7._Artikel_UJAR8-10428682_Okt_2022.pdf

by

Farmers' Interest in Implementing Climate Smart Agriculture (CSA) Supports Increasing Paddy Productivity in Northern Sumatra

Nurliana Harahap[1,*], Elrisa Rahmadani[1], Ameilia Zuliyanti Siregar[1,2], Yusra Muharami Lestari[1], Novitasari Napitupulu[1]

[1]Agricultural Development Polytechnic Medan Jl. Binjai Km 10, Tromol Pos 18, Medan, 20002 Indonesia
[2]Faculty of Agriculture, University of Sumatera Utara, Jln. Prof. A. Sofyan No. 3 Medan, Indonesia

Abstract This study examines farmers' interest in implementing Climate Smart Agriculture (CSA) in Northern Sumatra. Climate change is one of the environmental factors that can have a negative impact on lowland rice productivity due to several abiotic factors such as rainfall, drought, flooding, temperature and solar radiation that affect rice production. The aim of this study is to examine the level of interest of lowland rice farmers in implementing CSA and to examine the factors that influence the interest of lowland rice farmers in implementing CSA in Northern Sumatra. This type of research is descriptive quantitative by testing 5 variables X (education, farming experience, characteristics of innovation, the role of government, and role extension) and Variable Y (farmers interest). Respondents were 44 farmers and the sampling technique was Non Probability Random Sampling. Data were analyzed by Multiple Linear Regression. The result of the analysis is that the influence of variable X simultaneously is 62.3% on variable Y (farmers' interest). The influences of partial variables are X1 (14.7%), X2 (33.5%), X3 (40.6%), X4 (35.5%) and X5 (2.7%). The level of interest of farmers to the application of CSA in increasing rice production in the sub-district is 76.3% or in high category.

Keywords Interests, Farmers, CSA, Productivity, Rice

1. Introduction

In handling food security at The Hague Conference 2010, FAO introduced the concept of Climate Smart Agriculture (CSA). According to [1], approach to transforming and realigning agricultural systems to support food security is adopted in the face of climate change. The CSA focuses land management practices, crop-based modeling, and how agricultural practices can integrate the three pillars (i.e. adaptation, mitigation, and food security) [2].

Abbreviated as CSA, on agriculture, food security and climate change. The concept integrates three dimensions of sustainable development, economy, society and the environment, and jointly addresses food security and climate challenges. This approach aims to develop the technical, policy and investment conditions to achieve sustainable agricultural development for food security [3]. Goal CSA:

a. Increase agricultural productivity and income in a sustainable manner.
b. Adapt and build resilience to climate change.

c. Reduce and/or eliminate greenhouse gas emissions, where possible in agricultural production

Indonesia is in line with population growth which has reached 271,349,889 individuals. This condition will affect food needs, especially rice as the main food for the Indonesian population. Rice is one of the food sources in the world. Indonesia is the third largest rice-producing agricultural country in the world after China and India. Rice harvested area in Indonesia reaches 10,657,274.96 ha, with an average productivity of 5,128 ton/ha and a production of 54,649,202.24 tons. The standard area of rice fields in Indonesia is 7.46 million ha or about 70% of the standard area of rice cultivation in Indonesian [4].

North Sumatra Province is one of the areas that has an agricultural land area of 647,223 ha with an area of 75,500 ha of raw rice fields or about 11.7% of the agricultural standard area in North Sumatra. The productivity of a plant depends on the interactions that occur between environmental and genetic factors [5]. Climate change is one of the environmental factors that can have a negative impact on lowland rice productivity. Climate change causes many abiotic factors such as rainfall, drought, flooding, temperature and solar radiation to greatly affect rice production at various stages of growth. It is estimated that almost 51% of rice cultivation and production will decrease over the next century due to global climate change [6].

Variables income, channels of information recognition knowledge, understanding, attitude and problems in agriculture as well as the staff responsible for promoting the use of agricultural technology which adopted from [7] applied to this research. The aim of this study is to examine the level of interest of lowland rice farmers in implementing CSA and to examine the factors that influence the interest of lowland rice farmers in implementing CSA in Northern Sumatra.

2. Materials and Methods

This research was conducted in Serdang Bedagai Regency, namely in Teluk Mengkudu District where there are 2 villages, namely Pematang Setrak and Sei Buluh villages, next to Ular River considering that this area is an area that has participated in an extension program with training based on CSA. This study uses a quantitative descriptive model, which is a method that explains how to analyze data and describe existing research data. Testing 6 variables consist of 5 independent variables (X) and one variable Y. Variables X1 (education), X2 (Farming experience), X3 (Characteristics of innovation), X4 (Role of Extension) and X5 (Role of local government) and Y are the Farmer's interest. Research data consists of primary data and secondary data. As many as 44 respondents of farmers applied climate-friendly smart agriculture (CSA). Data analysis using Multiple Linear Regression with the following model:

$$Y = \alpha + \beta X1 + \beta X2 + \beta X3 + \beta X4 + \beta X5 + e$$

Information:
Y = Interest of rice farmers
α = Constant
β = Coefficient regression
X1 = Education
X2 = Farming experience
X3 = Characteristics of innovation
X4 = The role of the extension
X5 = Role of local government
e = Error

To see the effect of the independent variable (X) on the dependent variable (Y) analyzed through the F test with the following formula:

$$F_{count} = \frac{R^2/k}{(1-R^2)/n - k - 1}$$

Where:
R^2 = Coefficient of determination
K = Number of variables X
N = Number of samples

Seeing the contribution of each variable X to variable Y is done through the T test with the following formula:

$$t \, count = \frac{bi}{Se\,(bi)}$$

Where:
bi = i-th regression coefficient, with degrees of freedom n -k-1
Se (bi) = root of variance (*bi*)

3. Results and Discussion

a. Analysis of the Interest Level of Farmers in implementing CSA in Teluk Mengkudu District.

The results of the analysis of farmers' interest in the application CSA can be seen in the following figure 1.
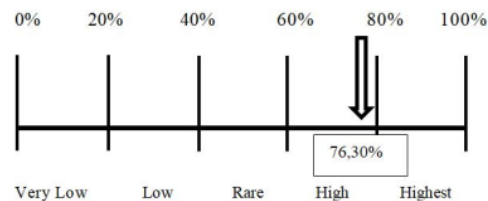

Figure 1. Continum line

Figure 1 shows the value of the farmer's interest score is 859 from a maximum score of 1100, then the percentage is 76.30%. It can be concluded that the level of interest of farmers to the application of CSA in increasing rice production in Teluk Mengkudu District lies in the high category. The reasons are:

1. Farmers are happy or interested in the characteristics of CSA because it fits the situation on the farm.
2. Farmers have an interest in CSA because to implement it, farmers already have the potential for the necessary agricultural inputs.
3. Farmers are starting to focus and pay attention to CSA by actively inviting extension workers and other farmers to practice the use of organic waste through making bokashi fertilizer from cow dung and others.
4. Farmers are directly involved in the implementation of CSA by conducting more structured farming and in accordance with the characteristics of CSA.

b. Analysis of Factors Affecting Farmers' Interest in Implementing CSA

The effect of the tested variables (X and Y) was described in the analysis of results as follows:

3.1. Influence Collectively (Simultaneously)

Based on the results of the analysis, it can be obtained that the R square value of 0.623, then the value of the Coefficient of Determination (CD = R Square x 100%, it can be concluded that the coefficient of determination obtained is 62.3%. This indicates that the variables X (education, experience, farming, the characteristics of innovation, the role of extension workers, and the role of local government) have a simultaneous or joint effect of 62.3% on variable Y (farmers' interest) and 37.7% are influenced by other factors not used in this study.

3.2. Partial Influence

The equation of multiple linear regression based on the results of the analysis can be explained that the values in question are as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$$

$$Y = 0.221 - 0.138 X_1 + 0.307 X_2 + 0.535 X_3 + 0.304 X_4 + 0.052 X_5$$

By the way, seeing the magnitude of the effect of each variable X on Y can be seen based on the results of the analysis of the partial effect (t (t-test). The education variable (X1) has a coefficient value of t-count (-1,080) < t-table (2.02269) with a significant level of $0.287 > 0.050$ it means that the education variable has no significant effect or H_0 is accepted. The regression coefficient value of the education variable is -0.138 and is negative or not in the same direction indicating that the greater the value of education, the lower the influence of education on the interest of lowland rice farmers in implementing CSA in Teluk Mengkudu District. The magnitude of the influence of the X1 variable on the interest of lowland rice farmers in implementing CSA (Y) is 12.8%, it can be seen based on the standardized coefficients beta value is 0.128%.

Table 1. Analysis of Factors Affecting Farmers' Interest in Implementing CSA

			Model Summary b		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.789a	.623	.573	1.348	1,882

a. Predictors: (Constant), x5, x3, x4, x2, x1

b. Dependent Variable: y

Table 2. Analysis of Factors Affecting Farmers' Interest in Implementing *CSA*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.221	3.799		.058	.954
	x1	-.138	.128	-.147	-1,080	.287
1	x2	.307	.118	.335	2,612	.013
	x3	.535	.172	.406	3.110	.004
	x4	.304	.106	.355	2.877	.007
	x5	.052	.195	.027	.268	.790

F-table (5%): 2,46

F-count: 12,554

T-table: 2,02269

Based on the results in the field, the respondent's education level is dominated by junior high school and is less interested in implementing CSA. This is because most of the respondents in gaining knowledge and developing mindsets and developing farming are not only obtained through formal education but through farming experience, training and counseling and sharing knowledge from fellow farmers. This is not in line with the study conducted by [8] which states that education affects farmers' interest in implementing farming innovations and also the opinion of [9] which states that education and communication professionals engage in climate change communications framing discussions on climate change with agricultural producers

Variable Farming experience (X2) has an influence on farmers' interest in developing a farming business. The coefficient value of t-count (2.612) > t-table (2.0226) with a significant level of 0.013 <0.050 means that the variable farming experience has a significant effect or H_0 is rejected. The regression coefficient value of the farming experience variable is 0.325 and is positive or in the same direction which shows the greater the value of farming experience, the greater the influence of farming experience on the interest of lowland rice farmers in implementing CSA in Teluk Mengkudu District. Experience in carrying out farmer's farming will better understand the steps that must be taken in strengthening their farming business [10].

Experience Farming businesses owned by respondents encourage interest in implementing CSA because respondents realize that CSA is an effort to develop farming and provide changes for the better based on the experience of farming activities that have been done previously so as to help farmers to farms that are more structured and environmentally friendly. This is in line with the study by [10] which states that the experience of farming business affects farmers' interest in farming. The more experience of farming carried out by farmers, the greater the interest of farmers to implement existing innovations. The more experience the farmers gain, the higher their interest in lowland rice farming, with the many experiences they have gone through,

Based on the results of the partial effect test analysis (t) the innovation characteristic variable (X3) has a coefficient value of t-count (3,110) > table (2.02269) with a significant level of 0.004 <0.050, meaning that the innovation characteristic variable has a significant effect or H_0 is rejected. Variable regression coefficient value innovation characteristics is 0.535 and is positive or in the same direction, which shows that the greater the value of the innovation characteristics obtained by the respondents, the more the influence of the innovation characteristics on the interest of lowland rice farmers in implementing CSA in Teluk Mengkudu District. The value of standardized coefficients beta Variable of innovation characteristics is 0.406, which means that the variable of innovation characteristics has an influence of 40.6% on the interest of rice farmers in implementing CSA.

The characteristics of CSA innovation which include the benefits of innovation, the level of ease of application, the advantages of technological innovation, whether or not technological innovation can be tested and the suitability of the location have a real influence on the majority of respondents so that it affects the interest in implementing CSA in Teluk Mengkudu District. In addition to the agricultural inputs and processes that characterize CSA, most of the respondents can do farming. This is supported by [11] which states that the characteristics of innovation with indicators of relative advantage, suitability, complexity, can be tried, and the visible results of innovation have a relationship with the sustainability of the application of farming technology.

The results of the analysis of the partial influence test (t-test) of the variable of the role of the extension worker (X4) showed that the coefficient t-count (2.8777) > t-table (2.02269) with a significant level of 0.007 <0.050, it means that the role of the extension agent has a significant effect or H_0 is rejected. The regression coefficient value of the role of the extension agent is 0.304 and is positive or unidirectional, which indicates the greater the role of the extension worker obtained by the respondent, the more influence the role of the extension agent has on the interest of rice farmers in implementing CSA in Teluk Mengkudu District.

The role of the extension agent has a standardized coefficient of beta value of 0.355 which means that the role of the extension agent has an influence of 35.5% on the interest of lowland rice farmers in implementing CSA. This is supported by the statement of [12,13] where farmers are more confident in climate change and more agree with the role of extension services in capacity building. Farmers' beliefs about climate change are significantly influenced by agricultural cooperative membership, access to loans, use of extension services, age, farm size, and soil fertility levels. Access to loans was the only significant factor to explain the differences in farmer concerns.

Government role variable (X5) has no significant effect on the interest of lowland rice farmers in implementing CSA. This is evidenced from coefficient value t-count (0.268) < t-table (2.02269) and significant level with a value of 0.790 > 0.050. According to [14] stated that policies aimed at mainstreaming CSA technology should pay adequate attention to its application in the location under consideration and emphasize the important role of providing information about CSA technology or practices

4. Conclusions

1. The level of interest of lowland rice farmers in implementing CSA in Teluk Mengkudu District is 73.30% which is included in the high category.
2. The factors that influence farmers' interest in implementing CSA in Teluk Mengkudu District, such as: education, farming experience, characteristics of

innovation, the role of extension workers, and the role of local governments given a significant effect on the interest of lowland rice farmers in implementing CSA in Teluk Mengkudu District.

3. The contribution of all variables (farming experience variables (X2); innovation characteristics (X3); and the role of extension workers (X4) and have positive values), exception variable education (X1) and the role of local government (X5).

5. Suggestions

Based on the results of the studies that have been carried out, the interest of lowland rice farmers in implementing CSA can be increased through several things as follows:

1. Increasing the interest of farmers through counseling with material that is a priority consideration in implementing CSA

2. Increased encouragement from farmers who are already interested in implementing CSA to farmers who are not yet interested in implementing it

3. It is hoped that there will be more intensive and systematic assistance to farmers who can implement CSA, both extension workers and fellow farmers.

REFERENCES

[1]   Leslie Lipper, Philip Thornton, Bruce M. Campbell, Tobias Baedeker, Ademola Braimoh, Martin Bwalya, Patrick Caron, Andrea Cattaneo, Dennis Garrity, Kevin Henry, Ryan Hottle, Louise Jackson, Andrew Jarvis, Fred Kossam, Wendy Mann, Nancy McCarthy, Alexandre Meybeck, Henry Neufeldt, Tom Remington, Pham Thi Sen, Reuben Sessa, Reynolds Shula, Austin Tibu and Emmanuel F. Torquebiau. Climate-smart agriculture for food security Perspective, Nature Climate Change. Vol. 4, 1068–1072, DOI: 10.1038/NCLIMATE2437, 2014.

[2]   Alvin Chandra, Karen E. McNamara & Paul Dargusch. Climate-smart agriculture: perspectives and framings, Climate Policy, 526-54, DOI: 10.1080/14693062.2017.131 6968, 2017.

[3]   FAO. Facing The Challenges Of Climate Change And Food Security: The Role Of Research, Extension And Communication For Development. Rome, 2013.

[4]   Data of Ministry of Affairs, Central Bureau of Statistics. 2020. Harvest Area, Production, and Rice Productivity by Province, BPS Jakarta, 2020.

[5]   Cahyaningtyas, A., Azizah, N., & Herlina, N. Evaluation of the Impact of Climate Change on Rice Productivity (*Oryza sativa* L.) in Gresik Regency, Journal of Crop Production Vol. 6, No. 9, 30–37, 2018.

[6]   Hussain, S. Rice Production Under Climate Change: Adaptions And Mitigating Strategies, Doi. 10.1007/978-3-030-49732-3-26, 2020.

[7]   Abdoulaye Djido, Robert B. Zougmor´e, Prosper Houessionon, Mathieu Ou´edraogo, Issa Ou´edraogo, Ndeye Seynabou Diouf. To what extent do weather and climate information services drive the adoption of climate-smart agriculture practices in Ghana?, Climate Risk Management, Vol. 32, P. 1-14, https://doi.org/10.1016/j.cr m.2021.100309, 2021.

[8]   Setiawan, I., Dedy K., & Harniati. Farmers' Interest in the Development of a Sustainable Food House (DSFH) Verticulture System in Cilaku District, Cianjur Regency, West Java Province. Journal of Research Innovation, Vol. 1, No.3, 513-522, 2020.

[9]   Rohling, K., C Wandersee, LM Baker. Communicating climate change: A qualitative study exploring how communicators and educators are approaching climate-change discussions. Journal of Applied Communications, Vol. 100, No. 3, 83p, 2016.

[10] Ginting, N and Dionius S. Analysis of Factors Affecting Farmers Interest in Corn Farming in Mardingding Village. Journal of Plans Vol.13. No. 2, 77-81, 2018.

[11] Wahyuni, S. The Relationship between Innovation Characteristics and Communication Patterns on the Sustainability of the Application of Salibu Rice Technology in Tanah Datar Regency. Journal of Extension And Development. Vol. 1, No. 2, 72-80, 2019.

[12] Alotaibi, and Bader Alhafi. Farmers' Beliefs and Concerns about Climate Change: An Assessment from Southern Saudi Arabia. Agriculture, Vol. 10, No. 7, 1-15, 2020.

[13] Panurat, SM Factors Affecting Farmers Interest in Rice Farming in Sendangan Village, Kakas District, Minahasa Regency. Manado: Faculty of Agriculture, Sam Ratulangi University, 2014.

[14] Abegunde, Victor O., Melusi Sibanda 1, and Ajuruchukwu Obi. Mainstreaming Climate-Smart Agriculture in Small Scale Farming Systems: A Holistic Nonparametric Applicability Assessment in South Africa. Agriculture, Vol. 10, No. 3, 1-18, 2020.

7._Artikel_UJAR8-10428682_Okt_2022.pdf

6	Submitted to Fiji National University Student Paper	1%
7	"Proceeding of the 1st International Conference on Tropical Agriculture", Springer Science and Business Media LLC, 2017 Publication	1%
8	Submitted to University of Peloponnese Student Paper	1%
9	www.ijisrt.com Internet Source	1%
10	www.journalresearchijf.com Internet Source	1%
11	Submitted to Universitas Negeri Jakarta Student Paper	1%
12	irispublishers.com Internet Source	1%
13	www.kth.se Internet Source	1%
14	www.neliti.com Internet Source	1%
15	idr.uin-antasari.ac.id Internet Source	1%
16	Alvin Chandra, Karen E. McNamara, Paul Dargusch. "Climate-smart agriculture:	1%

perspectives and framings", Climate Policy, 2017
Publication

17   Submitted to National University of Singapore   1%
      Student Paper

18   www.egerton.ac.ke   <1%
      Internet Source

19   "Climate Change and Multi-Dimensional Sustainability in African Agriculture", Springer Science and Business Media LLC, 2016   <1%
      Publication

20   Submitted to Universitas Jenderal Soedirman   <1%
      Student Paper

21   Submitted to University of Sheffield   <1%
      Student Paper

22   docplayer.net   <1%
      Internet Source

23   docplayer.info   <1%
      Internet Source

24   pdfs.semanticscholar.org   <1%
      Internet Source

25   hdl.handle.net   <1%
      Internet Source

26   Gessesse Gizachew Asresie, Mulugeta Belayneh Birara, Tadesse Asmare Gebrie.   <1%

"The Effect of Organizational Culture on Organizational Commitment During Covid-19: Evidence From Debre Markos Referral Hospital", Research Square Platform LLC, 2022

Publication

27   cgspace.cgiar.org
     Internet Source   <1 %

28   e-journal.trisakti.ac.id
     Internet Source   <1 %

29   Victor O. Abegunde, Melusi Sibanda,
     Ajuruchukwu Obi. "Mainstreaming Climate-
     Smart Agriculture in Small-Scale Farming
     Systems: A Holistic Nonparametric
     Applicability Assessment in South Africa",
     Agriculture, 2020   <1 %

     Publication

Exclude quotes   Off   Exclude matches   Off
Exclude bibliography   On