia using the Cobb Douglas frontier production function found that the greatest contribution to agricultural productivity in Brazil was the land factor (harvested area) and agricultural credit. Based on the research results of Mamondol and Tambeo (2016) in the District of North Pampena, Poso Regency, Central Sulawesi Province found that the factors that influence the production of lowland rice are seeds, fertilizers, and herbicides. The study uses multiple regression with the Cobb-Douglas production function.

CONCLUSIONS

The priority criteria for increasing food production is too useful irrigated wetland paddy fields (0.586), in order to achieve the goals by increased cropping index (0.272) and increased productivity (0.263). Alternatives are things that must be done to achieve the goal, the priority is optimization of agricultural machinery (0.303), Optimization of farming input (0.262).

Significant factors affecting the production of paddy rice in RS 2017/2018 are The use of Urea fertilizer, the amount of use of solid organic fertilizer, the amount of use of human labor rent, and the arable land area.

The cumulative elasticity is 1.45, which is elastic, meaning that the addition of 1% of the production factor will increase production by 1.45% or increasing return to scale. So rice farming in irrigated land is relatively efficient. To increase production, it is necessary to increase rice productivity and to increase crop index in irrigated paddy fields.

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