

WHICH FARMERS FERMENT THEIR COCOA BEANS IN INDONESIA?

Amzul Rifin

Department of Agribusiness, Faculty of Economics and Management,
IPB University, Darmaga, Indonesia
Corresponding author: amzul@apps.ipb.ac.id

(Received: September 17, 2019; Accepted: May 19, 2020)

ABSTRACT

Cocoa farmers are still facing low income caused by the low quality of cocoa beans produced. One way to increase quality and income is through cocoa beans fermentation. In order to increase bean quality, the Indonesian government issued a regulation all the cocoa beans sold by farmers should be fermented in May 2016. On the other hand, farmers are still reluctant to ferment their beans for various reasons. This study sought to analyze the determinants for farmer decision to ferment their cocoa beans. The study was conducted in three sites in three provinces which are the central production of cocoa beans in Indonesia, i.e. West Sumatra, Bali and West Sulawesi. The field survey was conducted on January 2016 and ninety farmers were selected from each of the provinces. Logit regression is utilized since the dependent variable is in binary, which is whether the farmers fermented or not their cocoa beans. The independent variables consist of farmer's and farm characteristics variables. The results in the three sites indicated that age has negative effect meanwhile farmers which has attended the fermentation training and cocoa beans production has positive effect in conducting fermentation on their cocoa beans. Intensified fermentation training is needed to make farmers ferment their beans while support is required to procure the fermentation apparatus that will increase cocoa productivity, leading to increased production.

Key words: fermentation, logit, West Sumatra, West Sulawesi, Bali

INTRODUCTION

Indonesia was the third largest producer of cocoa beans in the world with estimated production of 325,000 tons in 2015/2016 but in the 2018/2019 it is forecasted Indonesia will only produce 220,000 tons and drop to sixth place which contributes to 4.58 percent to the world's cocoa beans production (ICCO 2019). The largest producer in 2018/2019 is Ivory Coast which is forecasted to produce with 2.15 million tons of cocoa beans (Fig. 1). In terms of growth during the period of 2005/2006 until 2018/2019, Indonesia's production suffered a decrease by an average of 6.6 percent; the largest average increase during the period is Ecuador with an average increase of 8.1 percent followed by Ivory Coast and Ghana with the average increase of 4.1 percent and 3.3 percent, respectively. In 2017, 97.8 percent of the cocoa area belonged to farmers and the rest belonged to private and government companies (Statistics Indonesia, 2018). The cocoa beans from farmers will end up into exporter, which eventually will be exported, or enter the processing companies which become intermediate products such as cocoa paste, butter or powder. In addition, almost 80 percent of cocoa beans produced by farmers are in the form of unfermented beans; therefore, the quality and the price received by farmers are relatively low (Mochtar and Darma 2011). Meanwhile according to the survey conducted by Statistics Indonesia in 2014, 59 percent of farmers did not ferment the cocoa beans (Statistics Indonesia 2014).

Which farmers fermented their cocoa beans.....

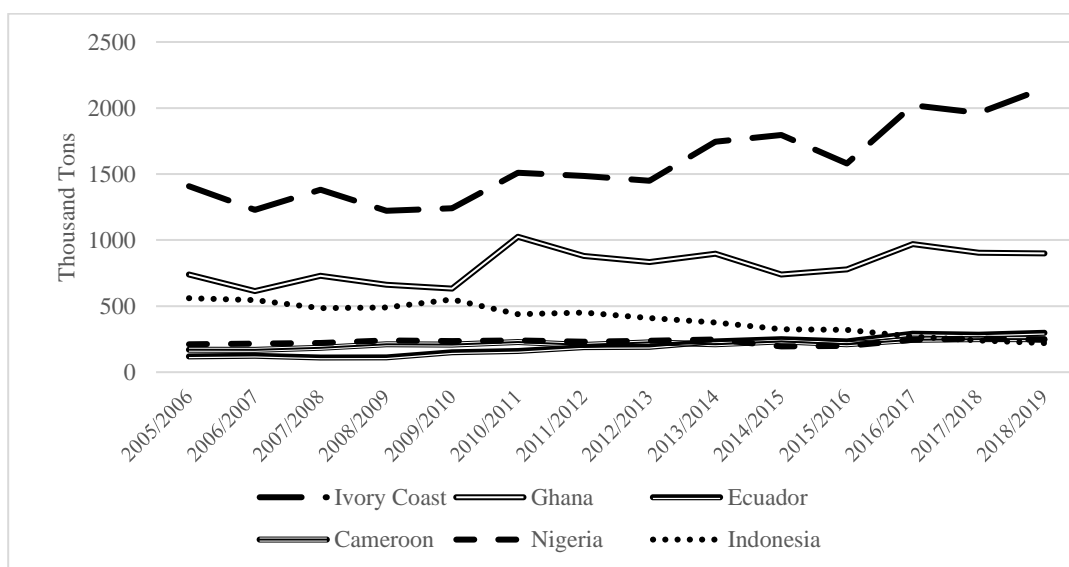


Fig. 1. Production of largest cocoa beans producer, 2005-2019
Source ICCO, 2019

The low quality of cocoa beans produced can be caused by the production activity and farmers' reluctant to fermented their cocoa beans. By fermenting the cocoa beans, farmer can demand higher price depend on the location and buyers. Most farmers operated inefficiently which are caused by the use of low quality seeds, organic fertilizers, frequency of extension and training of farm managers, access to bank credit and the market, the participation of women, and the farm manager's gender (Effendy et al. 2019). Only 41 percent of farmers in Indonesia fermented cocoa beans in 2013 (Statistics Indonesia 2014). In order to increase the quality of cocoa beans produced by farmers, the government issued a regulation in 2014 which stated that all the cocoa beans sold by farmers should be fermented in May 2016; however, the implementation was postponed. The policy sought to increase the quality of the cocoa beans produced in order to support the downstream industry along with the export tax policy (Permani 2013; Rifin 2015). On the other hand, farmers were still reluctant in fermenting their beans for various reasons. This study sought to analyze the determinants of farmers in fermenting their cocoa beans in order to increase the cocoa beans' quality and eventually increase farmer income.

Many scholars have tried to explain the reason why farmers are reluctant to have their beans fermented. The approach applied in this study can be classified into two approaches: the first one used a qualitative approach which was mainly in the form of observation in the field. In this approach, many scholars blamed the low price difference between fermented and unfermented cocoa beans (Wally 2001; Supriatna 2004; Iek 2009; Napitupulu 2009, Hasbi et al. 2010; Nuryanti 2010; Mulato 2010; Arsyad et al. 2013; Fahmid 2013; Raharto 2016), low production (Supriatna 2004; Nuryanti 2010; Hasbi et al. 2010; Syadullah 2012), difficulty in fermentation (Mulato 2010; Rinaldi 2013) and longer time needed (Napitupulu 2009; Hasbi et al. 2010; Mulato 2010; Sefriadi et al. 2011).

The second approach used a quantitative method which was mainly the logistic regression. With this method, the variable can be tested statistically (Hariyati 2008); Nurjanah 2014 and Soemarno et al. 2015. Hariyati (2008) analyzed the factor determining farmers decision to ferment their cocoa beans in Jembrana Regency, Bali. Price has a positive effect on farmer's decision to ferment their cocoa beans, meanwhile, experience and joining the fermentation training has a negative effect. Using the same method, Nurjanah (2014) analyzed the determinants for farmers in Mamuju Regency, West

Sulawesi. The result indicated that price difference and access to fermentation technology has a positive effect on farmer's conducting fermentation. The same analysis in Jembrana Regency determined that the number of traders, the solidity of farmers and skill result in positive effect; meanwhile, an inappropriate sales price of cocoa beans has a negative effect on the decision of farmers to ferment their beans (Soemarno et al. 2015). Meanwhile, it was determined, using Structural Equation Model (SEM), that according to farmers, proper fermentation technology would be adopted if farmers perceived that proper fermentation technology will result in higher price (Sefriadi et al. 2013). On the other hand, this study also revealed that better fermentation technology did not guarantee higher price.

This article will provide additional information concerning the limited literature on this topic. Moreover, the study was conducted using the same method but in three locations, namely West Sumatra, Bali and West Sulawesi. In addition, other articles discussing the choice of fermentation always assume farmers choose to ferment their cocoa beans for one harvest period only. This study collected data on the last three harvesting periods of each farmer of which the data showed that farmers can ferment their cocoa beans in one harvesting period, yet they do not do fermentation in other periods.

CONCEPTUAL FRAMEWORK

This study focused on modelling the farmer's decision to ferment their cocoa beans, specifically on the determinants of farmers' decision to ferment their cocoa beans. This decision is assumed to be led by farmer's willingness to maximize their profit and based on several factors (Doll and Orazem 1984).

Following the approach of Arinloye et al. (2014) in marketing channel selection, it is assumed that a farmer's decision to ferment their cocoa beans derives from the maximization of expected utility or profit the farmer expects to gain from fermenting their cocoa beans. This utility is a function of a vector of factors (X_f^F), unknown parameters β_f , and an error term ε , assumed to be independently $N(0, \sigma^2)$ (Equation 1). It is expected that farmers will decide whether to conduct fermentation or not that shows the most positive utility. The expected difference in utility is expected is as follows:

$$U_j = [\pi_{ij}^F - \pi_{ij}^N] = X_f^F \beta_f + \varepsilon^F \quad [1]$$

where U_j is the unobserved expectation operator representing the expected utility difference, π_{ij}^F is the utility derived from choosing to ferment their beans i if selected by farmers and π_{ij}^N is the utility if farmers do not ferment their cocoa beans. Farmers make a subjective comparison between fermenting their cocoa beans and not fermenting their cocoa beans. Farmers choose to ferment only when it is assumed to receive higher profit than not fermenting. From Equation 1, it can be inferred that the decision to ferment as follows:

$$Y_{ij}^F = \begin{cases} 1 \text{ if } [\pi_i^F - \pi_i^N] \geq 0 \Leftrightarrow X_f^F \beta_f \geq -\varepsilon^F \\ 0 \text{ if } [\pi_i^F - \pi_i^N] < 0 \Leftrightarrow X_f^F \beta_f < -\varepsilon^F \end{cases} \quad [2]$$

The decision to ferment i by farmer j is defined as Y_{ij}^F . The choice of farmer to ferment j to ferment i ($Y_{ij}^F = 1$) or not fermenting ($Y_{ij}^F = 0$) is expressed as follows:

$$Y_{ij}^F = \begin{cases} 1 \text{ if } Y_{ij}^F = \alpha_{ij} X_{ij}^F + \varepsilon^F \geq 0 \Leftrightarrow X_f^F \alpha_{ij} \geq -\varepsilon^F \\ 0 \text{ if } Y_{ij}^F = \alpha_{ij} X_{ij}^F + \varepsilon^F < 0 \Leftrightarrow X_f^F \alpha_{ij} < -\varepsilon^F \end{cases} \quad [3]$$

where α_{ij} is a vector of estimators and ε^F is a vector of error terms under the assumption of normal distribution, Y_{ij}^F is the dependent variable and X_{ij}^F is the is the combined effect of the independent variables.

MATERIALS AND METHODS

This research was conducted in three provinces, namely West Sumatra, Bali and West Sulawesi, which are the central production areas of cocoa beans in Indonesia. The three locations were chosen since these locations have different sponsors in developing the cocoa farming. West Sumatra's cocoa sector was mostly supported by the government, Bali by NGO and West Sulawesi by NGO and also by cocoa industry (Boer et al. 2019). In each province, 90 farmers were questioned, hence there were 270 farmers in total. The farmers were chosen purposively since there was no sampling frame found. Interviews were conducted in January 2016.

In order to identify the factors affecting farmers to ferment their cocoa beans, logistic regression is calculated with the dependent variable in the form of binary (cocoa beans are fermented or not). The logistic regression is as follows:

$$L_i = \alpha_0 + \alpha_1 AGE_i + \alpha_2 EDU_i + \alpha_3 EXP_i + \alpha_4 OCC_i + \alpha_5 TRE_i + \alpha_6 FTRA_i + \alpha_7 GRO_i + \alpha_8 PROD_i + \alpha_9 DPRICE_i + \varepsilon_i$$

where:

L_i	= production form (0 = non fermented; 1=fermented)
AGE	= farmer's age (years)
EDU	= farmer's education (years)
EXP	= farming experience (years)
OCC	= main occupation (0 = farming is not the main occupation; 1= farming is the main occupation)
TRE	= number of cocoa trees (trees)
FTRA	= fermentation training (1 = yes; 0 = no)
GRO	= length of time farmer joins as farmer's group member (years)
PROD	= cocoa beans production (kg)
DPRICE	= price difference between fermented and non-fermented beans (Rp/kg)

RESULTS AND DISCUSSION

In the questionnaire, farmers were asked information during the last three harvest periods. Farmers considered fermenting their cocoa beans at least in one of the harvesting periods (Table 1).

Table 1. Data summary

No. of Fermentation	West Sumatra		Bali		West Sulawesi	
	Farmers	%	Farmers	%	Farmers	%
0	80	89	69	77	66	73
1	3	3	3	3	8	9
2	1	1	2	2	9	10
3	6	7	16	18	7	8
Total	90	100	90	100	90	100

The survey indicated that the highest number of farmers who fermented their beans were from West Sulawesi, while the lowest was in West Sumatra. The buyer of the fermented beans in West Sulawesi was a big processing company with its own buying station in the region. Moreover, several NGOs bought the fermented beans in Bali. Meanwhile, in West Sumatra, especially in Payakumbuh and Lima Puluh Kota Regency, the main buyer of fermented beans was a small processing company which produced chocolate product but in a limited capacity. The price difference variable was calculated by differencing the price of fermented beans with the unfermented beans on the same period in absolute terms.

Farmers who fermented their beans in West Sumatra were older, had higher education level, longer farming experience, more number of trees, higher production and also had experienced greater price difference than those who did not ferment (Table 2). The same pattern was found in Bali, yet it was only in Bali where farmers fermenting their cocoa beans experienced a slightly lower price difference. Meanwhile, in West Sulawesi, the same pattern obtained was only the difference in education and price difference.

Table 2. Average variable description

Variables	West Sumatra		Bali		West Sulawesi	
	Ferm.	No Ferm.	Ferm.	No Ferm.	Ferm.	No Ferm.
Age (years)	53.00	51.67	53.29	50.52	42.50	39.71
Education (years)	13.40	10.61	9.48	8.94	7.25	7.55
Experience (years)	9.00	8.96	19.86	18.99	15.71	14.17
No. of trees	741.90	383.10	815.95	473.28	1073.58	730.83
Production (kg)	32.13	15.75	159.44	48.98	117.34	61.00
Price difference (Rp/kg)	858.70	857.99	7770.02	7792.59	2554.89	2998.05

Furthermore, by comparing the three regions, farmers in West Sulawesi were the youngest but had higher experience compared with farmers in West Sumatra. Cocoa in West Sumatra was a relatively new commodity compared with the other two areas. Farmers in West Sulawesi had the highest number of trees and production compared with the other two areas. Meanwhile, in terms of the price difference between fermented and nonfermented beans, Bali achieved the highest difference compared with the two areas, showing that fermented beans were valued at a very high price in Bali, reaching more than Rp 7000 per kg, yet it was only around Rp 800 per kg in West Sumatra.

The correlation matrix for the independent variables can be seen in Table 3 until Table 5. The correlation matrix showed that most of the independent variables have low correlation except for production and number of trees in Bali, therefore in Bali only production is included in the model. The high correlation between number of trees and production in Bali indicated that cocoa farming was relatively homogeneous meanwhile in West Sumatra and West Sulawesi the correlation was relatively low indicating that the cocoa farming in those area was more heterogeneous in terms of distance between trees, production, productivity and others.

Table 3. Correlation matrix among independent variables in West Sumatra.

Variables	Age	Educ	Exp	Occ	Trees	Train	Group	Prod
Age	1.00							
Education	-0.11	1.00						
Experience	-0.00	-0.22	1.00					
Occupation	0.05	-0.30	0.15	1.00				
No. of trees	-0.05	0.26	-0.04	-0.12	1.00			
Training	-0.02	0.21	-0.07	-0.21	0.12	1.00		
Group membership	0.08	-0.30	0.23	0.07	-0.12	0.04	1.00	
Production	0.21	0.09	0.02	-0.18	0.44	-0.00	-0.17	1.00
Price difference	-0.03	0.01	-0.10	-0.11	-0.26	0.05	0.16	-0.23

Table 4. Correlation matrix among independent variables in Bali.

Variables	Age	Educ	Exp	Occ	Trees	Train	Group	Prod
Age	1.00							
Education	-0.40	1.00						
Experience	0.52	-0.18	1.00					
Occupation	-0.05	0.04	-0.02	1.00				
No. of trees	-0.06	0.07	-0.02	0.04	1.00			
Training	0.11	0.07	0.10	0.36	0.32	1.00		
Group membership	0.40	-0.13	0.71	-0.25	-0.04	-0.03	1.00	
Production	-0.01	0.01	-0.07	-0.05	0.90	0.23	-0.03	1.00
Price difference	0.00	-0.06	0.24	0.00	0.22	-0.12	-0.14	0.29

Table 5. Correlation matrix among independent variables in West Sulawesi.

Variables	Age	Educ	Exp	Occ	Trees	Train	Group	Prod
Age	1.00							
Education	-0.19	1.00						
Experience	0.52	-0.21	1.00					
Occupation	0.20	-0.27	0.21	1.00				
No. of trees	0.13	-0.04	-0.02	-0.02	1.00			
Training	-0.13	-0.05	0.21	-0.17	0.22	1.00		
Group membership	0.25	0.04	0.38	0.02	-0.00	0.14	1.00	
Production	0.15	0.02	-0.04	-0.03	0.36	0.06	0.04	1.00
Price difference	0.14	-0.15	0.01	0.03	-0.05	-0.04	0.11	-0.21

Each area had different factors affecting farmers' decision to ferment their cocoa beans (Table 6) which has been checked for multicollinearity. In West Sumatra, four variables are significant, namely age, dummy training, group member, and production. Younger farmers have a higher probability to ferment their beans since younger farmers are more capable conducting the fermentation process. The fermentation process needs more time and effort therefore younger farmer with more energy has higher possibility to conduct fermentation. Dummy training is significant and the coefficient is found to be the highest compared to the other variables. Farmer with experience in training has 121.5 ($e^{4.8}$) times of probability to ferment their beans as one of the lessons learned in the training is the procedure of bean fermentation. Farmer's training has the highest impact on the decision of fermentation in West Sumatra since cocoa is relatively new in the region; therefore, knowledge on fermentation process in West Sumatra will be beneficial. Meanwhile, the duration of membership had a negative effect on cocoa beans fermentation, indicating relatively new or younger farmers have higher probability to conduct cocoa bean fermentation since they are more open to innovation and have more energy compared to farmers who have been group members longer. Finally, farmers with higher production had the probability of fermenting their beans. A box with a 40 kg capacity of wet beans is required in fermenting the cocoa beans, hence, farmers who produced less will probably not ferment their beans because of the under capacity of the fermenting box. This is supported by the findings of Supriatna (2004), Nuryanti (2010), Hasbi et al. (2010) and Syadullah (2012).

In Bali, farmers' training on fermentation is a significant variable. Farmers who participated in fermentation training have 4.38 times of fermenting probability compared with farmers without any experience in fermentation training and is similar to the case study in Bali where farmers' training was a variable that made the farmers ferment cocoa beans (Hariyati 2008). Meanwhile other farmer characteristic did not have any effect on fermentation activities. Cocoa farmers in Bali based their decision to ferment on the technical aspect rather than the economic aspect such as price difference.

In West Sulawesi, there are also three significant variables, namely education, main occupation and production. Education has a negative effect on the decision to ferment cocoa beans, farmers with lower education have a higher probability to ferment their cocoa beans. Meanwhile, main occupation

has a different effect compared with results obtained in Bali. In West Sulawesi, farmers with other occupation have higher probability to ferment their cocoa beans since they are usually hired paid labor asked to manage the farmer’s land and therefore have more time in fermenting the cocoa beans. The other significant variable is production, where farmers with higher production have higher probability in fermenting their cocoa beans.

The variable of price difference is not significant in the three regions. This result is different from the result obtained by Haryati (2008) in Bali and Nurjanah (2014) in West Sulawesi. The difference with the previous studies is in the calculation of price difference. In the previous studies, the price difference was relatively similar for all respondents, yet in this article it is different among respondents. The price of cocoa beans, fermented or non-fermented, fluctuated therefore the price difference calculation was based on which months that the farmer harvested their beans. The price difference was calculated by the difference on specific month by subtracting the price received by farmers, fermented or not fermented, with the average price of fermented beans or nonfermented beans. In addition, in this study the last three harvest periods were observed and not all farmers conducted fermentation in all three harvest period or vice versa.

The results indicate that every region has different characteristics. In West Sumatra, fermentation training is important in making farmers decide to ferment beans since the commodity is relatively new compared with the other areas. In Bali, farmer’s experience in fermentation training is an important variable; therefore, conducting these trainings will make farmers decide to conduct fermentation. Moreover, in two areas, West Sumatra and West Sulawesi, farmers with higher production are more likely to ferment their beans.

Table 6. Factors affecting farmer’s decision to ferment cocoa beans

Variables	Odds Ratio					
	West Sumatra		Bali		West Sulawesi	
	Coefficient	Prob	Coefficient	Prob	Coefficient	Prob
Age	0.941 **	0.030	0.977	0.259	0.990	0.735
Education	1.086	0.283	0.900	0.214	0.906 *	0.073
Experience	1.055	0.465	0.980	0.655	1.039	0.391
Dummy main Occupation	0.965	0.962	2.687	0.128	0.225 **	0.012
No. of trees	1.001	0.360			1.000	0.625
Dummy training	4.840 **	0.028	4.384 **	0.025	1.809	0.326
Group membership	0.665 **	0.033	1.012	0.793	0.922	0.142
Production	1.015 *	0.084	1.001	0.274	1.007 **	0.032
Price difference	1.000	0.988	0.999	0.568	0.999	0.753
Number of observation	90		90		89	
χ^2	28.39 ***		30.28 ***		28.10 ***	

Note: *** Significance at 1% level

** Significance at 5% level

* Significance at 10% level

From the calculations it can be inferred that there are two ways to make farmers ferment their cocoa beans, first by increasing the number of production through increasing the productivity by implementing Good Agricultural Practices (GAP). During the field visit, it was observed that many farmers do not conduct proper measures to take care of their cocoa trees. The Good Agricultural Practices (GAP) training is conducted by government officials and NGO, such as Swisscontact, in several areas especially in Sulawesi. Trainings conducted through the SCCP (Sustainable Cocoa

Which farmers fermented their cocoa beans.....

Production Program) in southeast Sulawesi increased successfully the productivity in the long term and increased market access through farmers cooperatives (Schaad and Fromm 2018). Secondly by conducting fermentation training, the technical aspect becomes important in making farmers decide to ferment their cocoa beans. In addition, the training must be followed by providing the fermentation apparatus in order for farmers to apply directly the knowledge gained from the fermentation training. In several regions, government provided fermentation apparatus, such as big fermentation box or drying net for drying the cocoa beans after fermentation hence fermentation can be done in large scale.

CONCLUSION

Each location has different characteristic; therefore, the determinants of farmers conducting fermentation are different in each area which eventually will increase bean quality and income. Fermentation training is an important aspect in making farmers decide to conduct fermentation in West Sumatra and Bali. On the other hand, total production is an important aspect in determining farmer decision to ferment their cocoa beans in West Sumatra and Sulawesi. From the analysis, it can be inferred that two strategies that can be applied to encourage farmers to decide to ferment their cocoa beans, namely increasing productivity and fermentation training.

ACKNOWLEDGEMENT

The author would like to thank The Netherlands Initiative for Capacity Development in Higher Education (NICHE) for funding this research and for Huub Mudde, Dr Nunung Kusnadi, Dr Suharno, Dr Netti Tinaprilla, Dr Nia Rosiana, Tursina Andita Putri, MS, Herawati, MS, Triana Gita Dewi, MS and the enumerators for the collaboration on the research.

REFERENCES CITED

- Arinloye, D.A.A., Pascucci, S., Linneman, A.R., Coulibaly, O.N., Hagelaar G., and O.S.W.F. Omta 2014. Marketing channel selection by smallholder farmers. *Journal of Food Products Marketing*. 21(4): 337-357.
- Arsyad, M., Nuddin, A., and S. Yusuf. 2013. Strengthening institutional towards smallholder's welfare: Evidence from existing condition of cocoa smallholders in Sulawesi, Indonesia. *Ryukoku Journal of Economic Studies*. 52(1/2): 71-86.
- De Boer, D., Limpens, G., Rifin, A. and N. Kusnadi. 2019. Inclusive productive value chains: An overview of Indonesia's cocoa industry. *J. Agribusiness in Developing and Emerging Economies*. 9(5): 439-456.
- Doll, J.P. and F. Orazem. 1984. *Production Economics: Theory with Application* (2nd ed.). New York: Wiley. 470p
- Effendy, M.F. Pratama, R.A. Rauf, M. Antara, M. Basir-Cyio, Mahfudz and Muhardi. 2019. Factors influencing the efficiency of cocoa farms: A study to increase income in rural Indonesia. *PLOS ONE*. 14(4): 1-15.
- Fahmid, I. M. 2013. Cocoa farmers performance at highland area in South Sulawesi, Indonesia. *Asian Journal of Agriculture and Rural Development*. 3(6): 360-370.
- Hariyati, Y. 2008. Income and determinants of farmers conducting cocoa fermentation in Jember Regency. Working Paper. University of Jember, Indonesia.
- Hasbi, M., Laga, A., Waris, A., and M. Arsyad. 2010. Cocoa fermentation process in increasing economic value added. *Publikasi Ilmiah Program Ib-IKK*. University of Hasanuddin, Indonesia.
- ICCO [International Cocoa Organization]. 2019. ICCO Annual Report 2017/2018. Retrieved from <https://www.icco.org/statistics/production-and-grindings/production.html>

- Iek, A. 2009. Quality evaluation of dried cocoa beans in Manokwari Regency, Papua. (Unpublished master thesis). Papua State University, Indonesia.
- Mochtar, A.H. and R. Darma. 2011. The prospect of cocoa processing in Makassar: A feasibility study. *Jurnal Agrisistem*. 7(1): 46-62.
- Mulato, S. 2010. Post harvest technology development in increasing national cocoa quality. Indonesian Coffee and Cocoa Institute. 15p.
- Napitupulu, S.K. 2009. Cocoa development evaluation in North Tapanuli Regency”, (Unpublished undergraduate thesis), University of North Sumatera, Indonesia.
- Nurjanah, S. 2014. Determinants of fermented cocoa beans production (Case: Nestle Cocoa Plan Farmers in Kalukku Sub District, Mamuju Regency, West Sulawesi). (Unpublished undergraduate thesis), Bogor Agricultural University, Indonesia.
- Nuryanti, N. 2010. Determinants of cocoa (*Theobroma cacao* L.) competitiveness in Ciamis Regency, West Java. (Unpublished undergraduate thesis). Bogor Agricultural University, Indonesia.
- Permani, R. 2013. Optimal export tax rates of cocoa beans: A vector correction model approach. *Australian Journal of Agricultural and Resource Economics*. 57(4): 579-600.
- Raharto, S. 2016. Institutional development model cocoa farmers in East Java Province District Blitar. *Agriculture and Agricultural Science Prodia*. 9: 95-102.
- Rifin, A. 2015. The effect of export tax policy on cocoa farmers and supply chain. *The International Trade Journal*. 29(1): 39-62.
- Rinaldi, J. 2013. Cocoa production efficiency in smallholders farm in Bali: Stochastic frontier approach. (Unpublished master thesis). Bogor Agricultural University, Indonesia.
- Schaad, N. and Fromm. 2018. Sustainable Cocoa Production Program (SCCP): Analysis of cocoa beans processing and quality in post-harvest in Southeast Sulawesi in Indonesia. *Asia Pacific Journal of Sustainable Agriculture Food and Energy*. 6(1): 1-6.
- Sefriadi, H., Fleming, E., Villano, R.A., and I. Patrick. 2011. The potential of cocoa agribusiness for poverty alleviation in West Sumatra. Paper presented at 55th National Conference of the Australian Agricultural and Resource Economics Society, Melbourne 8-11 February 2011.
- Sefriadi, H., Fleming, E., Villano, R.A., and I. Patrick. 2013. Production constraints and their causes in the cacao industry in West Sumatra: from the farmers’ perspective. *International Journal of Agricultural Management*. 3(1):30-42.
- Soemarno, D., Haryati, Y., Abdoellah, S. and D.F.S. Hartatri. 2015. Study on incentive price of fermented cocoa to overcome reluctance of farmers to apply fermentation: Case study in Jembrana Regency. *Pelita Perkebunan*. 31(2): 130-141.
- Statistics Indonesia. 2014. Estate Crops Household Survey in 2014. Statistics Indonesia.
- Statistics Indonesia. 2018. Indonesian Cocoa Statistics 2017. Statistics Indonesia.76p.
- Supriatna, A. 2004. Smallholders cocoa performance before and after the economic crisis (Case Study in South Sulawesi Province). ICASERD Working Paper No. 44. 14p.
- Syadullah, M. 2012. The impact of export tax on export and cocoa processing industry. *Bulletin Ilmiah Litbang Perdagangan*. 6 (1): 53-68.
- Wally, F. 2001. Smallholders cocoa marketing analysis and determinants affecting the choice of marketing institution in Jayapura Regency. (Unpublished master thesis), Bogor Agricultural University, Indonesia.