COFFEE FARMERS PERCEPTION OF CLIMATE CHANGE AND SOCIOECONOMICS FACTORS AFFECTING THE ADOPTION OF CLIMATE SMART AGRICULTURE (CSA) IN LAMPUNG PROVINCE

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Abstract
This research focused on the effect of perception and socioeconomic factors in adoption of Climate Smart Agriculture (CSA) and coffee productivity. It was conducted in one Community Forest in Indonesia. Results indicate that the farmers perception and land size farming significantly related to CSA adoption. The farmers' perception to CSA, their household income, and land size are significantly correlated with the coffee productivity and number of days invested on coffee farms for CSA practices such as in fertilizing, pruning, and pests and diseases control. Farmers with positive perception have allocated 44.98% more time and therefore gain more productivity of 38.99%.
Keywords: Climate-Smart Agriculture, Coffee, Farmers, Productivity

INTRODUCTION

Climate change is being in Indonesia and affected Indonesian coffee production. Coffee is one of the commodity plantation products important roles in economic activity in Indonesia. Coffee also one of Indonesia's export commodities which is quite important as foreign exchange earner other than oil and gas. This can be seen from its contribution to the Gross Domestic Product (GDP), which is quite large, namely around 13.70 percent in 2020 or is second only to the Manufacturing Industry sector. Coffee production from 2018 to 2020 has experienced fluctuation. In 2018 coffee production was 756.05 thousand tons decreased to 752.51 thousand tons in 2019 or turn by 0.47 percent. In 2020 coffee production increased to 762.38 thousand tons or an increase of 1.31 percent. The total area of state estates coffee in 2018 was recorded at 19.92 thousand hectares, down 27.20 percent to 14.50 thousand hectares in 2019, and in 2020, the state estates coffee area decreased by 4.57 percent to 13.84 thousand hectare (BPS-Indonesian Statistics, 2021). Based on the 2019 Coffee Report Development, Indonesia is in the third position with the largest number of coffee farmers after Ethiopia and Uganda, namely 1.3 million coffee farmers.

Coffee farmers especially in Indonesia are very climate dependent. Indonesia had a rainy season and a dry season cycle and in the past 10 years has changed and caused a lot of economic trouble for farmers. The southern half of Sumatra contributes to more than 60% of Robusta coffee in Indonesia. As a report by IDH (2019) described the effect of climate change for coffee producers in Indonesia includes: higher proportion of rain falling in heavy events, increase in temperature (average) of 1.7°C and number of hot days and nights, moreover there was intermittent rain in the dry season. Yields are expected to decline because of decreasing rainfall instead of heavy rain on southern Sumatra and Java, intermittent rainfall throughout the year (which leading to continuous flowering and fruit setting), and heavy rain and wind (which damaging flowers). Moreover, this heavy and continuous rainfalls interrupt coffee drying process which rely solely on sun drying, this requires farmers to adjust and cost higher investments (e.g., storage capacity, drying equipment, etc.) for their coffee production.

Coffee farming in Indonesia is highly dependent on weather conditions especially rainfalls. Climate change may result on high variability of productivity from annually, which can cause the reduction of coffee farming' economic viability. Climate Smart Agriculture (CSA) is an innovation which integrates climate change into the agricultural systems systematically, and unlike conventional agricultural development, CSA promotes better management of farms, ecosystem, and landscape for farmers to be able to conserve ecosystem services that are key to increase sustainability and resource efficiency and resilience of their farms. With the knowledge and skills of CSA implementation, farmers will benefit from increased productivity and increased additional source of income from other agricultural and forestry commodities, thus will increase farmers' welfare and livelihoods, and secure both ecosystems and livelihoods to future climate shocks. Therefore, the purpose of this study was to determine the effect of the application of CSA on coffee production, and coffee farmers' perceptions of

the application of CSA in the coffee farming. In addition, this study was also to determine the effect of the application of CSA on the time spent in coffee farming.

METHODS

This research was conducted in the Community Forestry of the Batu Tegi Forest Management Unit (FMU) in Tanggamus District, Lampung Province, Indonesia. Multistage sampling procedure used to select one hundred (100) coffee farmers for this research. The selection criteria include farmers who have coffee as their main crops, and farmers who have completed questions on climate perception and number of days working on farms. Data were collected with interview techniques and field observations with a questionnaire from September 1 to November 30, 2020. In this research, respondents' perceptions on CSA are measured using Multiple-Choice question. Coffee farmers' perceptions are categorized into three categories: weak, medium, and strong related to how many indicators of coffee farmers' perceptions of CSA are selected through the survey. Data analyzed using Statistical Parametric Partial Correlation.

RESULTS AND DISCUSSION

Characteristics of Respondents

The general condition of the respondent is a description of the character and values that develop from an individual that can distinguish him/her from other individuals. The general condition of the respondents in this study consisted of age, education level, number of family members, and household income.

Age of Respondent

Age is a factor that can affect work productivity and is closely related to the ability of workers to manage their farms. In general, workers with older age have limited energy in carrying out gardening activities, when compared to workers with young ages. In addition, young farmers are generally more responsive to new innovations (Triana, 2018). Based on the results of the research it appears that the average age of the respondents is 44 years. Thus, most of the age of the coffee farmers respondents is still classified as productive age and can carry out activities in coffee cultivation well.

Education of Respondent

The level of education will affect the mindset and ability of farmers to receive information, knowledge, innovations, and new technologies that are useful for developing plantation farming. According to Sukmayanto, et al. (2022), formal education will accelerate the learning process, skills and there are skills needed by society. Education affects whether farmers easily accept innovation and technological change. The distribution of coffee farmers based on the latest education level can be seen in Table 1.

Table 1. Distribution of Coffee Farmers' Education

Level of education	Number (farmers)	Percentage
Elementary School	46	46.00
Middle School	36	36.00
High School	18	18.00
Total	100	100.00

Based on Table 1. the number of respondents from Elementary School is 46 farmers with a percentage of 46.00 percent. Farmers with elementary education level are usually closed or difficult to accept new innovations. This will affect the mindset of farmers in accepting something new. The level of education of coffee farmers will affect the level of absorption of farmers to new knowledge and innovations so that they can produce quality products.

Number of Family Dependents

The number of family dependents is the number of family members who are depending on their life to family leader and are still under one roof. The results showed that the number of dependents of coffee farming families was in the range of 1 to 6 people. Based on the research it appears that the number of dependents of the coffee farmer household is quite small, namely between 3-4 people (79.00 percent). The number of dependents of farmers household can be seen in Table 2.

Table 2. Distribution of Coffee Farmers Based on Number of Family Dependents

Family dependents (person)	Percentage
1 – 2	7.00
3 – 4	79.00
5 - 6	14.00
Total	100.00

Table 2 shows that the number of family dependents owned by coffee farmers is three to four family members. Most coffee farmers have three to four dependents with a percentage of 79.00 percent. The number of dependents affects the size of the farmers' household expenses incurred. The greater the number of dependents in the family, the greater the burden borne by the head of the family, in addition to farming activities. The amount of labor used can be affected by the number of family dependents. The large number of workers in the family can reduce the use of labor outside the family and therefore reducing the cost of coffee farming in terms of use of labor.

Household Income

Farmer household income is the sum of all income received in both agricultural and non-agricultural sectors (IDR). Income is the difference between total revenue (IDR) and total cost (IDR) in a farm. The income earned by coffee farmers does not only come from coffee farming but can come from several other side jobs, such as farm laborers, construction workers, trading, and other jobs. According to Triana (2018), the high level of household income of farmers affects the perceptions of farmers in accepting new innovations. Farmers households that have low income are generally reluctant to accept new innovations. The distribution of coffee farmers based on household income can be seen in Table 3.

Table 3. Distribution of Coffee Farmers Based on Household Income/year.

Household Income (IDR)	Percentage
1,900,000.00 - 18,650,000.00	30.00
19,000,000.00 – 50,000,000.00	55.00
51,200,000.00 - 273,500,000.00	15.00
Total	100.00
Average (IDR)	34,394,140.00

Table 3 shows that almost all (85%) of the household incomes owned by coffee farmers ranged from IDR 1,900,000 to IDR 50,000,000. The highest household income is IDR 273,500,000. The average household income of coffee farmers is IDR 34,394,140.00. The income of the coffee farmers is being used by the household for daily needs.

Perception of Coffee Farmers on CSA

Acceptance of a new agricultural innovation is influenced by many factors. According to Nwaobiala et al. (2022), farmer perceptions are related to the adoption of innovations by farmers. Mohan, et al. (2021) states that a person's perception will influence the decision in making a choice. CSA as an innovation is also a reference in the application of cropping patterns due to global climate change to increase productivity, crop production, and income of coffee farmers income. In the research, farmers were asked on what contribute to good production, and whether CSA such us pruning, pest and disease controls helps and effective on coffee productivity. Farmers responses then categorized to 3 classes as can be seen in Table 4.

Table 4. Coffee Farmer's Perception of CSA

Farmer's Perception	Percentage
CSA is not effective	53.28
CSA is somehow effective	36.89
CSA is effective	9.84
Total	100.00

Table 4 shows that 53.28 % coffee farmers perceived that CSA is not effective. This might be caused by farmers do not understand or they simply have not practiced CSA yet on their farms. These

farmers still think that the fluctuations in productivity and coffee income are caused solely by climate; rainy season and dry season which regulated coffee production from flowering to harvesting. As shown in the table, only 9.84 % farmers demonstrate good perception on CSA.

Use of Labour

The use of labour is to carry out several coffee farming activities which include land processing, planting, fertilizing, weeding, and harvesting. The use of labour consists of family labour and hired workers, both men and women. Workers in an ordinary family come from all family members who live under the same roof with the farmer, either his wife, children, or other relatives. The use of labour outside the family is carried out by farm workers located around the farmers' residences. The distribution of coffee farmers based on working days can be seen in Table.

Table 5. Farmers and The Use of Labour

Use of labour (days/year)	Percentage
8.00 - 39.67	73.77
39.68 - 71.35	20.49
71.36 - 103.00	5.74
Total	100.00

In this research, we considered days spent both by farmers/family labour and hired workers for all coffee farming activities except for harvesting onwards. Table 5 shows that 73.77 % of farmers use labour between 8.00 – 39.67 days per year. The average use of labour is 31.70 days per year. Labor simultaneously has a significant effect on coffee production. The analysis of coffee farmers and their coffee productivity can be seen in the next section.

Coffee Productivity

Coffee productivity can be seen from the comparison of the amount of production obtained with the average area of land cultivated. Productivity shows the ability of coffee farming production obtained in one area of land, coffee revenue is calculated based on the amount of production obtained by farmers and the current selling price of coffee. According to Assamha et al. (2017), climate change will be decreasing the productivity of Arabica and Robusta coffee plants. Coffee productivity is estimated reduce at around 20% for arabica and 40% for Robusta. Syakir et al. (2017) mentions the impact of change the climate also threatens to achieve the production increase target. Results of this research shows that distribution of coffee farmers based on coffee productivity in Tanggamus District, Lampung Province, Indonesia can be seen in Table 6.

Table 6. Coffee Farms' Productivity

Coffee productivity (kg/ha)	Percentage
200 – 800	70.49
800 – 1,400	25.41
1,400 – 2,000	4.10
Total	100.00

Table 6 shows that 70.49 % of farmers have coffee productivity ranges from 200 to 800 kg/ha. The average productivity of coffee produced in the research area is 687 kg/ha, whereas according to the BPS-Statistics Lampung Province (2022), Lampung coffee production and productivity in 2021 is 118,043.00 tons and 0.75 tons/ha. Therefore, coffee productivity in the study area is relatively low.

Correlation of socioeconomics factors to adoption of CSA and Coffee Productivity

To determine the relationship between the application of CSA innovation in coffee cultivation to coffee production and use of labor and farmers' perceptions of CSA innovation, Partial Correlation statistical analysis was used. According to Muriithi et al. (2021), education level significantly influenced adoption of the adaptation strategies but information sources such as mobile phones, and neighbors/friends are negatively affected to adaptation strategies. Based on the data analysis it appears that the level of production, time spent, and farming revenue obtained is different between farmers who perceive CSA as effective and therefore applying CSA and those who perceive CSA as ineffective and are not applying it on their farm. The productivity of coffee farming who apply CSA is 0.884 tons/ha, while not apply CSA are 0.636 tons/ha. When viewed from the time spent in coffee

farming the application of CSA it is 66.04 workday/ha, while not apply CSA are 44.93 workday/ha. Thus, the application of CSA in coffee farming causes an increase in time spent on farming activities and increase coffee productivity. Based on the analysis that has been carried out from the farming revenue of coffee farming that applies CSA is IDR 16,942,095.80/ha, while not apply CSA are IDR 11,894,865.07/ha. Thus, the application of CSA in coffee farming can increase farming productivity and farming revenue of coffee farmers. The time spent, productivity, and farming revenue by coffee farmers who apply CSA and not apply CSA can be seen in Table 7.

Table 7. The Time Spent, Productivity, and Farming Revenue by Coffee Farmers.

Variable	Apply CSA	Not Apply CSA
Use of labour (workday)	66.04	44.93
Productivity (ton/ha)	0.884	0.636
Farm Revenue (IDR/ha)	16,942,095	11,894,865

Based on the results of Partial Correlation Analysis between of farmers' perceptions, land size, farmers' education, farmer age, household size, household income, adoptions of CSA, and coffee productivity can be seen in Table 8.

Table 8. Effect of Socioeconomics factors to Adoption of Climate Smart Agriculture (CSA) and Coffee Productivity

Variable	Control Variable	Variable	Significance (α = 0,05)	Variable	Significance (α = 0,05)
Perception (X1)	X2, X3, X4, X5, X6	Adoption of CSA	**0,05***	Productivity of coffee	0,33
Land size (X2)	X1, X3, X4, X5, X6		**0,000****		**0,04***
Education (X3)	X1, X2, X4, X5, X6		0,20		0,32
Household income (X4)	X1, X2, X3, X5, X6		0,08		**0,00****
Household Size (X5)	X1, X2, X3, X4, X6		0,73		0,13
Age (X6)	X1, X2, X3, X4, X5		0,16		0,89

Table 8. show that the farmers' perceptions of the CSA innovation and land size farmer is related to adoption of CSA, while the variables related to coffee productivity are land size and household income. In fact, based on the results of the statistical analysis it appears that farmers' perceptions of CSA innovation and land size farmers greatly influence the application of CSA by farmers. Climate Smart Agriculture (CSA) innovation is a reference in implementing cropping patterns due to global climate change to increase productivity, crop production, and coffee farmers' revenue. The current uncertain climate change causes disruption of the coffee farming system that is carried out, so that it can have an impact on the productivity of the coffee plant produced. CSA is a reference in implementing coffee farming patterns that are adapted to the influence of the current climate or weather.

The results of the analysis show that there is CSA innovation have influenced coffee cultivation practices such as fertilizing, pruning coffee branches, and controlling pests and diseases. In addition, it will indirectly encourage an increase in the number of workdays. Farmers who perceive that CSA innovation contributes to coffee productivity have allocated 44.98 % more time on their farms and

have 38.99% higher coffee farming productivity. Therefore, the adoption of CSA innovations can increase farmers income and can adapt to climate change that has occurred recently.

The high perception of CSA can provide an illustration that the application of CSA as a reference in applying cropping patterns due to global climate change to increase coffee productivity. Coffee productivity produced by coffee farmers is also influenced using labour (days). Based on study by Kamanda, et al. (2022) found that the adoption of production innovation technologies was significantly influenced socioeconomic factors of smallholder farmers. On the other hand, Akinbile et al. (2018) recommends the need to educate farmers in dealing with losses due to climate change.

CONCLUSION

Farmers who perceive that CSA innovation contributes to coffee productivity have allocated 44.98 % more time on their farms and have 38.99% higher coffee farming productivity. Therefore, the adoption of CSA innovations first needs perception alterations and after its application it can increase farmers income and their adaptation capacity to climate change.

SUGGESTION

More in-depth further research is needed on farmers' sustainability in adapting to climate change.

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