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## Cocoa Farmers Performance at Highland Area in South Sulawesi, Indonesia

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### Abstract

This study aims to: (1) discover the performance of cocoa farmers in highland areas in South Sulawesi province of Indonesia, using a approach of four typologies; (2) determine the factors causing the level of cocoa production per hectare per year on each typology. This study uses cluster approach; descriptive-qualitative, purposive cluster sampling and snow ball sampling used in determined the respondent, in-depth interviews and desk study employed in data collection techniques. The results showed that the quantity and quality of input on the stage in the production (on farm) affects the quality and quantity of output in the production phase, processing to marketing. It proved in the very real relationship between the extents of land owned by farmers with the seriousness of the production management by farmers. Farmers belonging to the typology LLOP and LLYP show seriousness in production management. Instead of farmers on typology SLOP and SLYP who did not give optimal treatment to production management. The impact of different management actions in production, at the LLOP and LLYP typology has much higher productivity. In contrast, the typology SLOP and SLYP and its productivity level is only half of the productivity of LLOP and LLYP typology.

**Keywords:** Performance, Cocoa, Highland, Typology

### Introduction

Cocoa is one of the important commodities for Indonesian economy, especially as a provider for employment, income and foreign exchange. Same cases also apply in cocoa-producing countries such as Ivory Coast and Ghana (Brempong and Apraku, 1987). In addition, cocoa also play a role in encouraging the development of the region and the development of agro-industry.

In the last five years, Indonesia produced an average of 782 000 tonnes of cocoa beans (FAOSTAT, 2011). With the amount of production, Indonesia accounted for 13% of

cocoa in the world, and became the world's third-largest cocoa producer after the Ivory Coast (34%) and Ghana (15%). Indonesian cocoa exports value in 2010 has reached nearly \$ 1.2 billion per year (FAOSTAT, 2011), and is able to provide jobs for more than 400,000 families of small farmers. In the world, there are an estimated 4.5 million cocoa farmers, especially in Ivory Coast and Ghana. Cocoa in Ghana even accounted for 64% of total export (The European Chocolate and Cocoa Industry (ed); Brempong and Apraku, 1987).

Indonesia cocoa has experienced tremendous growth since 1988, in the last 25 years, farmers with the scale below one hectare experiencing rapid expansion. Along with quality improvement and rehabilitation of the cocoa plant program that caused increased in total area of cocoa plantation in Indonesia in the last 10

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years, has reached 1, 76 million hectares in 2011 with average productivity per hectare of 645 kg (FAO STAT, 2011). The Indonesian government projected, in the future average production per hectare exceed 1 ton. Quality cocoa beans are also expected to be fermented by farmers and free from the contamination of mycotoxins, excessive pesticides and other substance. However, the government effort to improve cocoa productivity is not accompanied by a growth conscious strategy and sustainable environment. Use of fertilizer and pesticide to increase productivity spawned environmental problems, such as degradation of soil fertility, pests and diseases in more resistance against cocoa (Slomkowski, 2005; Bentley *et al.*, 2004; Rice and Greenburg, 2000).

Data from the Ministry of Industry Republic of Indonesia (2009); FAO (2011), Indonesia's cocoa-producing areas in order are as follows: South Sulawesi 31.9%, Central Sulawesi 23.7%, Southeast Sulawesi 19.2%, , West Sulawesi 13.8%, North Sulawesi 3.6%, Lampung 2.9%, East Kalimantan 2.6% and other areas 16.3%. According to scale of business the Indonesian cocoa plantation business types are grouped into three (3) groups; Smallholders (Farmers) (87%), State owned estates (8%) and private estates (5%).

Based on the above data, the island of Sulawesi is the largest producer (78%) of Indonesian cocoa beans. South Sulawesi province is the largest contributor of cocoa bean (31.9%) in Indonesia.

In general, the productivity of cocoa in Indonesia is still very low, ranging from 645 kg per hectare per year. Actual potential of cocoa production could reach 1.5 tons per hectare per year. In 1998, Indonesian cocoa farmers have managed to reach production of 1.2 tons per hectare per year. The causes of declining productivity of the cocoa plant are pest attack, mainly Cocoa Fruit Borer disease (phytophthora pod rot) and Vascular Streak Dieback (VSD) disease, as well as poor quality of seeds and limited fertilizer, pesticide and herbicides to eradicate pests and diseases. In addition, limited access to credit from financial institutions, and the producer level, price is quite low. (Aikpokpodion and Adeogun, 2011; Dormon *et*

*al.*, 2004) resulting in decreased productivity into 645 kg/ha/year or 46.3% of the productivity has been achieved (1200 kg/ha/yr). This resulted in loss of 660.000 tones/year, equivalent to 7.9 trillion rupiah per year or USD 806 million (FAO 2011). Besides lowering productivity, pest attack causes cocoa quality continues to decline, so the cocoa bean exports to United States experienced a price cut of U.S. \$ 301.5/ton. The low quality of Indonesian cocoa, damaged the image of Indonesian cocoa in the international market. Based on this research and Lawrence and Ogheneruemu (2012) in Idanre LGA of Ondo State, Nigeria, every increase of 10% on one of the production means such as fertilizers, seeds, pesticide, or herbicides, will be able to increase the cocoa beans out-put of 9.6%.

The second caused of not optimum cocoa trees productivity in Indonesia, particularly in the province of South Sulawesi is total cocoa land owned by farmers on average of less than 1 hectare per farmer's household. With a very limited land and does not meet the household economies scale, farmers do not willing to fully maintain and give production inputs (fertilizer and pest extermination) according to standards for the cocoa plant. This is also experienced by cocoa farmers in Nigeria (Lawrence and Ogheneruemu, 2012; Onumah, *et al.*, 2013; Azhar and Lee, 2004; Oluyole, 2013). Cocoa plantations become a side income for most farmers, therefore, an attempt to find the typology of cocoa farmers is important to understand the factors that affect the level of productivity of cocoa per hectare per year.

The third cause for the low productivity of cocoa in South Sulawesi is the age of the plant that is quite old or too young. Most of the cocoa crop in the province aged over 20 years, while others are still under the age of 5 years (Onumah *et al.*, 2013; Morales *et al.*, 2012)

This study aims to: (1) discover the performance of cocoa farmers in highland areas in South Sulawesi province of Indonesia, using a approach of four typologies: (i) the typology of the vast land area with old plants (LLOP), (ii) the vast land area with young plants (LLYP), (iii) Small land with old plants ( SLOP), and (iv) Small land with young plants (SLYP); (2) determine the factors causing the level of cocoa

production per hectare per year on each typology. This study started from the stage of land preparation, planting, crop maintenance, harvesting, post-harvest and marketing.

### Method

Data collection method used is in-depth interviews. Sampling technique (respondent) in this study there was; *purposive* sampling with *cluster sampling* method and snowball sampling methods.

Purposive cluster sampling method used to determine and locate the sample / respondents in the cocoa farm level based on typology that refers to; topography (cocoa farms located at the highest village above sea level), the land size and the age of the cocoa plant.

Determination of resources (respondent) refers to a typology which is determined by; typology large estates and old plants (LLOP) is a cocoa farm land with an area of 1-3 hectares and plant age above 20 years. Typology large estates and young plants (LLYP) is a cocoa farm land with an area of 1-3 hectares and cocoa plant aged under 20 years; typology of small land and old plants (SLOP) is a cocoa farm land with an area of between 0.5 to 1 hectare and aged of cocoa trees over 20 years old, and the typology of small land and young plants (SLYP) is a cocoa farm land with an area of between 0.5 to 1 hectare and cocoa tree aged under 20 years.

This study selected four districts, from about 10 major cocoa producing districts in South Sulawesi province. The four selected districts are districts that have long tradition of cocoa farming with high productivity and production compared with six other districts. Other considerations in the study are geographic and ethnic factors, the 4 districts can represent geographical and ethnic characteristics of cocoa farmers in South Sulawesi. In each selected district 2 cocoa producing villages were selected where the location is at the highest above sea level. In each village, eight farmers were chosen, consisting of: four farmers who own cocoa plantations between 1-3 hectares, and four others are farmers who have land between 0.5-1 hectares. Four farmers, who have land 1-3 hectare, are classified into two typologies; 2 farmers whose plant aged over 20 years old, and

two other farmers whose cocoa plants age less than 20 years. Same as in the location where farmers have land between 0.5-1 hectare are also classified into two typologies; 2 cocoa farmers whose cocoa plant age less than 20 years and 2 other farmers have cocoa plant age over 20 years.

Eight farmers chosen in each village at the highland in each district as the purpose of finding; (1) differences in farm management, (2) the seriousness of the cocoa farmers of the plantation business, and (3) the influence of the land size or scale of business, experience and knowledge of farmers on their productivity.

Total farmer respondents at 4 selected districts of study locations is as much as 64 farmers. To find these farmers, this study used a snowball sampling method that starts from the information farmers to find other farmers who fit the criteria based on the typology above. The next step is to validate and classify all in-depth interviews result of all respondents, based on predetermined typology.

### Result and Discussion

Increase in cocoa production is strongly influenced by the upstream-downstream process from the selection / procurement of seeds until marketing of cocoa. Production inputs and production processes will greatly affect the outcome of production, especially on the income of farmers.

### Performance in Typology of Large Land and Old Plants (LLOP) and Large Land and Young Plants (LLYP)

#### Means of Production

##### Land

Typology of farmers on land LLOP have an average of 1, 8 the number of acres of cocoa trees averaged about 850 trees per hectare. The land owned by farmers generally with the average condition of land fertile and friable. Physiologically cocoa plant do not required excessive water for growth, therefore, irrigation area were not found in LLYP and LLOP typology. Rain is the source of water for the cocoa plant on this typology, when rainfall is

high, cocoa leaves will change color to yellowish and become rotten.

While on the typology of LLYP, average size of farmer owned land is 3 hectare with average of 900 trees per hectare. Besides cocoa trees, plantations on the typology of LLOP and LLYP also planted with durian, rambutan and banana. Durian and rambutan is usually planted on the outskirts of boundary of land.

### Seed

The type seeds planted and side grafted by farmers on typology of LLOP is local hybrid such as BR 25, 4511 and 01. There are 3 ways to obtain seeds; (i) farmers purchased it from surrounding areas; (ii) make seed from their own crops, (iii) the government assistance.

Cocoa farmers in the typology of LLOP performed traditional and manual seeding by put the cocoa beans in the soil mixed with compost (organic fertilizer), then put the mixture in the zak and cover it with sand, when it sprout the seed moved to the poly bag. Another way is by take out the cocoa beans from the healthy and best fruit and dry them out for 1-2 days then put them in polybag. Traditional breeding/seeding is used to obtain new plant while side grafting is used to rejuvenate the cocoa plant. A cost for cocoa seedling is approximately Rp. 250.000 / USD 3 (see table 1).

Farmers in LLOP the typology also rejuvenating cocoa crops by side-grafting. Side grafting is done first put fertilizer on the old trunk as a stimulus to increase mucus, after 1 month then mounted new entries by rinding 2 cm of the tree which had been cut slanted then tie it with plastic.

While on LLYP typologies the varieties of cocoa planted are hybrids and BR. These varieties has large fruit and good quality, seedlings is done with mini grafting technique.

### Fertilizer

Urea is the most widely used fertilizer by farmers on LLOP typology, whereas other types of fertilizer namely; Za, Poska, KCl and TSP and only a fraction of those who use organic fertilizers.

Farmers in the typology of LLOP and LLYP buy these types of fertilizers the dealer near their residence area. In one year, the typology of LLOP spent on fertilizers is around Rp. 865.834/ USD 90 (see table 1).

On LLOP typology fertilization usually done when the plant aged over one year, then continued every 6 months, 4 months or 3 months. Fertilization usually done by farmers on LLOP and LLYP typology is by sowing fertilizer around the trees or make holes around the cocoa tree then spread the fertilizer into the hole. In every hole they put as much as 0.5 kg of fertilizer mixed with organic fertilizer.

Farmers on LLYP typology used the same type of fertilizer that is used in typology LLOP; Urea, Za, TSP, Poska and SP36. On average, farmer in this typology spent about 10 bags of fertilizer for each fertilization. Fertilization is done twice a year with the total cost to buy fertilizer of Rp. 1.122.5000 (USD110) per hectare per year (see table 2)

### Pesticides / Herbicides

Pesticides / herbicides used by farmers to deal with pests and plant diseases on cocoa, the type of pesticides used by farmers vary, among others; brand name *cristalon*, *Nurel*, *Sevin*, *matador* and *505*.

The farmers acquired pesticides by buying at the dealer, store or market around their farm. Knowledge of pest and disease eradication learnt from family, friends, fellow farmers and usage direction stated on product packaging. Treatment for pests and diseases, both in typology of LLYP and LLOP quite similar the difference are on the dosage used. For farmers in the LLOP typology, spraying is usually done by mixing 50 cc of pesticide into a tank containing 15 liters of water, and then sprayed on crops of cocoa or by mixing pesticides powder as much as 1-2 tablespoons into a tank containing 15 liters of water and then sprayed onto the cocoa plants attacked by pests and diseases. For liquid pesticide the dosage usually used 2 bottle caps per 15 liters of water and then sprayed on crops. Spraying usually done when the cocoa fruit is still small and the flowers not yet blooming, spraying is done 6 times in 3 months or twice a month, at the harvest time. However, there are some farmers who do not often spray their crops

due to lack of fund. For every hectare cocoa plantation in highland with LLOP typology, on average farmer purchased of pesticide and herbicides around Rp. 1,920,000 (USD 210) per year (see table 1).

Eradication of pests and diseases on the LLYP and LLOP typology usually done by spraying the infected plant or by cutting off the infected branches and stems. Those farmers who do not want or cannot afford to buy pesticide usually smearing powder of used batteries on the stems and stalks of infected plants. The type pests and diseases that often attack the cocoa crops, namely: *conopomorpha cramerella* snell, *phytophthora palmivora* Butl, *phyophthora palmivora* but, *corticium salmoncolor*, vascular streak dieback, *zeuzera*.

The type of pesticide and herbicides used on LLYP typology is very diverse; brand name Nordox, aim to eradicate *conopomorpha cramerella* snell and pesticide with brands name *Tuntas* to eradicate ants that attack cocoa trees. Other brands such as *supremo*, *ramoxone* and *round up* are also widely used. Dosage for Nordox pesticide is 50 cc per 15 liters of water. Spraying is done 3 times a month. As for the brand name *Tuntas* 1 bottle caps mixed with 15 liters of water to spray as much as once a month. As for the pesticides brand name Round up and Gramaxon, used each as much as 5 liters per hectare. Total costs spent to buy pesticides / herbicides for farmers in LLYP typology is Rp. 574.167 (USD 60) per year per hectare (see table 2).

## Production Process

### Land Preparation and Shade

Tillage on LLOP typology done long before planting or side grafting, land clearing usually done using chain saw, crowbars and machetes. Majority of farmers spray their land prior to side grafting. The time lapses between land preparation and planting or side graft usually 2-4 months. Costs for land preparation for the LLOP typology around Rp. 200.000/Ha (USD 22) (see table 1).

For shade plants, farmers use plants that are easy to grow with minimal maintenance such as *Gliricidia sepium*. The shade plants planted long

before planting the cocoa trees so the shade plant will be able to provide shade for the new cocoa trees. Distance shade plants with cocoa plants ranged from 1.5 to 2 meters with alternating patterns.

While the LLYP typology tillage begins with land clearing. On this typology, farmer cleared the land by cut grass and bushes; some farmer sprayed the poison grass to let the grass dry for few days and then burned. The time lapse between the preparation of land and the planting about 1 month, for total land area of 3 hectares usually take 2 months.

After land clearing, continued with planting of seeds, spacing of 3 to 4 meters between hole, with total employment ranges from 1-3 people. Costs required for planting and shade plants of Rp. 166 667 (USD 18) per hectare per year (see table 2 ).

Types of shade plants are grown by farmers in the LLYP and LLOP typology is *Gliricidia sepium*. There are also other types of plants that serve as intercropping as well as shade plants, namely durian, lanzones and coconut. These crops generate additional income for the farmers. The most distance between shade plants and cocoa plants about 4-5 meters.

### Pruning, Harvesting and Post-harvest

Pruning done with the intention of dispose unproductive leaves or branches. Pruning is done by trimming the branches of five branched trees, usually done 1-2 times a year. Firstly done on plant aged over 1 year then twice a month or once a month thereafter.

For LLOP typology, trimming or maintenance costs per hectare per year is Rp. 250.000 (USD 25) (see table 1). As for typology of LLYP, costs for trimming or maintenance per hectare per year is Rp. 254.000 (USD 26) (see table 2).

Cocoa is ready for harvest when the color of cocoa fruit is transformed into yellowish until dark red. Farmers at LLYP and LLOP typology harvest almost every month and grand harvest is done 2 times a year around the month of April to October or harvesting is only done once a year around the month of June-July. Harvesting generally use large scissors or machete for cocoa that within

reached, while for the cocoa pods that are hard to reach, farmer use a long stick tied with a net. Drying of cocoa beans after harvest, beans with higher level of dryness have better price. The beans are dried cocoa beans on the net or sack at the yard around the home of farmers. In the dry season with high intensity of sunlight, drying was only takes 4 days, during the rainy season, drying can take up to one week. Weight of wet cocoa beans around 50 kg per sack will shrink to only 30 kg after drying. Indicators of dried cocoa beans are ready for sale is by break the cocoa beans and if the center is no longer wet means beans are dried. Farmers on LLOP and LLYP typology do not ferment the cocoa beans because no extra incentive or premium for fermented beans. Costs of harvest and post-harvest for LLOP typology ranges from Rp. 225,000 (USD 24) per hectare per year (see table 1). While in the typology of LLYP farmers spent about Rp.209, 000 (USD 21) per hectare per year (see table 2).

#### **Production (Performance Analysis)**

There are two systems of sales; farmers brought goods directly to the merchant or merchants visit the farmers. Determination of cocoa prices used by traders is measured from the level of dryness or moisture content of cocoa beans. In this case trader is the price setter. Farmers usually sell dried cocoa beans with moisture level between 15-7 percent. The lower the moisture level, the higher the selling price.

Price negotiations can only be done by farmers when farmers have high quantity of cocoa with low moisture level. Price fluctuations may occur when the demand for cocoa from wholesalers in the city (Palopo or Makassar) increases, so that the village trader will try to collect large quantity of cocoa and willing to buy at more expensive price.

In the LLYP and LLOP typology, cocoa beans with 15 percent moisture content purchased by collectors at a price of Rp. 7,000/kg, while the cocoa beans with moisture content 10 percent is sold at Rp. 13,000/kg. Cocoa beans with the

lowest water content (7 percent) were sold at a price of Rp.19,000/kg.

With direct sales to traders, farmers' position in the transaction and pricing is very weak, because farmers do not have access to alternative information about the price of cocoa beans in the world market. To find understand the performance analysis of farmers on the LLYP and LLOP typology see Table 1 and 2.

Farmer's performance on the typology of LLOP, only able to earn gross earnings of Rp. 18,600,000 (USD 1850). The total expenditure of farmers around Rp. 2,945, 000 (USD 320), which consists of labor cost of Rp. 775,000 (USD 80) and the cost of production of Rp.2,170,000 (USD 222). On LLOP typology net income is around Rp.15,655,000 (USD 1600). Productivity of cocoa in this typology is 1,200 kg per hectare per year, with an average selling price per kg of Rp. 15,500 (USD 2) (see table 1).

When compared to the performance of LLYP typology, showed that the production or productivity per hectare per year is 1.307 kg, 107 kg higher productivity than LLOP typology, the price is the same, the average of Rp.15. 500. Total expenses for the farmer on LLYP typology is Rp. 2,821,667 (USD 30), per hectare per year, with details of Rp. 750,000 for labor cost and Rp. 2,066,667 cost of production facilities consisting of; seeds, pesticide/herbicides and fertilizers. Expenditure of LLYP typology is Rp. 123.333 (USD 13) per hectare per year lower than the of LLOP typology. Farmers' net income on LLYP typology is Rp. 17, 445, 000 (USD 1780) (see table 2).

One of the important factors that cause performance typology LLOP lower than LLYP typology is lower productivity by 107 kg. This influenced by the age of the cocoa plants at LLOP typology are old when compared with plants on LLYP typology, although the cost of care and the means of production is higher at LLOP in comparison to the LLYP typology.

**Table 1: Performance of Cocoa Farmers with Large Land and Old Plant Typology**

<b>Performance analysis of cocoa farmers LLOP typology per hectare per year</b>					
<b>Labor</b>	Land preparation	Planting	Maintenance	Harvest	Post-Harvest
Production costs/Ha (Rp.)	20 0,000	125,000	2 50,000	1 25, 000	1 00, 000
<b>Total Labor Costs</b>					<b>775,000</b>
<b>Means of Production</b>	<b>Fertilizer</b>	<b>Pesticide/ herbicide</b>	<b>Seed</b>		
Cost/ha (Rp.)	820,000	1,100,000	250,000		
<b>Total Cost of Production Facilities</b>					<b>2, 170, 000</b>
<b>Total expenditure</b>					<b>2, 945, 000</b>
Production / ha (Kg)					1,200
Rata-rata/Kg Selling Price (USD)					15,500
Total selling price (USD)					18,600,000
<b>Net income of farmers / yr</b>					<b>15.65 5,000</b>

Source: Field Study

**Table 2: Performance of Cocoa Farmers with Large Land and Young Plant Typology**

<b>Performance analysis of cocoa farmers LLYP typology per hectare per year</b>					
<b>Labor</b>	Land preparation	Planting	Maintenance	Harvest	Post-Harvest
Production costs/Ha (Rp.)	125,000	166 667	254,000	100. 000	109. 333
<b>Total Labor Costs</b>					<b>755 000</b>
<b>Means of Production</b>	<b>Seed</b>	<b>Pesticide / herbicide</b>	<b>Fertilizer</b>	<b>Seed</b>	
Cost / ha (Rp.)	120,000	574 167	1.1225	250,000	
<b>Total Cost of Production Facilities</b>					<b>2,066,667</b>
<b>Total expenditure</b>					<b>2,821,667</b>
Production / ha (Kg)					1,307
Rata-rata/Kg Selling Price (USD)					15,500
Total selling price (USD)					20,266,667
<b>Net income of farmers / yr</b>					<b>17,445,000</b>

Source: Field Study

**Performance in Typology Small Land and Old Plant (SLOP) and Small Land and Young Plant (SLYP)**

**Input Production Land**

Total land area in the typology of SLOP and SLYP is 0.5 to 1 hectare, with the cocoa plant age over 20 years for farm with old plant and age less than 20 years for farm with young plants, and sandy loose soil conditions. Farmers’ knowledge of land management and treatment for cocoa by the self-taught, due to lack of

training or counseling either by the government, private sector and CSOs (civil society organizations).

**Seed and Fertilizer**

Types of seeds / entries used by farmers in the typology SLOP and SLYP are BR. Side grafting of BR type began on the typology of SLYP-about three years ago. This variety was originally imported from other regions. But now BR varieties are propagated using mini grafting by farmers on this typology. According to farmers, BR considered as superior varieties



because of the fast growing and fast harvesting, in addition to easy maintenance and good quality of cocoa. Generally, farmers in SLYP typology have been doing multiplication of BR varieties by mini grafting around 850 trees per hectare. Initial cost for the purchase of seeds on SLYP and SLOP typology around Rp.150, 000 (USD 16) (see table 3 and 4.)

Types of fertilizers used on SLOP and SLYP typology is; Urea, SP36, ZA, KCL, TSP and Ponska. Farmers at SLOP typology spent about Rp.338 834 (USD 35) per hectare per year, to buy fertilizer (see table 3) while Rp. 457,167 (USD 47) spent on SLYP typology (see table 4). These cost is only able to cover 30-35 percent of the cost needed to buy fertilizer required on both typologies. Functions of four widely used fertilizer, namely: (i) UREA and ZA serves to multiply the leaves and stems; (ii) NPK serves to multiply the cocoa pods (iii) SP 36 serves to enrich the soil.

#### **Pesticides / Herbicides**

Types of pesticides used by farmers in the typology of SLOP include Nordox, *Tuntas* and Polado. While farmers on SLYP typology choose the brand of pesticide and herbicides; *Tuntas*, Supretox, Sunup, Supremo Nokson, Gramoson, Decis and Nordoks. Process and usage of pesticide and herbicides for pest eradication is relatively similar on LLYP or LLOP typology, i.e. mix 50 cc of pesticides / herbicides into the tank containing 15 liters of water and then sprayed on crops.

Typology of SLOP spent at least Rp.180 834 (USD 19) on pesticide and herbicide per hectare per year (see table 3). As for the SLYP typology required Rp. 466 500 (USD 47) per hectare per year (see table 4).

#### **Production Process**

##### **Land preparation and shade**

The process of land preparation made by farmers at SLYP and SLOP typology is similar to that done on the typology of LLYP and LLOP. At the stage of determining shade plants, typology SLOP and SLYP to choose plants that can provide additional short-term income such as bananas, prior to planting cocoa the land planted with corn. As happened in other

typologies, shade plants can provide additional income such as durian, rambutan and lanzones also available on SLOP typology and SLYP. Costs incurred in the SLOP typology for land preparation and shade plants ranging from Rp. 41.667 (USD 5) and Rp.35,000 (USD 4) per hectare per years (see table 3). While SLYP typology spent up to Rp. 48.333 (USD 5) and Rp. 35,000 (4) for land preparation and shade plants.

Tillage on SLOP and SLYP typology done by farmers during the land clearing, long before planting the cocoa seed. Land clearing process only used simple tools such as machetes, sickles, hoes and axes. The time lapses between land preparation and the planting of about 2 months to 1 year.

##### **Planting, Fertilization and Pruning**

Cultivation techniques of farmers in SLYP and SLOP typology have no differences with other typology. The same was found in the fertilization system. Fertilization occurs in a way that other typologies, have similarities that occur on premises of SLOP typology. Differences only on the number of doses used and the age of the plant to be maintain. The typology of SLOP, fertilization started during the plant age of 19 months and regularly twice a year thereafter. Costs for fertilization in SLOP typology of Rp. 338,834 (USD 34) (see table 3). Technique of fertilization by farmers in the typology of SLYP is by spreading fertilizer around the cocoa plant. Specific to the type of SP 36 fertilizer, fertilization done by sowing it the around the cocoa tree. Use of urea, NPK, ZA three times a year, while for SP 36 used twice a year. Farmers on this typology used as much as 200 kg of fertilizer to an area of 1 ha. Total fertilizer expenditure per hectare per year for SLYP typology around Rp. 457 167 (USD 46) (see table 4).

Pruning on SLOP typology done by trim unproductive branches and leaves. Costs required to pruning or maintenance can be seen in Table 3, the amount; Rp. 35,000 per hectare per year. Pruning at SLYP typology started when the age of plant at least one year after that routinely performed once a month. Pruning done using machetes and large scissors, with a cost of

approximately Rp. 40,000 per month per hectare (see table 4).

**Harvesting and Post-harvest**

Cocoa harvesting patterns at SLOP and SLYP typology showed the same pattern to other typologies, both to determine the harvest time, frequency of harvest and how to harvest. Post-harvest process also shows the same way between SLOP and SLYP typology with the other typologies. The striking difference between SLOP and SLYP typology others is the total expenditure that is used to harvest and post-harvest handling is very small; Rp. 32,000 (USD 3) and Rp. 33,000 (USD 3) per hectare per year (see table 3). While the cost of harvesting and post-harvest on SLYP typology Rp. 30,000 (see table 4). At SLYP and SLOP typology the beans are not fermented because it does not have added value (extra premium).

**Production (Performance)**

Performance of the cocoa farmers in the typology SLOP indicate that the results achieved or the gross income of Rp. 9,789,439 farmers per hectare per year. While the farmers' production costs per hectare per year is Rp. 849,668 (USD 85) consisting of cost of labor and means of production, respectively Rp. 180,000 (USD 19) and Rp. 669.668 (USD 68). Thus, the net income of farmers in this typology is Rp. 8,939,711 (USD 908). While productivity per hectare per year on this typology is 683 kg,

with an average selling price per kg of Rp.14.333 (USD 1.5). Total selling price is Rp.9,789,439 (USD 999) (see table 3).

When compared the performance of the cocoa farmer SLOP with SLYP typology, found differences in performance among others; productivity of cocoa trees on SLYP typology of 650 kg per hectare per year. SLOP typology has higher productivity by 33 kg per hectare per year. However, the average selling price of cocoa beans per kilogram Rp. 1,000 (USD 0.1) higher or Rp.15.333 (USD 16) on the SLYP typology (see table 4).

Total gross income of farmers on SLYP typology is Rp. 9.966.450 (USD 1000) while the cost of production per hectare per year is Rp. 1,268,667 (USD 130), the net income of cocoa farmers in this typology is Rp. 8,687,783 (USD 887). Net income of farmers in the typology of SLOP higher Rp.251.928 (USD 26) compared with net income of cocoa farmers in the typology of SLYP. Income differences between typology SLOP with SLYP, as influenced by the different cocoa crop productivity and cost of production of cocoa farmers in the typology SLYP higher Rp. 418.999 (USD 42). The most striking difference in the cost of production is the cost for the purchase of pesticide and herbicides (see tables 3 and 4).

**Table 3: Performance of Cocoa Farmers with Small Land and Old Plants (SLOP) Typology**

Performance analysis of cocoa farmers SLOP typology per hectare per year					
Labor	Land preparation	Planting	Maintenance	Harvest	Post-Harvest
Production costs / Ha (Rp.)	41 667	38 333	35,000	32,000	33,000
Total Labor Costs					180, 000
Means of Production	Fertilizer	Pesticide / herbicide	Seed		
Cost / ha (Rp.)	338 834	180 834	150,000		
Total Cost of Production Facilities					<b>669.668</b>
<b>Total expenditure</b>					<b>849.668</b>
Production / ha (Kg)					683
Average Selling Price/Kg (Rp.)					14 333
Total selling price (Rp.)					9789439
<b>Net income of farmers / yr</b>					<b>8.939771</b>

Source: Field Study

**Table 4: Performance of Cocoa Farmers with Small Land and Young Plant (SLYP) Typology**

<b>Performance analysis of cocoa farmers SLYP typology per hectare per year</b>					
<b>Labor</b>	Land preparation	Planting	Maintenance	Harvest	Post-Harvest
Production costs / Ha (Rp.)	48 333	46 667	40.00 0	30.00 0	30.00 0
Total Labor Costs					1 95,000
<b>Means of Production</b>	Fertilizer	Pesticide / herbicide	Seed		
Cost / ha (Rp.)	457 167	466 500	150,000		
Total Cost of Production Facilities					1,073 .667
<b>Total expenditure</b>					<b>1. 268 .667</b>
Production / ha (Kg)					<b>650</b>
Average Selling Price/Kg (Rp.)					<b>15 333</b>
Total selling price (Rp.)					<b>9966450</b>
<b>Net income of farmers / yr</b>					<b>8. 68 7783</b>

Source: Field Study

## Conclusion

The best performance is achieved by the cocoa farmers at LLYP typology, with a productivity rate of 1.307 kg per hectare per year. The productivity of farmers' net income is Rp.17,445,000 (USD 1780) per hectare per year. While the worst performance showed by cocoa farmers at SLYP typology, with the level of productivity of 650 kg per hectare per year, equivalent to net income of farmers amounted to Rp. 8,687,783 (USD 887).

LLOP typology performance ranks second with 1,200 kg of productivity levels per hectare per year, or parallel to the farmers' net income of Rp.15,655,000 (USD 1570). While the typology SLOP performance in the position of number 3, with the level of productivity of 683 kg per hectare per year, or equal to the farmers' net income of Rp.8,939,771 (USD 912).

The best performance is achieved by farmers at LLYP typology affected by the hard work in land management, planting, maintenance, harvesting, post-harvest and production inputs. Typology of LLYP of Rp. 2,821,667 (USD 288) per hectare per year for production management. While the typology SLYP (as the worst performing typology) only spent Rp.1,268,667 (USD 129) per hectare per year.

Size of land owned has heavy influence on the seriousness of farmers to manage their farm. In

the LLYP and LLOP typology showed clearly farmer production costs are much greater than the typology SLOP and SLYP. This difference in production costs come an impact on the level of productivity of cocoa farm. The average productivity of cocoa in the typology LLYP and LLOP is 1,118 kg per hectare per year, with an average production cost of Rp. 2,883,335 (USD 294). While the average level of productivity in the typology SLOP and SLYP is 666 kg per hectare per year, with an average production cost only Rp. 1,059,167 (USD 108). Other factors that influence the productivity of cocoa in all typologies are cocoa plant age, experience, skills and knowledge of cocoa farmers. Cocoa plants over the age of 20 years tend to decrease in productivity. Farmers who have the experience, skills and knowledge to manage cocoa plants have innovations to resolve problems they encounter.

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