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Rice Farmer Households' Perceptions of Rice Farming: Empirical Evidence from Aceh Province, Indonesia

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ABSTRACT

This article discusses the perceptions of rice farming households towards factors that become constraints in rice farming activities. It emphasizes more on-farm activities on how the dynamics of changes in farmers' perceptions, in the study of rice farming households in Aceh Province. This study uses Aceh Provincial Agricultural Census data for the food crop subsector from 3,353 rice farming households across the province in 2013. The analytical model used is a multivariate probit model, which consists of two dependent variables, i.e., harvest size, and farmer household perceptions. The following table estimates farmer households' perceptions of the various constraints faced that have led to a decline in farmer household productivity. All factors that are the focus of this study are positively perceived by rice farmers. The probability of an expansion of rice harvest area due to the loan factor, the ratio of input prices to output prices and climate change is more than 60 percent. While the perception of farmer households on the availability and wages of farm laborers at 57.7 percent. The implication of several factor's explaining that capital loans, changes in input and output ratios and climate change on rice farming households is positive any increase in access to loans, improvement in the value of output-input ratios, stability of climate change and farm labor wages will positively affect the probability of increasing the harvest area of rice farming households in Aceh Province.

Keywords: rice farming households; perception; climate change; wages; output-input ratios.

INTRODUCTION

Rice farming is one of the most important and strategic businesses in Indonesia in terms of employment and food security. However, the work of these farmers has not been able to provide hope for job security that can provide welfare for rice farming households. Constraints in rice farming are weather changes, pests and diseases, natural disasters that cause crop failure, scarcity of seeds, marketing, rice farming financing, rice price fluctuations, international markets, low skills, old farmers causing farmers' perception that rice farming is not attractive John and Fielding, (2014); 2014; Fahad et al., (2018); Satoto and Widyastuti (2021). The consequences are price stability, low average productivity of rice, gross income that does not meet basic needs. The perception of farming households towards rice farming that is less attractive has implications for new problems of regeneration of rice farmers in the future. The study of Szabo et al. (2021) argues that the problem of uncertainties such as weather conditions and disasters that cause crop failure, further adding to

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farmers' hesitation to make the farming job a guarantee of farmers' welfare in the future. Other barriers include moderate technology adoption, entrepreneurial skills, limited access to capital, and training in the utilization of modern agricultural equipment (Umar et al., 2020; Unay-Gailhard et al., 2019; Lakitan et al., 2018).

Adequate food availability is high on the agenda of faithful nations. Food availability is supplied by inputs that come from the agricultural sector. The development of agriculture and the attractiveness of working in the agricultural sector globally experience many constraints, including biotic, abiotic, and socioeconomic constraints (Fahad et al., 2018; John & Fielding, 2014). Some literature found several constraining factors that occur in rice farming in Indonesia, such as high input costs, lack of access to financing, low farmer skills, slow adoption of technology and innovation, labor availability and low wages that reduce interest in farming, agricultural infrastructure development such as irrigation are obstacles faced by rice farmers (Satoto and Widyastuti, 2021).

However, there are other constraints that have not been considered, such as socioeconomic constraints. There has been relatively little development of socioeconomic research to address rice production constraints (John & Fielding, 2014). The case study conducted by Wardie and Sintha, (2018) studied farmers' income within the scope of on-farm activities. Meanwhile, Inwood, Clark & Bean, (2013) studied in depth the income differences between generations of farmers and between regions on economic and non-economic values that affect the socio-economic structure on farms. The dynamics of changes in socio-economic values will certainly shape farmers' perceptions of agricultural activities as a livelihood. Therefore, this research emphasizes more on-farm activities on how the dynamics of changes in farmers' perceptions, in the study of rice farming households in Aceh Province.

The perception framework of farmer households is basically divided into two parts. The first part is problems at the production level and the second is distribution or low market participation that affects profitability (Abdullah et al., 2019; Noviar et al., 2020). The two problems can be made into a series which can be simply stated that production orientation by increasing productivity efficiently. Typically, smallholder farmers who farm traditionally will face the constraints of high costs and low market access with appropriate prices. The perception of farming households is important in maintaining the sustainability of agriculture in the future so that farmers' income and the sustainability of food security can be guaranteed. This article discusses the perceptions of rice farming households towards factors that become constraints in rice farming activities.

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RESEARCH METHOD

This study uses Aceh Provincial Agricultural Census data for the food crop subsector from 3,353 rice farming households across the province in 2013. The analytical model used is a multivariate probit model, which consists of two dependent variables y_1 and y_2, i.e., harvest size 1 = harvest size more than 4 tons; and 0 = perception of harvest size less than 4 tons measured on a scale of 1 = better perception and 0 = worse perception. Assuming a normally distributed function, the probit model in this study referring to Maddala, (1985); Greene, (2012); Unay-Gailhard et al., (2019); Kansiime et al., (2021) is written as follows:

$$\text{Prob}\,[y_i = 1|\mathbf{x}_i] = \text{Prob}\,(\varepsilon_i < \alpha + \tilde{\boldsymbol{\gamma}}'\mathbf{x}_i)$$
$$= \text{Prob}\,(\varepsilon_i - \theta < (\alpha - \theta) + \tilde{\boldsymbol{\gamma}}'\mathbf{x}_i)$$
$$= \text{Prob}\,(\varepsilon_i^* < \alpha^* + \tilde{\boldsymbol{\gamma}}'\mathbf{x}_i)$$

$y_i = 1$ where $\boldsymbol{\gamma}'\mathbf{x}_i + \varepsilon_i > 0$ and $y_i = 0$ otherwise. Where $\boldsymbol{\gamma}'\mathbf{x}_i$ is $y_i^* - \varepsilon_i$ is the deterministic component with y_i^* is the unobservable dependent variable and $y_i = 1$ if $y_i^* > 0$. The dependent variable y_1 is the harvest area where $y_1 = 1$ for a harvest area of more than 4 hectares, and otherwise $y_1 = 0$. For y_2 is the dependent variable of perception where $y_2 = 1$ is the probability of rice farming households having a worse perception and y_2=0 a better perception. The probit model used in this article (Greene and Hensher, 2010), explicitly:

$$\text{Prob}\,[y_i = 1|\mathbf{x}_i] = \boldsymbol{\gamma}'\mathbf{x}_i + \varepsilon_i \quad (2)$$

The probit model was estimated using the Maximum Likelihood method (Ichimura and Thompson, 1998). To obtain the coefficient estimate $\hat{\boldsymbol{\gamma}}'$ of the vector $\mathbf{x}_i$ which consists of: loan problem (LOAN), production input prices and output prices (ICOP), perception of weather and climate (CLIMT), farm labor wages (LABW).

The regression coefficients of the probit model cannot be interpreted directly, except from the sign of the coefficients (Akin and Guilkey, 1979; Greene and Hensher, 2010). Therefore, the coefficient estimates are calculated using the marginal effect method, which can be specifically written:

$$\frac{\partial E[y_i|\mathbf{x}_i]}{\partial \mathbf{x}_i} = \left[\frac{dF(\boldsymbol{\gamma}'\mathbf{x}_i)}{d(\boldsymbol{\gamma}')}\right]\boldsymbol{\gamma} \quad (3)$$

Marginal effects are partial derivatives of the probability distribution function $F(\boldsymbol{\gamma}'\mathbf{x}_i)$ for each variable $\mathbf{x}_i$ of the probit function. In this study, the data used is cross-section data of farmer households from the 2013 Agricultural Census of the Central Bureau of Statistics of Aceh Province.

RESULT AND DISCUSSION

Aceh Province is located in the western region of Indonesia. Agriculture is the main source of livelihood for its residents. Like most people in Indonesia, rice is the staple food for the people of this province. The distribution of households in 23 districts/cities are mostly farming households with a total population in 2021 of 5.3 million people spread across urban and rural areas. Most agricultural activities are carried out in rural areas. The poverty rate has experienced a downward trend from 18 percent in 2014 to 15.3 percent, but is still relatively high compared to other provinces on the island of Sumatra. The ratio of poor people is more in rural areas with a ratio of 10.4 : 17.8 in 2021 (BPS, 2022). The number of farming and fishing households in the agricultural sector is 178,000, of which more than 22% are rice farming households, followed by 21% plantation households (BPS, 2013). The development of the number of farmer households in 2023 is being enumerated in the 2023 Agricultural Census program. It is predicted that the number of farming households will decline along with the development of the modern sector and the declining interest of the younger generation to become farmers.

The average harvested area of rice farming households in Aceh Province is nearly 4 hectares with a standard deviation of 2,869.77. However, there are still households cultivating less than 0.5 hectares of land out of a total of 3,353 observed rice farming households. The inequality in harvesting area is clearly can be found in the harvesting area which reaches 60 square meters. Furthermore, in the explanatory variables, to estimate household perceptions, a measurement scale was used where those who answered in the affirmative had odd values and those who answered negatively had even

values, which can be seen in Table 1 in the minimum and maximum values.

Table 1
Descriptive Overview of Research Variables

Variables	Obs.	Mean	Std. Dev.	Min	Max
HRV	3353	3949.64	2869.7	225	60000
PERCV	3353	3.418	.7892	1	5
LOAN	3353	1.490	.4999	1	2
ICOP	3353	3.329	.4700	3	4
CLIMT	3353	7.428	.4949	7	8
LABW	3353	1.577	.4941	1	2
Total		3,35	100.00		

Source: Agricultural Census Data, BPS 2013 (authors' calculation).

Mostly respondents cultivate less than 10,000 square meters of land or 94.3 per cent. Meanwhile, those classified as smallholders cultivate less than 1 square meter of land and only about 1.8 percent cultivate more than 10,000 square meters. This indicates that in terms of land area harvested, farming households have low land productivity.

Table 2
Harvested Area of Rice Farmer Households in Aceh

Harvested Area (m^2)	Frequencies	%
≤ 1000	130	3.88
1,000 – 10,000	316	94.30
10,001 – 20,000	59	1.76
20,001 – 30,000	0	0.00
30,001 – 40,000	0	0.00
40,001 – 50,000	1	0.03
≥ 60,000	1	0.03
Total	3,35	100.00

Source: Agricultural Census Data, BPS 2013 (authors' calculation).

This low productivity will result in harvested dry grain which is then converted to milled dry grain, depending on the yield factor and good drying methods. The grain yield coefficient in Aceh Province of 87.86 percent is high compared to other provinces (BPS, 2018). Therefore, the issue of rice productivity is important to improve in the future. The following table estimates farmer households' perceptions of the various constraints faced that have led to a decline in farmer household productivity.

The results of the probit model estimation results based on the Log Likelihood ratio test of 17.65 with a Chi squared probability value of 0.0014 indicate that the model of rice farmer household perceptions of the probability of a decrease in rice harvest area is statistically significant. Farmers' perceptions of access to capital (LOAN) and the availability of labor and wages (LAB_W) are positive, the more the two variables increase, the more the harvest area produced by the household. In other words, farmers can still device these variables to maintain rice productivity. In

contrast, rice farmers' perceptions of climate and weather conditions (CLIMT) such as dry season or flood season and other factors that cannot be controlled are negative. Likewise, the factor of the ratio of input prices to harvest prices (ICOP) is perceived negatively. Furthermore, uncertainty and price stability factors are also perceived negatively by rice farmers. The price stability policy by the government's Logistics Agency (BULOG) through the determination of the ceiling price and the floor price of paddy or acknowledged as the basic price of government rice purchases (HPP) has not been fully perceived positively by farmers.

Table 3
Estimation Result of Probability of Declining in Rice Harvest Area

Variables	Coefficient	Std. Error	*z* Statistics	P>|z|
LOAN	0.0156	.0504	0.31	0.757
ICOP	-0.0494	.0571	-0.87	0.386
CLIMT	-0.0885	.0447	-1.98	0.048
LAB_W	0.1882	.0520	3.62	0.000
CONS	0.2702	.0463	5.83	0.000
Number of obs. = 3,353				
Wald chi2(4) = 17.65				
Prob > chi2 = 0.0014				
Log likelihood = -237.147				

Source: Agricultural Census Data, BPS 2013 (authors' calculation).

Table 4
Probability of Rice Farmer Households' Perception of Rice Farming Constraints

Variables	Coefficient	Std. Error	*z* Statistics	P>|z|
LOAN	0.2583	0.0709	3.64	0.000
ICOP	-0.1130	0.0792	-1.43	0.154
CLIMT	0.2173	0.0626	3.47	0.001
LAB_W	-0.0512	0.0712	-072	0.472
CONS	-1.4786	0.0659	-22.45	0.000
Number of obs. = 3,353				
Wald chi2(4) = 25.64				
Prob > chi2 = 0.0000				
Log likelihood = -1047.3353				

Source: Agricultural Census Data, BPS 2013 (authors' calculation).

The estimation results of the probit model cannot be directly interpreted and analyzed, assuming a normal distribution, the z probability distribution is used to analyze changes in analyzing the estimation results of the probit model. For this reason, in this analysis, the estimated marginal effects on the mean dy/dx at the means show a positive influence on land area and farmers' perceptions. All factors that are the focus of this study are positively perceived by rice farmers. The probability of increasing the rice harvest area will increase by more than 50 percent.

In most developing countries, farmers are below the poverty line due to lack of infrastructure and high input prices (Fahad et al., 2018). This indicates that the average rice farming household in this study is dominated by cultivating less than 4 hectares of land with a production of only 1.7 tons in 2013. This phenomenon indicates the low productivity of output and labor, which has implications for the low interest of young farmers to become farmers, which will threaten the stability of food security in the future. The condition also occurs globally in the agricultural sector, especially in smallholder households (Szabo et al., 2021; Ren et al., 2023).

Table 5
Probability of Marginal Effect of Rice Harvested Area

Variables	Marginal Effect	Std. Error	*z* Statistics	P>|*z*|
LOAN	0.6045	0.0129	46.77	0.000
ICOP	0.6200	0.0166	37.31	0.000
CLIMT	0.6268	0.0127	49.18	0.000
LAB_W	0.5770	0.0139	46.85	0.000

Source: Agricultural Census Data, BPS 2013 (authors' calculation).

The probability of an expansion of rice harvest area due to the loan factor, the ratio of input prices to output prices and climate change is more than 60 percent. While the perception of farmer households on the availability and wages of farm laborers at 57.7 percent is relatively lower than the previous factor with a probability value of 1 percent (Table 5). The simple argument is that some farm laborers involved in farming activities involve the role and participation of household members. In line with this argument, our previous research indicates that household members' income returns to the household as jointly consumed income. Thus, the cycle of income from cash flow farming activities, particularly individual farming, returns to rice farmer households (Noviar et al., 2020; 2022). Rahim et al., (2022) argue that social conditions, such as the number of family members and their productive age that drive family members' participation in agricultural activities. Another implication of several factor's explaining that capital loans, changes in input and output ratios and climate change on rice farming households is positive any increase in access to loans, improvement in the value of output-input ratios, stability of climate change and farm labor wages will positively affect the probability of increasing the harvest area of rice farming households in Aceh Province.

Table 6
Results of Estimated Marginal Effects of Farmer Household Perceptions

Variables	Marginal Effect	Std. Error	*z* Statistics	P>|z|
LOAN	0.0748	0.0068	10.98	0.000
ICOP	0.1097	0.0115	9.56	0.000
CLIMT	0.0756	0.0070	10.81	0.000
LAB_W	0.0999	0.0075	13.35	0.000

Source: Agricultural Census Data, BPS 2013 (authors' calculation).

Meanwhile, Table 6 shows the relationship between these factors and the probability of changes in the perception of rice farming households. The output-input ratio is the factor that has the most influence on changes in farmer household perceptions. An increase in the value of the ratio, which can be caused by a decrease in the price of rice production inputs or an increase in the price of grain, will increase 10% the probability of a change in the perception of rice farming households in the province. The output-input ratio can be improved through government intervention in the input subsidy mechanism that has been running so far, but it needs control and effectiveness of distribution that is evenly distributed and well-targeted. Meanwhile, from the output factor, government intervention through the government purchase price (HPP) of grain used as government rice reserves later. Thus, the perception of farming households will be more in favor of agriculture, in particular rice farming.

Furthermore, in the aspect of labor, an increase in wages will increase the probability of perception of rice farming households by 9 percent, in line with the previous argument that the participation of household members in rice farming activities is relatively high. Then the perception of farmer households towards climate change, there is only 7 percent change if there is 1 percent change in climate. Weather and climate variation conditions are perceived positively but the changes are relatively small. Some previous studies, for example Naylor et al., ,(2001); Falcon et al., (2004), bad conditions, such as floods and droughts seasons are cyclical conditions that may occur. In contrast to the findings of Arifah et al., (2022) that climate change has a negative impact on the amount of water availability, rice quality, increasing pest attacks, and crop failure. The possibility of why respondents' perceptions are not too great related to climate change can be seen from the productivity and harvest area which is dominated by households farming with a harvest area of 1000 - 10,000 square meters, so respondents are less responsive to this variable.

RESEARCH IMPLICATION

The first policy implication that can be conveyed in the results of this study is to strengthen the output-input ratio of grain prices by increasing the effectiveness of subsidized inputs so as to improve the value of the ratio from the input side. The role of the government in distributing evenly and on target is a step that continues to be monitored and evaluated. Meanwhile, from the output side, increasing the value of the ratio by making the basic price policy effective at the right time is a necessary step to keep the value of this ratio stable or increasing. This role can be played by state-owned enterprises such as the Logistics Agency (BULOG). Thus, the perception of rice farming households will become better and the motivation to grow rice will be more attractive to farmers. Second, the role of financial institutions needs to be strengthened in assisting the capitalization process, especially in conditions of climate change that tend to reduce rice production, especially in Aceh Province. Financial institutions at the rural level need to be improved given easier access and more in favor of the interests of the surrounding rural community, especially farming households. Village economies, which are generally agrarian in nature, will be more dynamic due to the role of financial institutions such as BUMG, which can be involved not only in the production side but also in the distribution or marketing aspects.

Policy implications, especially on BPS census data in 2013, need to be extended data related to the perceptions of farmers or farmer households related to input prices, outputs, and climate

change through the extension of questions on questionnaires circulated in future agricultural censuses. This perception factor is important in an effort to explore the motivation and responsiveness of farmers to changes in factors that are relevant in exploring the needs of farmers to overcome the constraints faced in rice farming.

CONCLUSION AND SUGGESTION

The problems of rice farming households in Aceh Province from this study are significant to the probability of harvested area and perception of rice farmers. The stability of the output-input price ratio is the most influential factor in increasing the size of harvest areas and rice farming households' perception of the problems they face. An increase in the rice output-input price ratio will increase rice harvested area by more than 60 percent, with respondents perceiving this price issue as relatively important to farmers in Aceh compared to other constraints such as the availability of financial institutions, climate change, and labor wages.

Pragmatically, input prices and grain prices are important issues perceived by farming households. Therefore, the necessary policy implications concern the institutionalization of Bulog in addressing the issue of grain price stability with the basic price policy instrument and the highest price. For input supply prices such as rice seeds, fertilizers and pesticides which are the authority of the Ministry of Agriculture are important institutional instruments and are directly related to overcoming the problems faced by rice farmer households. Thus, the stability or improvement of the output-input ratio is a positive perception for rice farmer households as well as can encourage the growth of grain production productivity in this province.

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