

## Interdependence of Farmers and Increasing Cocoa Productivity in Central Sulawesi Province, Indonesia

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### Abstract

Cocoa is a pre-eminent commodity in Central Sulawesi Province. Cocoa farming has not increased its productivity due to pest infestation, low maintenance of crops and low access of farmers to capital. This has an impact on the low productivity and income of farmers. This study aims to analyze the effect of interdependence level of farmers on the productivity of cocoa farming in Central Sulawesi Province. The study was conducted in four districts in Central Sulawesi Province, namely Poso, Sigi, North Morowali and Donggala districts. Cluster random sampling technique was used drawing 380 sample respondents, in relatively advanced and less developed village clusters. The results showed that low in the filter system, competitiveness, and partnership sub-system of farmer interdependence. Low productivity of farmers (0,8 tons/hectare) while the potential productivity was (2 tons/hectare). Their low productivity of farmers was due to the low level of their interdependence. Farmer income per month Rp.1,325,030.00 is also below the minimum wage rate of laborers of Central Sulawesi Province Rp.1,807,775.00.

**Keywords:** cocoa, farmer, interdependence, productivity

### 1. Introduction

Cocoa commodities in Central Sulawesi Province, Indonesia, from year to year have not experienced much development. Low productivity of farmers due to increased pests and diseases of plants, low quality of cocoa beans (not through fermentation process), low access technology due to extension not based on the needs of farmers (top-down), increasing the population of old or damaged plants, the low maintenance of plants, limited partnerships leads to lower access of farmers to capital institutions, as well as trading practices dominated by middlemen and owners of capital. According to Clough *et al.* (2009) increased pest and disease attacks allowing farmers in Sulawesi to abandon cacao crops as cocoa production declines. Therefore, increasing the level of interdependence farmers is important to overcome the low productivity and income.

Cocoa crops become Indonesia's pre-eminent commodities after palm oil, coconut, and rubber. From the economic value of cocoa, commodities can contribute the third largest foreign exchange after oil palm and rubber (Hasibuan *et al.* 2012). From the International Cocoa Organization (ICCO) demand for dry cocoa beans grew an average of 5 percent per year. Directorate General of Plantation of Indonesia (2014) stated that cocoa consumption in Indonesia, India, and China will reach 1 kilogram/capita/year causing the increase of demand for cocoa of Indonesia about 2.2 million tons of dry beans per year.

The cocoa commodity can contribute the US \$ 1.1 billion in foreign exchange in 2012 and also the third largest foreign exchange gain after palm oil and rubber (Ministry of Trade, 2013). This shows that cocoa commodities have great potential to be developed. The price of dry cocoa beans in Central Sulawesi, Indonesia how many years last ranged from Rp.20,000.00 – Rp.38,000.00. The low price is due to the low harvesting and postharvest process from farmers (Rachibini *et al.* 2012).

Farmers' dependence on production technology causes farmers to think only and expect how to get production technology aid from the government and the private sector without the desire to think of building mutually beneficial cooperation with industry or private parties, in planning the farm should be based on information about cocoa (cultivation, harvesting, processing and marketing) and farmers are able to produce cocoa beans according to Indonesian National Standard (SNI) so that changes in the farming environment are no longer a problem in cocoa farming. Increasing the interdependence of farmers into a way to improve the productivity of cocoa farming. According to Sumardjo (2012) the increasing demands of livelihood, the demand for the ability to develop farming and various other demands so that farmers must also be independent to reach various opportunities and overcome the existing threats, by increasing its potential and eliminating existing weaknesses.

Previous researches are limited to interdependence in decision making, interdependence in a concept of trust building, social networking, entrepreneurship, agribusiness interdependence and interdependence of farmers (Farid 2008; Mehta *et al.* 2011; Marliati 2008; Stock & Forney 2014). Furthermore Sumardjo (1999: 2010)

explains that building farmers as the main perpetrators of reliable agriculture means building interdependence of farmers. Based on this research, it is important to know the level of the farmer's interdependence, the filter system, competitiveness, partnership and the influence of the level of interdependence of farmers to increase the productivity of cocoa farmers in Central Sulawesi Province.

Increasing the productivity of cocoa is not only through the improvement of location-specific technology both cultivation, processing and marketing, with the existing interdependence of farmers is expected to increase technological inputs and improve farming activities such as fermentation of cocoa beans, organic fertilizer from cocoa peel, pesticide use vegetable and promote partnerships between industry, private and government. From this background, this study aims to analyze the influence of interdependence from the aspect of the filter system, competitiveness, and partnership to increase the productivity of cocoa farming in Central Sulawesi Province.

## 2. Method

This study used a survey design carried out in Central Sulawesi Province covering four districts based on the zone division of the region, namely North of Donggala District, West Region of Sigi Regency, Central Region of Poso Regency and Southeast Region of North Morowali Regency. The selection of this location is based on the fact that Central Sulawesi Province is the main center of cocoa production in Indonesia. This study uses a gradual sampling technique (cluster random sampling). Overall the research sample is spread in Donggala Regency as many as 100 farmers, Sigi regency 84 farmers, Poso regency 144 farmers and North Morowali Regency 52 farmers so that the total sample of research as much as 380 respondents. Data analysis using multiple regression analysis using SPSS version 20.

## 3. Results

### 3.1 Characteristics of Cocoa Farmers

Farmer characteristics are important in determining farming change. Farmers who have good characteristics in developing their farm can easily solve problems and use every opportunity to increase their income and welfare. The characteristics of farmers are inseparable in the development of productivity and business (Table 1). Characteristics of a good cocoa farmer can enable an increase in cocoa farmer interdependence. According to Rogers & Shoemaker (1987) that the underlying characteristics of one's behavior in the work situation as well as in other situations. There is a very strong relationship between the characteristics of farmers and the decision to develop agricultural farming (Ondersteijn 2003).

Viewed from the composition of farmer age 92.1 percent of cocoa farmers belong to the productive age. Limitation of one's productive age in working according to Rusli (1995) 15-65 years. Farmers over the age of 65 years are only accepting and aware of new things but are less adopting useful information and technology that suits their needs as it is influenced by farming practices that they do for generations. Yamada & Chi (2002) states that farmers are easily more progressive than older farmers. Old farmers farm based on their own experience and hesitate in applying new technologies.

Research Espinoza *et al.* (2007) in Mexico found that older farmers were more traditional and less likely to change, while farmers were more likely to be progressive, willing to do or try new things and easier to participate in extension activities. Farming changes are also determined by the characteristics of farmers in their farming efforts. According to Rogers & Shoemaker (1995) the underlying characteristics of a person's behavior in working as well as doing other business.

Farmer participation rates in the development of farming in categories tend to be low, illustrating that cocoa farmers seek to be involved in community groups and willing to engage in any social interaction with other farmers as well as government and private parties. According to Nahayo *et al.* (2017); Taylor & Grieken (2014) low farmer participation due to injustice to the farming they run. Farmers are made non-profit product producers, lack of extension, agricultural input, inadequate postharvest technology and government intervention in farming. Cooperation among peasants, local leaders and extension agencies, and local agencies can reduce political intervention and increase farmer participation.

Cocoa farming will not grow if cocoa farmers do not play an active role in their development efforts. The development of cocoa farming requires the participation of farmers. This could be from the involvement of farmers in planning to increase production with the government, private and other farmers. Farmers' participation in developing cocoa based on discussions with farmers is influenced by the need for information and benefits.

Based on the intensity of non-formal education through counseling, it is classified as low as once a year. This explains that the extension process has not gone well. According to Hu *et al.* (2012), a growing number of farmers following the counseling indicate that agricultural extension workers can meet farmers' demands.

The lack of knowledge and skills of extension workers on cocoa crops and extension work assignment focused more on food crops in rice, corn, and soybeans causing the low intensity of counseling of cocoa plants. Baloch & Thapa (2016); Sattaka *et al.* (2016) stated that the low level of counseling is due to institutional constraints, including the very limited number of extension workers and their lack of knowledge about how to

deal with problems facing farmers. Nonformal education through comprehensive counseling should play an important role in encouraging sustainable production, ensuring food security and local culture.

Table 1. Distribution and number of cocoa farmers in Central Sulawesi Province based on the characteristics of farmers, the Year 2017

Characteristics	Measurement	Poso (%)	Sigi (%)	North Morowali (%)	Donggala (%)	Total (%)
Farmer's Age (Year)	Young (30-46)	39,9	58,3	36,5	21,0	38,2
	<b>Adult (47-63)</b>	56,9	39,3	57,7	60,0	53,9
	Old (64-80)	4,2	2,4	5,8	19,0	7,9
Average year		49	46	50	55	50
Development of Farming (Frequency)	Low (0-50)	39,6	36,9	40,4	24,0	35,0
	<b>Middle (50.01-75)</b>	58,3	59,5	55,8	67,0	60,5
	High (75.01-100)	2,1	3,6	3,8	9,0	4,5
Average score		52,5	54,6	53,2	60,0	55,0
Non-formal Education (Frequency)	<b>Low (0-50)</b>	92,4	64,3	90,4	98,0	87,4
	Middle (50.01-75)	7,6	32,1	9,6	2,0	11,8
	High (75.01-100)	0,0	3,6	0,0	0,0	0,8
Frequency score		1	2	1	1	1
Scale Business (Hectare)	Narrow (0.5-1)	48,6	38,1	50,0	82,0	55,3
	<b>Middle (1.1-3)</b>	41,0	60,7	48,1	17,0	40,0
	Broad (3.1-6)	10,4	1,2	1,9	1,0	4,7
Average hectare		1,7	1,7	1,4	0,9	1,4
Plant Age (Year)	Easy (1-6)	7,6	22,6	5,8	6,0	10,3
	Adult (7-13)	23,6	19,0	11,5	7,0	16,6
	<b>Old (14-20)</b>	68,8	58,3	82,7	87,0	73,2
Average year		15	13	16	15	15

Description: n Poso = 144; n Sigi = 84; n North Morowali = 52; n Donggala = 100; Total = 380

The scale of the farm describes the area of cocoa farmed by the farmer and his family, either self-owned, rent or profit sharing. From the research result, the whole land area of cocoa farmers is their own. This explains that cocoa farmers in Central Sulawesi, working on cocoa farming and selling dried cocoa beans are enjoyed by farmers and their families. According to Aneani *et al.* (2012), the area of land has an effect on increasing the production and income of farmers because farmers tend to increase technology adoption in the use of herbicide, fertilizer, and pesticide.

The older the cocoa plant, the more decreased the productivity of the plant. Based on the research results of average cocoa plants in the study area in the old category (15 years). It should have been done rejuvenation through side grafting techniques and top grafting. According to Rubiyanto & Siswanto (2012), one of the efforts to improve the productivity and quality of cocoa yield can be done by colonization technique by side grafting.

Young and medium plants are the result of rejuvenation through side grafting and top grafting. Improvement of production as well as plant rejuvenation through vegetative propagation into farmers solution. According to Limbongan & Djufry (2013) vegetative propagation can be applied depending on the availability of entres, farmers ability, success rate of connection and availability of supporting facilities. However, based on observations and discussions with farmers, the difficulty of obtaining upper stems resistant to pests and diseases as well as low farmer competence caused the high percentage of failure of side grafting process by farmers.

### 3.2 Interdependence of Farmers

The interdependence of farmers in this study is a manifestation of the ability of farmers in making decisions, produce quality cocoa beans and build partnerships. The interdependence of the farmers is good in terms of the ability to select appropriate and useful information (filter system), the ability to improve the quality of dry beans so as to have good quantity and quality (competitiveness) and the ability of farmers in partnering with entrepreneurs or business players (partnership). The ability of farmers to utilize advantageous information, implement planning-based farming, produce dry cocoa beans that have not complied with Indonesian National Standard (SNI) and ability to build a partnership with private sector, bank and industry is still valley (Table 2). The lack of interdependence of farmers allows farmers not to be directly involved in the marketing process, weak bargaining position, processing process dependent on the industry and the dry beans produced less in accordance with export standards. Increasing the interdependence of farmers creates space for farmers to develop filter system, competitiveness, and partnership.

Table 2. Distribution and number of cocoa farmers in Central Sulawesi Province based on the level of farmers' interdependence, the Year 2017

Interdependence	Measurement	Poso (%)	Sigi (%)	North Morowali (%)	Donggala (%)	Total (%)
Filter System (Score)	<b>Low (0-50)</b>	64,6	66,7	88,5	57,0	66,3
	Middle (50.01-75)	32,6	32,1	9,6	39,0	31,1
	High (75.01-100)	2,8	1,2	1,9	4,0	2,6
Average score		48,9	47,5	41,5	49,5	47,7
Competitiveness (Score)	<b>Low (0-50)</b>	91,0	91,7	92,3	92,0	91,6
	Middle (50.01-75)	8,3	7,1	7,7	7,0	7,6
	High (75.01-100)	0,7	1,2	0,0	1	0,8
Average score		34,1	31,4	24,6	30,7	31,3
Partnership (Score)	<b>Low (0-50)</b>	71,5	90,5	90,4	92,0	83,7
	Middle (50.01-75)	26,4	2,1	8,3	6,0	14,7
	High (75.01-100)		1,2	0,0	2,0	1,6
Average score		43,7	36,7	32,4	37,0	38,8

Description: n Poso = 144; n Sigi = 84; n North Morowali = 52; n Donggala = 100; Total = 380

According to Sumardjo, (1999; 2012), interdependence is the product of a series of stages, beginning with dependence, then becoming an independent and ending in interdependence or individuality (human capital) rather than individualistic. As a driving force of creative social-cultural energy of society (social capital) man is placed as the central and subject of the historical actors for his life or people-centered development.

Furthermore, according to Sumardjo (1999; 2015; 2016) and Sumardjo *et al.* (2014) Interdependence consists of the filter system, competitiveness, and partnership. The filter system, farmers who can make decisions, able to encourage the progress of farming and filter the rapid flow of information or innovation that is beneficial to the progress of farming (smart, anticipative, adaptive and actual). Competitiveness (effective, efficient and qualified) contains a collegial, sustainable and quality nuance resulting in sustainability as it contains an element of trust. Partnership ability to build cooperation with parties that can be profitable in development (partnering synergistically and interdependence).

### 3.2.1 Filter System

Based on the results of the research, the level of farmer's filter system in the low category (Table 2). This explains the level of decision making in the selection of farming information, innovation in managing resources and the actual environment optimally for the development of farming by cocoa farmers is still low. Based on observations and discussions with farmers, no information about the eradication of pests and diseases through harvest often (once a week), pruning, sanitation, and fertilization are not considered by farmers as well as the utilization of natural enemies in the control of pod borer such as ants. Mulyoutami *et al.* (2004) states that every farmer has an opportunity for access to outside or scientific information that is relatively different from each other. This is greatly influenced by the involvement of farmers in farmer groups that allow farmers to have contacts with outside information sources such as researchers and extension workers.

Cocoa farmers in Central Sulawesi still rarely make the decision to choose a useful source of information. This is because farmers still rely on conventional habits. Farmers let cocoa skin waste around the cocoa plant, allowing the plants to grow without any pruning, weed control is not done regularly, fruits that are blackened and the disease is not cleaned. In the case of decision-making, run farming is also influenced by others, more dependent on the direction of others and less confident farmers in developing cocoa commodity, the decision to manage the cocoa farming is less based on the consideration of the progress and requirement of farming.

According to Tarnoczi & Berkes (2010); Ali & Kumar (2011); Ali (2012); Verma & Sihna (2017) are increasingly available and a wide variety of information obtained by farmers has a greater impact on ideas, quality of decision making and farming practices. Farmers will be easy to make decisions and choose to apply information when observing what other farmers have done, trials or demonstrations on farmland. Furthermore, Ali & Kumar (2011) stated that farmers need relevant information about agriculture both on inputs of cultivation, processing and market support.

The ability of farmers to utilize information and innovation for low farming purposes. This is because many farmers apply information that is less useful for farming, information obtained from farmers that cacao crops can no longer be relied upon, cacao plants are time to be replaced with other crops that are judged more profitable (nutmeg, pepper, cloves, oil palm). This has an impact on the lack of farmers' desire to develop cocoa as a leading commodity in Central Sulawesi Province.

Instead of useful information and innovations for farming are always ignored. The control of cocoa borer pests through the use of black ants as predators, the lack of utilization of cocoa waste as animal feed and organic fertilizer, provides a cloak on cocoa fruits so that cocoa fruit borer insects cannot lay their eggs on the surface of

the fruit through the process of condomization by farmers. According to farmers in addition to requiring a relatively long time also requires a lot of costs to provide material sheath. The process of pruning to maintain the condition of the cocoa plant moisture so that sunlight can enter, balanced fertilization and frequent harvesting (once a week) as well as garden sanitation to break the development of pests, are also still less attention to farmers.

### 3.2.2 Competitiveness

Based on the result of research, farmer competitiveness level on low category (Table 2). This explains the ability of farmers in the development of cocoa farming effectively and efficiently can affect the low quality of yield and the level of market acceptance of the quality of cocoa beans. According to Hasibuan *et al.* (2012); Tresliyana *et al.* (2015) Indonesia cocoa beans products have not competitiveness due to low quality and has not adjusted to market demand. Observations and discussions with farmers, the low quality of cocoa beans caused the farmers to prioritize the quantity, the acquisition price received compared to the quality of the dried cocoa beans produced (Table 3).

Table 3. Competitiveness of dry cocoa beans in Central Sulawesi Province 2017

Competitive Character	Potential of Cocoa Beans Central Sulawesi	Seeds at Farmer Level
Dry Seed Size	Maximum AA 85 seeds per 100 grams or class A: 86 to 100 seeds / hundred grams	Seeds are black, wrinkled, incomplete and light
Water Content	<75 % (good)	Drying relies on long sunlight for about 4 to 5 days. The duration of drying varies according to the farmer's money requirements and the weather conditions at that time
Fat Content	The high content of fat, color, and distinctive flavour. Becoming industry desires	(1) The low fermentation process affects the fat content produced from the dried cocoa beans. (2) Increased cocoa pod borer (PBK) and cocoa blight ( <i>Phytophthora palmivora</i> )
Prices of Dry Seeds	Based on moisture content, no mold, and presence or absence of dirt on cocoa beans	(1) Sorting process at the farmer level has not been done, just rely on sieve/duku. (2) Looks moldy and there are fragments of skin and placenta
Availability of Results	Land area and yield potential of cocoa beans are always available	Has not been able to meet market needs due to low productivity and low quality
Infrastructure	Processing into powder and cocoa fat growing	(1) Processing still depends on the industry. (2) Roads are inadequate resulting in lower prices of dry beans, fertilizers and pesticides are relatively more expensive. Receipts received are not worth the expenditure of farmers

To improve the competitiveness it is necessary to improve the quality of seeds in accordance with world market demand conditions and prices that can benefit farmers. The results showed that the dried beans produced by farmers did not meet the Indonesian National Standard (SNI) due to the use of machete is still done by farmers to break the skin of cocoa fruit causing damage to cocoa beans. The average cocoa crops owned by farmers are still local varieties (have not done rejuvenation through side grafts and top grafting) as well as increasing pest infestation (cocoa pod borer) and VSD (vascular streak dieback) disease.

Production of dry beans of cocoa farmers in Central Sulawesi Province based on observations in the field, the results of discussions with farmers and traders still have a low quantity and quality. The low competitiveness of dry cocoa beans is due to low yield quality. In general, farmers have not done the fermentation process. The process of cocoa fermentation prior to export is considered important to improve the competitiveness of Indonesian cocoa. Also to answer the opportunity of the upward trend in prices of plantation commodities such as cocoa on the world market. The process of direct fermentation has an impact on the smell and color of cocoa beans. In addition, fermented cocoa beans can be used for the fat, meal, and paste. According to Rifin (2013); Naully *et al.* (2014) Indonesia's dry cocoa beans have a comparative advantage compared to those from Ivory Coast, Ghana, and Nigeria. Indonesia only needs to improve the quality of cacao paste and powder. Cocoa dry beans are processed into intermediate products such as cocoa butter, pasta or cocoa powder will be able to increase the sale value.

Raharto (2016) and Kongor *et al.* (2016) states that the quality of the dry beans produced annually

determines the feasibility and acceptability of cocoa beans in the industry. Good fermentation and drying enhances the formation of taste precursors in cocoa dried beans. As a superior commodity, cocoa beans at cocoa farmers' level in Central Sulawesi generally do not go through the fermentation process. Factors that inhibit the fermentation process due to the difference between the price of dried cocoa beans fermented and not fermented is very small, the fermentation process is considered complicated and takes a long time. According to Rifin (2013), dry cocoa beans originating from Indonesia are well used as a mixture because it has a distinctive taste and is not obtained from other cocoa-producing countries.

In the research area, the application of fermentation technology is less done because the price of fermented cocoa is uniformed with non fermented cocoa. According to farmers fermentation process takes a long time 5 to 6 days plus the drying process takes 4 to 5 days depending on the weather. The urgency of family needs resulted in less fermentation and the process of selling the proceeds following family needs. Sales will be made by farmers when dry beans have been collected in two or more harvests depending on the number of dry beans obtained from the previous harvest. According to one trader of Palu city S.H, traders are reluctant to buy dried cocoa beans that flat or flat due to low quality, good quality cocoa is dense and contains. The price of cocoa beans currently stands at Rp.30,000.00/kilogram, while the poor quality is only valued at Rp.22,000.00/kilogram. This may explain that seed quality is an important factor in increasing the selling price.

Cocoa farmers have not been able to meet the needs or market demand due to low production and quality of cocoa beans. Processing of dry cocoa beans to powder and cocoa fat has not been implemented because farmers prefer to sell dry beans without processing cocoa. The sale of dried cocoa beans can immediately make money. Processing that takes a long time and the need for adequate equipment is the reason farmers do not do the processing.

Farmers pay less attention to the quality of cocoa beans, preferring the quantity and price. The low attention of farmers on the quality of the results and the processing of ready-made cocoa cause the dry beans produced by farmers less able to compete with the yield of dry beans of other countries. According to Raharto *et al.* (2015); Lada *et al.* (2014), the manufacturing industry is developing in other countries, while Indonesia only exports raw materials. Most of Indonesia's cocoa production is exported because its payment is faster than processing cocoa beans into processed cocoa products with higher added value. Strong competitive cocoa commodities are characterized by high productivity, good product quality, and are able to produce products in quantity and variety according to market demand. According to farmers, the desire to do the processing there is but constrained by the unavailability of processing facilities and assistance process obtained by farmers.

### 3.2.3 Partnership

The ability of farmers to cooperate in developing cocoa farming based on mutual trust, mutual need, mutual dependability and mutual benefit is still low (Table 2). According to Purnaningsih (2007), the implementation of agribusiness partnership is important in order to achieve product quality according to the needs of consumers, the source of motivation is not merely economic profit but also business sustainability. Transparency is a principle to be applied and unfair treatment, harming the other, exploitation and manipulation are things to be avoided.

Cooperation with banks, industry and private sector is still low because cocoa farmers are still prioritizing their own capital in their business. The development of cocoa farming requires inter-institutional cooperation in the face of insufficient information problems, limited marketing infrastructure, difficult access to capital, dry bean processing into low-consumption products, local institutions that have not run well in line with farmers' expectations, and low private and industrial sectors attention to the needs of cocoa farmers. Farmers are less cooperative with banks due to low farmers' confidence, farmers are not convinced to make the process of return with large interest, not to mention price and cocoa production fluctuate causing unstable income, complicated administration, and processes that take days even for weeks.

According to one farmer A.W from Poso, why to make it difficult for him to borrow money to the bank, it is difficult to restore. Better not have the money, the most important do not have debt. On the other hand, other farmers stated that farmers are easier to borrow through collecting traders with the debt bond system because, without administrative requirements and high interest, it only requires a payment pattern using dry cocoa beans. Farmers every month or every sale process deliver the dry beans to the collecting merchant until a specified time limit, based on the amount of dry weight and the amount of money borrowed by the farmer. According to Said (2010), the farmers' attachment to collecting traders through the debt bondage system is difficult to eliminate in some cocoa centers because their function is to help procure the costs and needs of the farmers in advance (ijon).

According to Sumardjo (1999: 2010), that building farmers as the main perpetrators of reliable agriculture means building interdependence of farmers. So far, the success of agriculture is only measured by the increase of production, while the interdependence of farmers is less attention and neglected. According to Bitzer & Bijman (2014); Bjarstig & Sandstrom (2016) establishing partnerships is the key to increasing market access for farmers and becoming a tool for improving rural development.

Listyati *et al.* (2014) stated that the form of business partners will provide benefits to farmers such as the availability of agricultural products market for farmers and farmers to avoid the risk of price fluctuations. Based

on discussions with farmers, community leaders, and extension agents, cocoa trading companies in Central Sulawesi include PT Almajaro, PT Mars Indonesia, PT Cargill Indonesia and Tanah Mas Celebes. PT Almajaro made the demonstration plot cooperate with farmers in applying the PsPSP method (frequent harvest, pruning, sanitation, and harvesting) and the application of side-grafting method and top grafting.

Based on the results of research district collectors traders do not directly sell to wholesalers or exporters but do day care until prices are considered adequate traders. District collector traders receive pricing information applicable to each day obtained from wholesalers or exporters via short messages from mobile phones. Considerations of district collector traders have not yet directly made a sale to exporters related to the cost efficiency incurred in marketing as well as the benefits to be received.

Farmers have collaborated with Syngenta companies through the application of pesticides in controlling pest and disease attacks, for example, Alike to eradicate the pests of PBK (cocoa pod borer) and Gramaxone as herbicides eradicate weeds on cocoa plants. The cooperation was not effective and unsustainable due to the participation of farmers following activities only because of incentives such as fertilizers, insecticides, herbicides, and crop maintenance money. According to Syahyuti, (2004) cooperation with the agency may not work, run but not effective, uneconomical and unfair to some parties specifically farmers. The result of the research shows that the cooperation done by private companies is aimed at promoting and obtaining the right of sale and purchase of dry beans between farmers and buyers without the cooperation of mutual trust, mutual need, mutual reliable, mutual benefit. The ongoing cooperation only aims to increase production through increasing production inputs without increasing self-employment of farmers and maximizing their potential.

### **3.3 Productivity of Cocoa Farming**

Low yield productivity, dry cocoa beans quality, fluctuating prices have an impact on the low income of farmers. The process of plant maintenance conducted by farmers in Central Sulawesi influenced the price, the higher the selling price of dry beans, the more motivated farmers to improve the maintenance of plants with the aim of increasing production and income.

Based on the results of research and interviews with farmers obtained information that many cocoa farmers are switching from cultivating cocoa to construction workers in Palu city as the capital of the province due to low cocoa prices. According to them the best price for farmers in the range of Rp 30,000.00/kilogram to Rp.35,000.00/kilogram. The price, according to farmers after deducting maintenance costs, can still provide benefits but if prices are lower cocoa farmers have a great opportunity to lose.

#### **3.3.1 Productivity of Dry Cocoa Beans**

The yield of dry cacao seeds obtained by farmers per unit of land is low of 0.8 ton/year (Table 4) compared to the cocoa potential of 2 tonnes of dry bean per hectare per year (Rubiyo & Siswanto 2012). This is due to the increasing intensity of pests and diseases and the age of the cacao plant is already 15 years old. According to Ermiami *et al.* (2012) cocoa plants can produce up to age more than 20 years, depending on the seed used and the treatment. For 20 years, cocoa farming with good conditions at the farm level is able to produce dry seeds of 13.14 tons/hectare.

Based on the results of the research, the decrease in production from the previous year was 0.2tons/hectare. The decline in productivity caused by El Nino impacted the decline of harvest time, post-harvest, marketing, and production decline. According to Sahardi *et al.* (2005) decreased cocoa productivity decreased due to low maintenance of the garden and cocoa pod borer (PBK).

The challenge of cocoa plantations in Central Sulawesi requires farmers to behave interdependence, make informed decisions that benefit farms, utilize useful information and innovations for farming, apply appropriate technology to site conditions in an effort to increase the price of dry cocoa beans and enhance cooperation among private institutions, industry, banks, and governments. Changes in the farming environment both pest and disease attacks and low farming production is no longer a problem in farming if the farmer has been interdependence.

Table 4. Distribution and number of cocoa farmers in Central Sulawesi Province based on farmers' productivity and income, the Year 2017

Productivity	Measurement	Poso (%)	Sigi (%)	North Morowali (%)	Donggala (%)	Total (%)
Productivity Farmers (Score)	<b>Low (0-50)</b>	81,9	83,3	96,2	98,0	88,4
	Medium (50.01-75)	16,0	15,5	3,8	2,0	10,5
	High (75.01-100)	2,1	1,2	0,0	0,0	1,1
Average score		37,4	34,5	24,5	24,9	37,4
Income (Score)	<b>Low (0-50)</b>	84,0	83,3	96,2	98,0	89,2
	Medium (50.01-75)	13,9	10,7	3,8	2,0	8,7 2,1
	High (75.01-100)	2,1	6,0	0	0,0	
Average score		47,5	57,5	51,3	24,7	44,2

Description: n Poso = 144; n Sigi = 84; n North Morowali = 52; n Donggala = 100; Total = 380

### 3.3.2 Farmers' Income

The income of cocoa farmers in Central Sulawesi Province is low (Table 5). The low income is influenced by the low production and the amount of expenditure by farmers, the high average expenditure for the purchase of fertilizer is Rp.580.751,00/ hectare, herbicide Rp. 509.666,00/hectare, pesticide equal to Rp.869.112,00/hectare, the labor of Rp. 917.908,00/hectare, depreciation cost of equipment amounting to Rp.863.207,00/hectare and transportation costs from the garden to the drying place, from the drying place to the selling point of Rp.836.979,00/hectare.

The income of cocoa farmers in Central Sulawesi Province is low (Table 4). The low income is influenced by the low production and the amount of expenditure by farmers, the high average expenditure for the purchase of fertilizer is Rp.580,751.00/hectare, herbicide Rp.509,666.00/hectare, pesticide Rp.869,112.00/hectare, labor Rp.917,908.00/hectare, depreciation cost of equipment equal to Rp.863,207.00/hectare and transportation cost from garden to drying place, from drying place to selling point Rp.836,979.00/hectare.

The income of cocoa farming is the difference between the amount of the sale and the production cost. Gross revenue (output) and production cost (input) are calculated per hectare. The income of cocoa farmers in Central Sulawesi Province is influenced by high, medium and low farmers' expenditure and income from the sales of dry cocoa beans per year. Average farmer expenditure per year/hectare is Rp.5,379,451.00, receipt of Rp.21,280,295.00 and farmer income in every year is Rp.15,900,844.00. According to Yanuardy (2014), farmers' income is also dependent on extreme weather changes, the price of cocoa beans regulated by traders and speculators and on chemical fertilizers and pesticides provided by farmers.

The income of cocoa farmers in Central Sulawesi Province is based on an average of Rp.1,325,030.00/month. This shows that the income of cocoa farmers is still below the minimum wage of Central Sulawesi Province of Rp.1,807,775.00/month. The price received by unstable farmers is influenced by collectors or middlemen who manage cocoa prices. The price received by farmers is adjusted to the price set by traders and farmers do not have bargaining position to participate in determining the selling price. To earn a satisfactory income from the sale of cocoa beans, the farmer is required to be careful in studying the price development as a solution in determining the choice whether he decides to sell or withhold production. But for cocoa farmers who generally rely on farming, they always have no ability to withstand dry beans unless other needs can be met without selling cocoa crops. Farmers follow the price determined by traders resulting in income earned by farmers in Central Sulawesi, Indonesia is low. There is a need for government intervention as a policymaker in determining the standard selling price and sanctioning traders who do not comply with the standard price set by the government. In addition, the government also needs to improve the road infrastructure to each cocoa plantation, the distribution of dry beans from the cocoa garden to the drying and the road from the drying place to the selling point.

## 4. Discussion

Increasing the production of dry cocoa beans and farmers' income is influenced by the improvement of farmers' ability to filter information or innovation that is beneficial to farming, to improve the quality of cocoa beans in accordance with Indonesian National Standard (SNI) to meet regional market needs and increase cooperation with industry, private.

Cooperation with banks, industry, and marketing is still low. The lack of cooperation on the basis of mutual trust, mutual need, mutual dependability and mutual benefit results in low income earned by farmers. According to Bitzer & Bijman (2014) that such cooperation in developing countries has a goal on issues of how to increase production, income so that farmers can be independent.

Based on the results of interviews and observations in the field, cocoa farmers prioritize the quantity regardless of the quality of dry beans. And cocoa produced by farmers is not through fermentation process.



According to Hasibuan *et al.* (2012) improvement of cocoa bean fermentation can improve cocoa product competitiveness. According Anantanyu (2011) that the institute is able to contribute in improving the interdependence and dignity of farmers. The weak institutional role in Central Sulawesi in increasing cocoa farmers' interdependence on the basis of mutual trust affects the low level of cooperation between farmers and the private sector.

According to Best *et al.* (2005); Choundhary *et al.* (2014)) globalization is now a challenge for farmers who want to develop their farming. To cope with increased business volatility and competition, farmers need to improve their filter system, competitiveness and partnership. Regression test results show a positive influence on filter system and competitiveness to increase the productivity of cocoa farmers in Central Sulawesi.

Table 5. The regression coefficient level of interdependence the farmers to increase the productivity of farmers in Central Sulawesi Province

Indicator	Farmers' Productivity		
	Regression Coefficient	t	Sig.
<i>Constant</i>	1,204	12,393	0,000
Filter System	<b>0,273</b>	3,945	0,000**
Competitiveness	<b>0,196</b>	3,022	0,003**
Partnership	0,040	0,568	0,571

Description: \*\* Significant at the level of  $\alpha = 0.01$

The regression equation is:  $Y = 1,204 + 0,273X_1 + 0,196X_2$   $R^2 = 0,30$ . Simultaneously the influence of interdependence can be explained by 30 percent while the rest is explained by other variables that have not been contained in the equation. The regression equation illustrates the increasing ability of farmers to utilize useful information for cocoa farming (filter system) can have an impact on increasing the productivity of farmers and increasing the quality of dry beans of cocoa farmers in accordance with market demand (competitiveness) will also increase the productivity of farmers. While the partnership has no significant effect on productivity improvement due to weak cooperation between private institutions, banks, and industries in support of cocoa farming (Table 5).

Weak cooperation between farmers with private and industry due to industry and private just want to meet the needs of dry cocoa beans production, its products sell well like fertilizers, pesticides, and insecticides. Cooperation with banks is lacking farmers in cocoa development due to difficult administration and mistrust of themselves to pay back capital so that farmers have difficulty accessing credit and still developing their business without bank support.

According to Bitzer *et al.* (2012) cooperation in developing countries has a purpose and revolves around issues of how to increase production, income and increase farmer interdependence. Increased production and income will be influenced by the ability of the farmers to develop the cocoa commodity according to the standard of cultivation, harvesting and postharvest so that the yield of cocoa beans is acceptable and can be seeded based on the quality of cocoa as per SNI (Indonesian National Standard).

Basically, cooperation with industry, banks and private parties is built on the basis of mutual support from the aspects of information, farming needs, financial and social support. The cooperation is not based on the industrial relations, the banks, the private beneficiaries but the sharing of resources, the risk of business failure and the sharing of expertise of industry, bank, private to farmers.

#### 4. Conclusions

Farmers productivity and income in Central Sulawesi Province is low due to the low level of farmers' interdependence (filter system, competitiveness, and partnership). Increasing the level of interdependence of farmers has an effect on increasing production and income of farmers. Improved cooperation between the private sector, bank, industry, and farmers is conducted on the basis of mutual trust, mutual need, mutual cooperation and mutual benefit.

Increasing the interdependence of cocoa farmers is focused on the ability of farmers in filter system, competitiveness, and partnership. Development is focused on improving: (1) the ability of farmers to decide appropriate fertilizer for cocoa fields in an effort to increase the productivity of cocoa, (2) the ability to decide appropriate pesticides in combating cocoa plant pests, (3) the ability to identify and solve the problem of low cocoa clones (4) improving the quality of dry beans through fermentation process, (5) producing cocoa beans according to Indonesian National Standard (SNI), (6) the ability to expand cooperation between industry, private and extension agencies in the process of capital provision, extension process and marketing.

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