

BUILDING A BUSINESS CASE FOR CONSERVATION

Cacao value chain analysis in Sintang
West Kalimantan

Implemented by:



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Cacao beans after going through the fermentation process

EXECUTIVE SUMMARY



Cacao fruit harvest



Cacao beans at the dryer facility

Kopernik, supported by Ford Foundation and Climate and Land Use Alliance (CLUA), aims to build business cases for environmental conservation. To achieve this, Kopernik partners with Lingkar Temu Kabupaten Lestari (LTKL) and Credit Union (CU) Keling Kumang to map and analyze the cacao value chain in Sintang, West Kalimantan. This report discusses the potential development of cacao as a sustainable commodity to support Sintang's economy whilst ensuring lands continue to be protected.

Currently, oil palm and rubber are the top commodities in Sintang. However, the fluctuation of commodity prices that tend to decline have impacted the income of smallholder farmers. In addition, the monoculture nature of oil palm plants have negatively impacted on soil quality and the surrounding environment. To address this, the government of Sintang (with the support of relevant stakeholders) aims to introduce cacao as an alternative commodity to be developed in Sintang.

Cacao has high endurance and can grow side by side with other plants, which can potentially help farmers improve their income. The limited technology, knowledge and skills of farmers toward good production and processing, unfortunately, have negatively affect the productivity and sales, thus not profitable.

The inability of farmers to see any economic benefits from cacao plantation makes it prone to being converted into palm plantation, or being sold to outsiders. Therefore, increasing farmers' capacity will increase the productivity and quality of harvests, which eventually can be sold at a price point that benefit the farmers.

The study was conducted for three months in Sintang which involved cacao farmers, middlemen, cacao experts, and several cacao bean processing business owners. The information presented in this report is the result of our observation in the field that will hopefully be able to provide a better understanding of the potentials to develop cacao as a sustainable commodity in Sintang.

EXECUTIVE SUMMARY

To develop a business case through conservation, Kopernik conducts the study following these steps: **identification of land ownership, initial assessment and collaboration, research & experimentation, and replication**

PHASE I

PHASE II

IDENTIFICATION OF LAND RIGHTS GRANTED

- Identify land and communities at risk of being unproductive or converted into palm plantation

ASSESSMENT & PARTNERSHIP

- Identify commodities that are environmentally sustainable and economically viable.
- Build partnerships with the local government and community.

RESEARCH & TESTING

- Map and analyze the commodity value chain starting from production to consumption.
- Design and test simple technology to improve process.
- Proof of concept

SCALE UP/REPLICATION

- Scale up simple technology by local community organizations with the support from local government

NEXT STEPS

Based on the success of activities in Sintang, Kopernik sees this as an initial step in supporting the development of business for conservation at the local level. Therefore, Kopernik aims to continue developing business cases in other regional areas to ensure lands continue to be protected.

LOCATION:

- Sanggau
- Sintang
- Siak

TIMEFRAME:

- Jan 2020 – Des 2021

ABOUT THIS REPORT

The discussion on cacao will concentrate on four aspects: **economic sustainability, availability of resources, environmental sustainability, and post-harvest processing**



ECONOMIC SUSTAINABILITY

Cacao commodity economic sustainability refers to the potential yield of cacao beans to meet market share.

With efforts to strengthen market access and the need for plantation equipment, farmers are expected to be able to increase their income from cacao plantations and meet future national cacao demand.



AVAILABILITY OF RESOURCES

The availability of resources refers to the capacity of farmers and stakeholders who can support the sustainability of cacao plantation activities in Sintang.

Supporting factors such as infrastructure, access to capital loans, access to markets, training, and assistance will influence the successful development of cacao agribusiness in Sintang.



ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability refers to efforts to harmonize infrastructure and economic development of the community with nature conservation. In addition to its commercial value, cacao can grow side by side with other forest plants (agroforestry), so that the preservation of nature is maintained.

This agroforestry system will not reduce production output, so it is highly recommended because it is more beneficial for the environment.



POST-HARVEST PROCESSING

Postharvest processing refers to the experiment of drying cacao beans using a solar dryer. It aims to improve the quality of dried beans in order to meet the quality standards of cacao beans in the market. This experiment was conducted with farmers and Keling Kumang CU in Penyangka, Sintang. Dried beans are tested by measuring the moisture content and cut test.

ABOUT THIS REPORT

Farmers' challenges in growing cacao can be grouped into **external and internal challenges** that directly affect cacao productivity.

EXTERNAL



Limited financial CAPITAL prevents farmers from buying supporting facilities such as fertilizer, which has an impact on cacao productivity



Poor INFRASTRUCTURE from/to cacao plantations results in long travel time for cacao transportation which is at risk of damaging wet beans



MARKET ACCESS and information on minimum prices compel farmers to sell cacao beans at low prices. Often prices are determined by intermediaries based on subjective assessments of the quality of farmers' cacao beans

INTERNAL



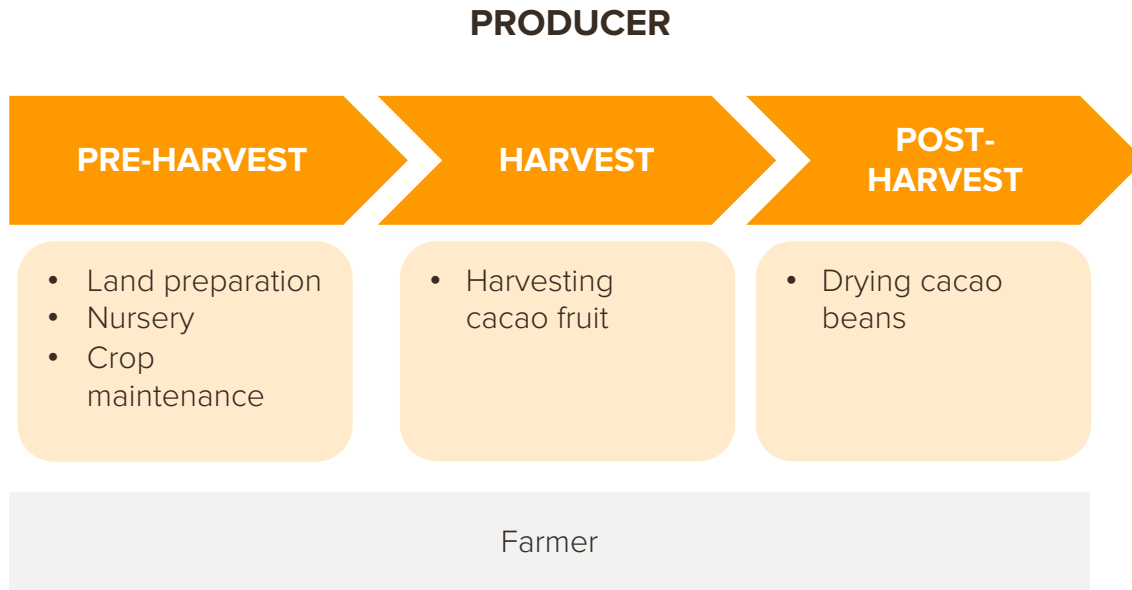
SKILLS and knowledge of farmers, especially in post-harvest seed processing are still minimal, so it is common for farmers to choose not to harvest and sell cacao beans if there are no buyers



MOTIVATION of the farmers tends to decrease due to external challenges, resulting in low productivity and minimal quality of cacao bean, impacting farmers income

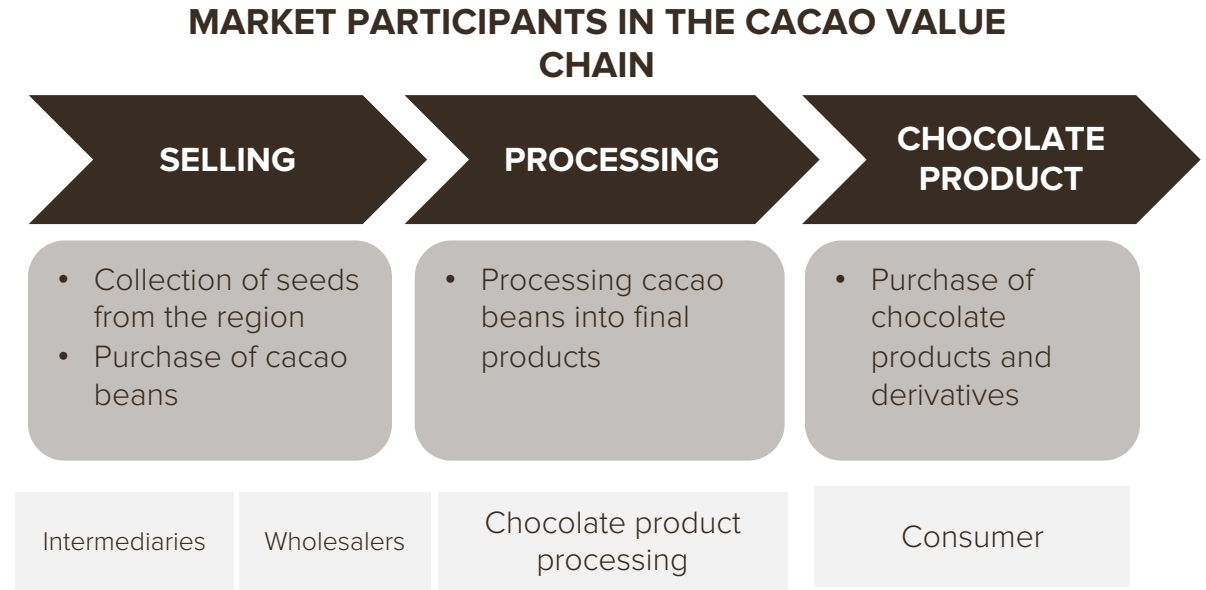
ABOUT THIS REPORT

The following mapping of the **cacao value chain** in Sintang aims to understand the farmers' readiness to run a cacao plantation. Most farmers are still in transition from rubber and oil palm plantation, therefore cacao farming is not yet maximized



OCCUR IN SINTANG

The pre-harvest, harvest and post-harvest activities carried out by farmers are still very simple. Besides still having to take care of other staple crops such as rubber and palm oil, farmers have not seen cacao as an alternative commodity to help their income due to various external and internal constraints.



OCCUR OUTSIDE SINTANG

Due to the unavailability of markets in Sintang, farmers had to bring and sell their dried seeds to intermediaries in the Sekadau, Entikong and Beduai areas at low prices. These intermediaries will then sell farmers' cacao beans to a larger market.

ABOUT THIS REPORT

Cacao value chain – market participants

The cacao market in Indonesia is generally divided into artisan chocolate markets (Sorga Chocolate, Krakakoa), large producers (Mars, Cargill), and producers of chocolate blended products. Each of these market types has different quality requirements, depending on the type of product. To produce chocolate mix products, for example, premium quality cacao beans are not needed. Cacao beans from Kalimantan are generally sold to intermediaries at low prices, which are ultimately sold to large traders to make chocolate mix products.

Selling prices in the cacao value chain (per kg)



* Cacao price data based on <https://www.icco.org/> per October 2019

** The price of artisan chocolate bars with processing, IDR. 50,000 / stick 50g

Middlemen buy dried cacao beans from farmers at a price of **IDR 16.000/kg** (Indonesian cacao beans are generally bought at 48.5% of the world market price of IDR 33,000). This price is obtained because the seeds are generally not fermented and well dried.

ABOUT THIS REPORT

Action steps – farmer capacity development

The capacity building of farmers aims to improve the technical skills of farmers in farming. Interventions can be in the form of workshops, intensive training, and direct assistance. The following concept of capacity building for farmers starts from evaluating the level of knowledge of farmers to determine appropriate interventions in channeling knowledge and skills so that farmers can optimally implement good practices.

The concept of capacity building for farmers

Assessment

Limited knowledge



- Agriculture facilitators from both the government and the private sector first evaluate the level of knowledge of farmers in technical and management aspects related to cacao.

Intervention

Transfer of knowledge and skills



- Based on the evaluation results, the facilitator determines the form of intervention to be distributed to farmers. Interventions can be in the form of intensive assistance or training with adjusted materials depending on the farmers' needs.

Result

Optimization of practices in the field



- Farmers can optimize the results of the intervention through field practice. The new method is expected to increase crop productivity and the quality of cacao beans as a commodity in Sintang. Advanced farmers are expected to be able to teach other colleagues to get similar results.

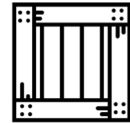
ABOUT THIS REPORT

Action steps – use of solar dryers

In order to improve the quality of seeds, experiments carried out using solar dryers have succeeded in drying the seeds according to market standards. Therefore, farmers are advised to use this dryer with the following methods:



FERMENTATION FRUIT SHELLS



FERMENTATION PROCESS



SOLAR DRYING PROCESS



DRIED SEEDS ARE READY TO SELL



- Cacao fruit is split to collect the beans, followed by the sorting to separate good beans and the insects infested or bad ones.

- In a wooden box, the cacao beans are fermented for five days. During the fermentation process, there will be a severe shrinkage of 19%.

- After completing the fermentation process, the cacao beans are dried in a solar dryer for 5-7 days to reduce the moisture content.

- Cacao beans are ready to be marketed.

ABOUT THIS REPORT

Action steps – support from local government and farmer activists in developing partnerships

The development of cacao plantations in Sintang requires cooperation from related parties such as the government in terms of mapping and data collection, the private sector in strengthening market access, and farmer experts in mentoring. Coordination between all parties is needed to enhance the program and develop partnerships with stakeholders outside the Sintang region.

The concept of developing partnerships is supported by the government and farmer experts to strengthen the cacao farmer's business

Approach to partners



- Identify business connections that can connect farmers with potential partners.
- Study the needs and interests of potential partners.
- Connect with potential partners through effective communication.

Business development and implementation



- Identify business risks.
- Develop business concepts that benefit both parties.
- Implement business concepts following agreed plans.

Business supervision







- Conduct periodic visits to exchange information.
- Identify challenges in doing business with partners, and help to find solutions



The farmer explains the condition of his cacao crops.

BACKGROUND

Sintang regency profile

ASPECT	DESCRIPTION
 Regional Conditions	<ul style="list-style-type: none">• District Area 21.635 km² with the dominance of hilly areas by 63%
 Climatic Conditions	<ul style="list-style-type: none">• Tropical (high humidity and rainfall)• Rainfall intensity is 249.08 mm / month• Rainy days 17 days / month
 Demographic Characteristics	<ul style="list-style-type: none">• Total population of 398,663 inhabitants• Population density of 27 people / km²
 Economic Conditions	<ul style="list-style-type: none">• The agriculture, forestry and fisheries sectors are the largest contributors to district revenues (25,97%)• The contribution of the agricultural sector has continued to decline from 2010 while the construction sector has continued to increase, which shows the ongoing development of infrastructure in Sintang

The environmental and demographic profile of Sintang Regency supports the development of cacao plantations, especially in terms of the many hilly areas and climate conditions.

CACAO AS AN ALTERNATIVE COMMODITY

The decline in rubber and palm oil prices at the farm level in recent years has reduced Sintang farmers' welfare. Therefore, in 2017, the Sintang District Government has added coffee and cacao as superior commodities as an alternative for farmers.

FORM OF SUPPORT TO FARMERS IN SINTANG

So far, the Sintang Plantation Service has provided agricultural counseling to farmers. The government is also targeting the expansion of plantation areas through the provision of seeds and fertilizer to farmer groups.

FORM OF SUPPORT TO NATURAL SUSTAINABILITY

In an effort to support the preservation of nature and biodiversity, the Regency Government no longer gives permission to open oil palm plantations. The government supports the development of cocoa because it is more environmentally friendly and supports the people's economy.

CURRENT PRODUCTIVITY

At present the cacao plantations in Sintang are still not popular and are not optimally managed. Cacao is planted among rubber trees, where the treatment is likened to rubber trees. This causes the productivity of cacao to be low, at **66 kg/ha**, compared to the national average production of **803 kg/ha**.



**ECONOMIC
SUSTAINABILITY**



**AVAILABILITY OF
RESOURCES**



**ENVIRONMENTAL
SUSTAINABILITY**



**POST-HARVEST
PROCESSING**

ECONOMIC SUSTAINABILITY

Background – Indonesia is the third largest producer of cacao beans in the world in 2017 with a total production of 659,776 tons of cacao beans. Even so, Indonesia still needs to import 270,200 tons of cacao beans to meet domestic needs. This shows the potential for the development of the country's cacao beans production. West Kalimantan as one of the regions with suitable regional profiles for cacao cultivation, began to look at these opportunities.

The Government of Sintang Regency and Keling Kumang Group, in this case PT. BAM, started to revive the cacao plantations which had been abandoned by farmers due to lack of motivation and knowledge. With efforts to strengthen access to inputs and markets, farmers are expected to be able to benefit from cacao plantations and contribute to meeting national cacao needs in the future.



Test of moisture content of the cacao beans being dried.

The results of interviews with farmers showed that farmers have not optimally processed and sold cacao. It is considered not profitable because of the absence of the market.

RESPONDENT STATEMENT



“I sold my cacao to Beduai (6 hours from Sintang), taken while visiting relatives there. I brought 20 kg in a carton and sold IDR. 20,000 a kilo, not bad for the bus fare” (Farmer Y, Sintang)

“I have never sold cacao from my garden. I once tried to harvest and dry, only got 5 kg and there were no buyers, I finally threw it out because it was moldy” (Farmer L, Sintang)



“The price of cacao is good, but there are no goods. There used to be farmers who sold up to 300 kg, but since last year no one else has sold cacao to my shop” (Middleman A, Sekadau)

ECONOMIC SUSTAINABILITY

Cacao has potential to support the farmers economy up to IDR 30.000.000/hectare, however, this potential can only be achieved with **optimal productivity and good quality, as well as market access**

Below are three different scenarios that are often experienced by farmers, namely:

- Scenario A – low productivity, low seed quality, and generally harvests are bought by intermediaries.
- Scenario B – high productivity, harvests are bought by intermediaries because of limited market access.
- Scenario C – high productivity with high quality seeds and have access to large buyers or processing plants.

COMPONENT	SCENARIO A	SCENARIO B	SCENARIO C
Condition	The area of the garden is 1 ha with, 1,000 productive cacao trees		
	<ul style="list-style-type: none"> • Low productivity • Non-premium quality • Consistent market (middleman) 	<ul style="list-style-type: none"> • High productivity • Non-premium quality • Consistent market (middleman) 	<ul style="list-style-type: none"> • High productivity • Premium quality • Consistent market (factories and big buyers)
Initial investment *	<ul style="list-style-type: none"> • Purchase of equipment IDR 1,000,000 	<ul style="list-style-type: none"> • Purchase of seeds IDR 10,000,000 • Purchase of equipment IDR 1,000,000 	<ul style="list-style-type: none"> • Purchase of seeds IDR 10,000,000 • Purchase of equipment IDR 1,000,000 • Making fermentation boxes and dryers IDR 5,000,000
Maintenance costs**	<ul style="list-style-type: none"> • IDR 3,290,000 	<ul style="list-style-type: none"> • IDR 6,720,000 	<ul style="list-style-type: none"> • IDR 6,880,000
Estimated sales of dried beans	<ul style="list-style-type: none"> • IDR 6,400,000 (1,000 trees x 0,4 kg x IDR 16,000) 	<ul style="list-style-type: none"> • IDR 6,400,000 (1,000 trees x 0,4 kg x IDR 16,000) 	<ul style="list-style-type: none"> • IDR 33,000,000 (1,000 trees x 1 kg x IDR 33,000)

It is hoped that more farmers can switch to scenario C where prices are much better

* Initial investment based on interviews with PT BAM

** The calculation of costs is based on the publication of a financial analysis of the diversification of smallholder cacao and goat farming at the farm level, 2014

ECONOMIC SUSTAINABILITY

Scheme of cacao development with the inclusion of KKG as a private party in the value chain

KKG is one of the cooperatives in West Kalimantan that supports the development of cacao plantations to improve the economy of farmers. PT BAM, which was established by KKG, provides cacao seeds, and also buys cacao beans (wet and dry) directly from farmers and distributes them to processing plants. With PT BAM in the value chain, farmers can sell their crops more easily in Sintang. The existence of PT BAM leads to the achievement of Scenario C by providing access to seeds, maintaining product quality by conducting post-harvest processing, and connecting farmers to the market.

The role of PT. BAM as a private party in the cacao value chain in Sintang



ECONOMIC SUSTAINABILITY

To increase cacao productivity in Sintang, there are three main factors that need to be considered by the government, private sector, and farmers: access to inputs, infrastructure, and market access.

STAKE HOLDERS	CURRENT CONDITION		
	Input Access	Infrastructure	Market Access
Government	<ul style="list-style-type: none"> • Provided assistance of IDR 125,000,000 in the form of seeds and fertilizer for farmer groups. 	<ul style="list-style-type: none"> • Road infrastructure to cacao plantations in Sintang and surrounding areas is still inadequate. This condition takes a long time to bring cacao so that it risks damaging wet cacao beans. 	<ul style="list-style-type: none"> • Cacao was developed in the Entikong and Ambalau areas through a government program but was not equipped with clear market information.
Private Party	<ul style="list-style-type: none"> • PT BAM sells superior cacao seedlings ready for planting and Keling Kumang Credit Union provides financial loans that make it easy for members. 	<ul style="list-style-type: none"> • KKG is building a cacao processing center in Sintang for fermentation and drying beans. 	<ul style="list-style-type: none"> • PT BAM will buy wet cacao beans from farmers for further processing and selling to the domestic market.
Farmer	<ul style="list-style-type: none"> • Farmers plant cacao from seeds that were previously provided through government programs and seeds found from the surrounding environment. • Application of fertilizers and pesticides is done together with rubber plants (1-2 times / year) due to lack of knowledge about good agriculture. 	<ul style="list-style-type: none"> • The condition of road infrastructure in Sintang that is still developing causes farmers can only sell to intermediaries located close to the plantation. 	<ul style="list-style-type: none"> • Farmers have no knowledge of the cacao market other than through intermediaries. The selling price is determined by the middleman depending on the subjective assessment of the quality of the cacao beans.

RECOMMENDATIONS

Provision of plantation inputs that can be easily accessed by farmers, intensive training and assistance

Improvement of infrastructure access through the construction of roads from farmers' plantation areas to urban areas

Development of direct collaboration with chocolate processing plants.



**ECONOMIC
SUSTAINABILITY**



**AVAILABILITY OF
RESOURCES**



**ENVIRONMENTAL
SUSTAINABILITY**



**POST-HARVEST
PROCESSING**

AVAILABILITY OF RESOURCES

Background - The majority of farmers now grow rubber as their main livelihood. The practice of growing cacao is usually following the treatment given for rubber. In addition, many farmers plan to plant cacao between their rubber plantations. This practice is not recommended because cacao and rubber have almost the same type of disease that allows rapid spread in one agricultural land.

Before starting to plant cacao, farmers must have knowledge about good practices to avoid the spread of pests and diseases and maximize productivity. In this case, collaboration is needed from the government and other stakeholders to strengthen the capacity of farmers.



Farmers do the top grafting to get strong trees that bear a lot of fruit.

The results of interviews with cacao farmers showed that farmers who had already planted cacao in general did not yet know how to plant and the right way to maintain cacao. On the other hand, farmers are interested in growing cacao after knowing the final product. They also look eager to learn and practice it in their garden. Some farmers have the opportunity to learn about cacao in the Philippines with KKG, and will help their fellow farmers when planting begins.

RESPONDENT STATEMENT



"I first planted cacao from government seedlings two years ago, taking it from around the unattended village in Melawi. I thought until 5 years later, people would still consume chocolate, but when I planted I didn't know how to treat it"
(Farmer J, Sintang)



"When I went to the Monggo chocolate factory in Lampung, I found out that it was the result of a tree that I had at home. So far I do not know how to process it"
(Farmer E, Sintang)



I get information traditionally. Breeding by tugal, such as planting cuttings by transferring it to the soil and then will grow on its own. Following people first because there is no education about cacao planting."
(Farmer S, Sintang)

AVAILABILITY OF RESOURCES

To increase the capacity of human resources, especially farmers, it is necessary to increase **access to information** as well as **training and assistance** -particularly in the early stages of planting activities.

STAKEHOLDERS	CURRENT CONDITION	
	Access to information	Training and assistance
Government	<ul style="list-style-type: none"> Representatives from the Agriculture and Plantation Service were sent to Jember to learn about cacao at the Coffee and Cacao Research Center. 	<ul style="list-style-type: none"> The government assigns Field Agricultural Instructors (PPL) to assist farmers based on work area, but there is no specialization based on commodities, especially cacao.
Private parties	<ul style="list-style-type: none"> PT BAM sent its representatives and several farmers to attend training in the Philippines on cacao cultivation and processing. 	<ul style="list-style-type: none"> PT. BAM and KKG hold workshops on cacao to motivate farmers. PT. BAM provides assistance to farmers who want to start planting cacao. KKG has a Self Help Group sub-unit whose job is to assist farmers.
Farmers	<ul style="list-style-type: none"> Sources of knowledge about agriculture practices reported by farmers are from self-taught learning, hereditary practices, and examples from other farmers. Farmers do not yet know post-harvest processing techniques such as good fermentation and drying, so far they rarely harvest and sell cacao beans to the market. 	<ul style="list-style-type: none"> Farmers have never received training and assistance before planting cacao, but they are quite open and expect assistance to produce maximum yields later.

RECOMMENDATIONS

Provision of information sources that can be easily and freely accessed by farmers about how to plant and process cacao properly.

Providing initial training and assistance for farmers who are just starting to plant cacao.



ECONOMIC
SUSTAINABILITY



AVAILABILITY OF
RESOURCES



ENVIRONMENTAL
SUSTAINABILITY



POST-HARVEST
PROCESSING

AVAILABILITY OF RESOURCES

Background - As the initiator of the District Collaborative Forum to Achieve Sustainable Development in Indonesia consortium, Sintang Regency seeks to harmonize community infrastructure and economic development with ENVIRONMENTAL SUSTAINABILITY, one of which is by including cacao as a superior commodity in Sintang RPJMD 2016-2021.

In addition to functioning as a commercial commodity, cacao can grow harmoniously in a protected forest buffer zone that borders the forest area with areas of community activity to protect the forest from damage. Besides that, cacao can also grow under the shade of other trees thereby increasing carbon storage capacity and supporting the preservation of biodiversity in the plantation environment.



Cacao tree in the middle of a rubber plantation, Tempunak, Sintang.

Discussions with relevant stakeholders (Plantation Office and PT BAM) indicate that the development of cacao plantations in Sintang will be directed to sustainable plantations and minimize the use of synthetic chemicals.

RESPONDENT STATEMENT



“PT BAM's representatives and several prospective accompanying farmers participated in training at Ralve Gourmet Inc., Philippines on agriculture practices and sustainable cacao processing. This planting practice is directed towards organic farming by minimizing the use of fertilizers and pesticides and other synthetic materials in land preparation, planting, and maintenance. The results of this training will be distributed to cacao farmers through assistance when starting a new planting.” (Manger of PT BAM)



“ One of the things I learned in the Philippines was to deal with pests including wrapping fruit so that it would not be hit by pod borer and spraying trees with chili water to ward off squirrels” (Farmer T, Sintang)



“We recommend intercropping with other wood or fruit plants with the correct layout for other sources of livelihood.” (Sintang Plantation Service Representative)

ENVIRONMENTAL SUSTAINABILITY

The development of cacao plantations in Sintang becomes an alternative environmentally friendly commodity, especially if viewed from the aspect of **carbon stocks, biodiversity, and sustainable agriculture.**

PLANTATION SCHEME	CURRENT CONDITION		
	Commodity carbon reserves	Biodiversity	Sustainable agriculture
The dominance of oil palm and rubber plantations	<ul style="list-style-type: none"> Carbon stocks in oil palm reached 45.3 tC / ha, and 213.6 tC / ha in rubber commodities. 	<ul style="list-style-type: none"> Oil palm plantations threaten biodiversity, so that permits for the opening of new oil palm lands are no longer issued by the Regional Government. 	<ul style="list-style-type: none"> Cacao plantations in Sintang are still not optimally managed, and their care is equated with rubber so productivity is low.
Development of cacao plantations	<ul style="list-style-type: none"> Carbon stocks in cacao plants is 65 tC / ha higher than oil palm plants. In agroforestry plantations, total carbon biomass reserves have increased 5 times compared to monoculture plantations. 	<ul style="list-style-type: none"> The ability of cacao trees to grow is affected by the presence of protective plants such as gamal, tengkawang, and fruit trees (mango, durian, banana) that are intercropped planted. This agroforestry plantation system is very beneficial for the environment without reducing yields. 	<ul style="list-style-type: none"> In order to produce sufficient yields and reach a wider market, cacao plantations should be developed sustainably and minimize the use of pesticides.

RECOMMENDATIONS

Cacao can be an alternative oil palm plantation

Application of intercropping cacao cultivation.

Provision of training and assistance in integrated pest management and organic farming systems for farmers.



ECONOMIC
SUSTAINABILITY



AVAILABILITY OF
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ENVIRONMENTAL
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POST-HARVEST
PROCESSING

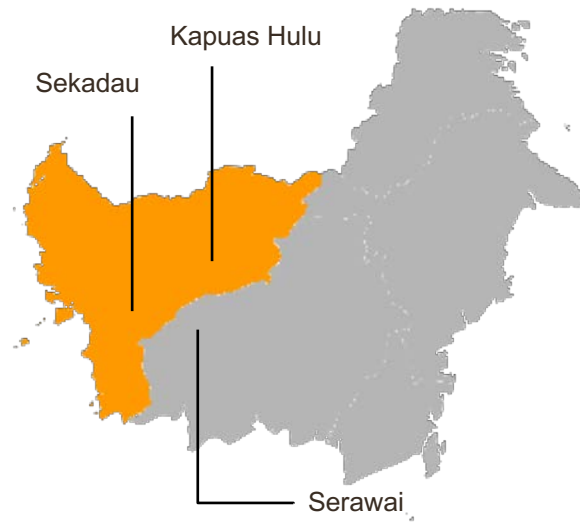
POST-HARVEST PROCESSING

Introduction of cacao in Sintang

Cacao planting has begun in Sintang through a government program in Serawai. Unfortunately, the cacao plantations are now largely neglected due to lack of market access, and farmers' lack of knowledge about postharvest practices. In addition to Sintang, several neighboring regencies such as Sekadau and Kapuas Hulu have also developed cacao, although the practice of postharvest processing is still limited to direct sun drying without fermentation. Inadequate road conditions also prevent farmers from traveling long distances between cacao plantations to sellers in markets or downtown.

Location of cacao plantation activities

The location of cacao farmers and the local market of dried cacao beans in Sintang Regency and surrounding areas.



The Keling Kumang Group Chocolate Processing Center (KKG)

In 2017, Indonesia imported 270,200 tons of cacao beans from several countries such as Ivory Coast, Malaysia and Ghana. Based on these figures, the KKG sees the potential for cacao to be developed in Sintang in order to meet national cacao needs. This year, the GFC has begun expanding cacao plantations and selling cacao beans owned by farmers to local buyers. To gain market confidence, KKG helps farmers produce premium quality dried beans. Therefore, the KKG built a cacao bean processing center so that the cacao will go through a fermentation and drying process. This scheme will greatly assist farmers in improving and maintaining the quality of seeds to be sold.



Keling Kumang's cacao bean processing center in Selebak

POST-HARVEST PROCESSING

Based on the results of interviews and observations of dry beans, **the post-harvest process carried out by farmers in Sintang is still limited and produces cacao beans with less-than-optimal quality.**

Postharvest process	CURRENT CONDITION		
	Seed extraction	Fermentation	Drying
Farmers	<ul style="list-style-type: none"> Cacao fruit is chopped lengthwise then wet beans are removed. Inadvertent seed extraction can cause the seeds to split and cannot be included in the fermentation process. 	<ul style="list-style-type: none"> Farmers usually do not ferment the seeds because they require a long processing time. One of the farmers tried to ferment in a plastic box because the amount of harvest was only small. Fermentation is carried out in a 1.5 L plastic box for 4 days. This process causes the air in the box to become hot and humid which allows the growth of mold. 	<ul style="list-style-type: none"> Farmers dry the cacao for 4 days in direct sunlight. Cacao beans are removed during the day and spread over sacks, then put into the room. Open drying facilitates insect attack on cacao beans.

RECOMMENDATIONS

Selection of good beans at the beginning of the process will maximize the final results of the dried cacao beans so that they can get the optimal price.

The fermentation process will create a distinctive taste of cacao. For this reason, this process should use a wooden box.

Drying using a solar dryer can protect seeds from insects, and does not require large amounts of energy to dry and store seeds.

POST-HARVEST PROCESSING

Good post-harvest processing practices are still very minimal among Sintang farmers. Through this study, we introduce the **Kopernik Solar Dryer** and how to work with farmers to improve the quality of dried beans.

PROBLEMS

- The practice of drying seeds in Sintang is still very simple - drying is carried out for only 3 to 5 days, so the seeds don't dry to the maximum. Sometimes the seeds that are not dried are sold in a wet state at a low price.
- Lack of knowledge of farmers in maintaining seed quality through drying methods.



SOLUTION

- Kopernik introduces solar dryer to improve the quality of dried beans. In addition to maximizing the drying process, this solar dryer also functions as a storage area for seeds to protect them from rain, insects and mold.



EXPERIMENTATION

- Kopernik and KKG assisted farmers are building solar dryer and fermentation boxes.
- Fermented seeds dried using Kopernik solar dryer are then compared to seeds dried by the simple method.



POST-HARVEST PROCESSING

Since 2016, Kopernik has been trying to improve the efficiency of the drying process by developing solar dryer prototypes for commodities such as cashews, copra and chocolate in Bali and East Nusa Tenggara. The advantages of this dryer box include the possibility of **drying during the rainy season, reducing operational costs and reducing manual labor done by farmers.**

COPRA

- Adonara, NTT
- Capacity of 1.000 kg
- US\$2,580



CACAO (PHASE 1)

- Tabanan, Bali
- Capacity of 500 kg
- US\$1,350



CASHEW NUT

- Ile Padung, NTT
- Capacity of 300 kg
- US\$704



CACAO (PHASE 2)

- Tabanan, Bali
- Capacity of 500 kg
- US\$1,350



2016

2017

2018

POST-HARVEST PROCESSING

In this study, Kopernik and KKG assisted farmers developing the latest prototype with the advantages of **capturing solar energy and retaining heat longer** in the room, **and maintaining air circulation and humidity**.

INNOVATIVE FEATURES

1

The layer of gravel is one of the heat-resisting mechanisms.



2

Automatic humidity regulation system and air circulation



3

The drying mat is made of a plastic net and does not require frequent reversing.



POST-HARVEST PROCESSING

Postharvest processes include **seed extraction, fermentation, and drying** in accordance with good practices.

CACAO BEAN EXTRACTION

- After harvesting, cacao fruit is split laterally to take wet beans.
- Good quality wet seeds are characterized by the absence of insects and the formation of sprouts in them.
- The sorting process is carried out at this stage by separating the ugly seeds and placental stems.



FERMENTATION

- Wet cacao beans are then fermented in a tiered fermentation box so that the aroma and flavor of chocolate is well formed.
- Fermentation is carried out for 5 days: 2 days at the top level, 2 days at the lower level and 1 day at the final level. During the fermentation process there was a weight reduction of 19%.



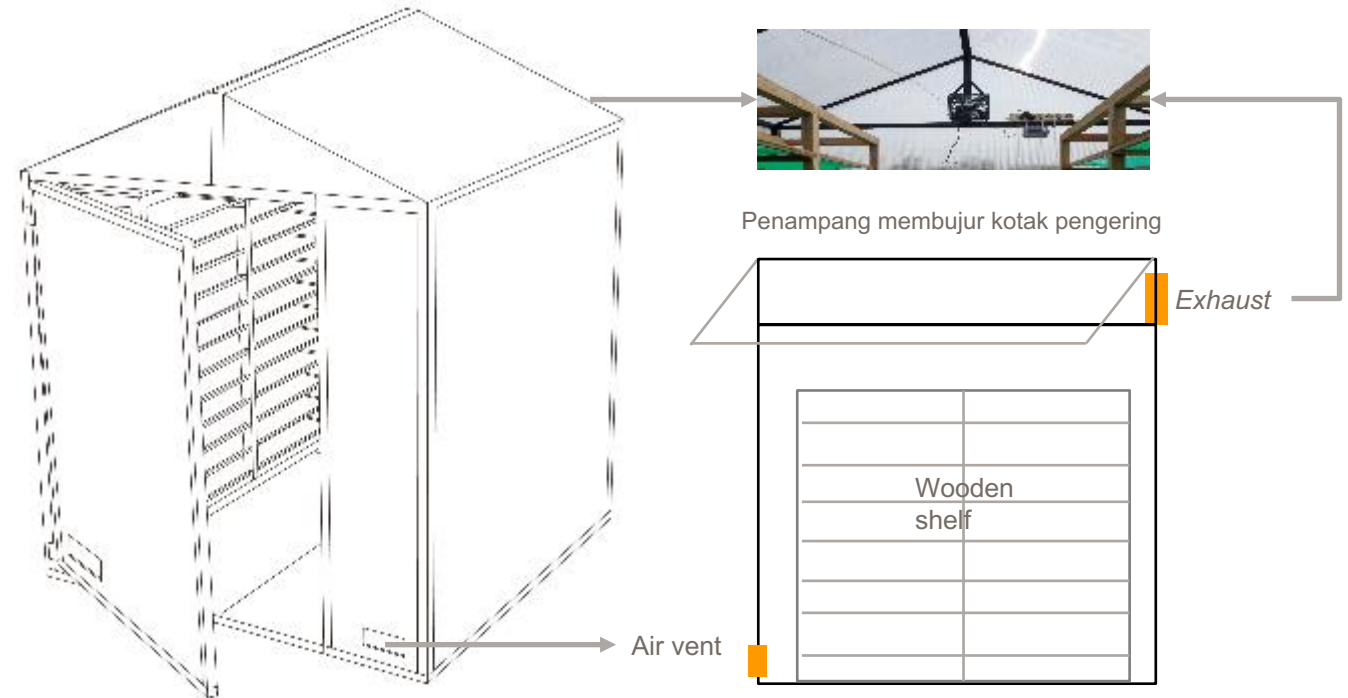
DRYING

- Cacao beans drying aims to reduce the moisture content of the seeds so they can be stored and further processed.
- The drying time in a Kopernik solar dryer ranges from 4-7 days, depending on weather conditions and the filling capacity of the solar dryer.



POST-HARVEST PROCESSING

The drying process is carried out in a **Kopernik Solar Dryer** which can be made **independently** by farmers using **local materials**.



Kopernik Solar Dryer

Capacity: 120 kg wet cacao beans

Manufacturing costs : IDR 8,500,000*

Energy source: Solar heating and automatic humidity regulation with electricity.

* Manufacturing costs may vary

Box material

- Hollow steel
- Iron plate
- Polycarbonate
- Gravels
- Wooden shelves and nets

Automatic humidity regulation system

- Exhaust fan
- Digital hygostat
- Ventilation holes

POST-HARVEST PROCESSING

2x2 meter Kopernik Solar Dryer is built and placed on **a foundation** containing gravel as a heat barrier. The function of the foundation is to keep water from entering the solar dryer during heavy rainfall



1 Foundation construction



2 Filling gravel in the foundation as a heat barrier



3 Placement of the solar dryer frame on the foundation



6 Making ventilation holes



5 Exhaust installation and automatic adjustment system

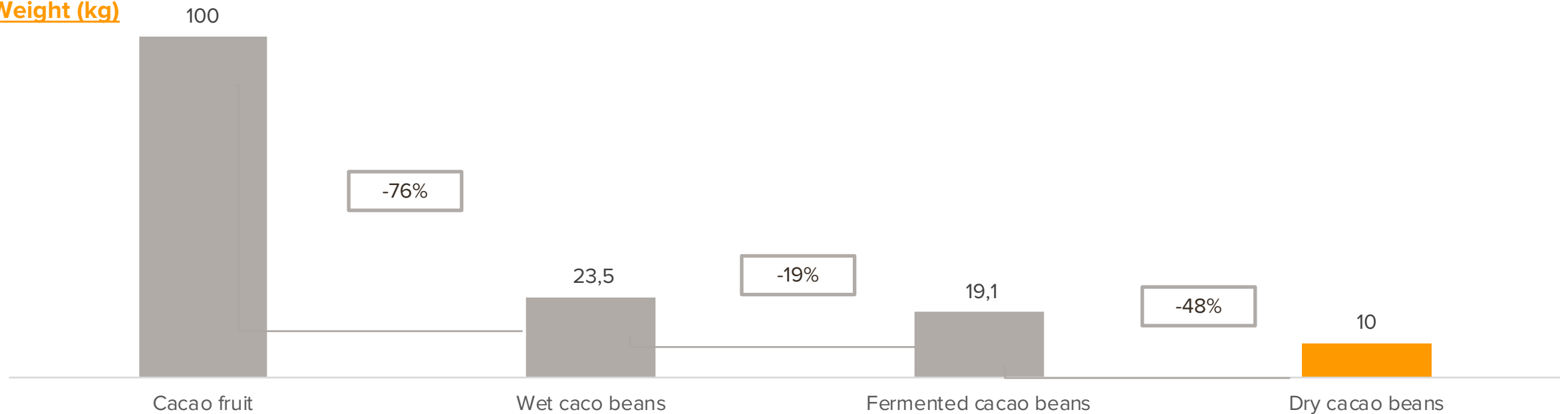


4 Electrical network connection

POST-HARVEST PROCESSING

Postharvest processing processes such as fermentation and drying **remove most of the water content and reduce weight**, but improve the quality of cacao beans for further processing.

Weight (kg)



POST-HARVEST PROCESSING

To find out the quality of dry beans, Kopernik compares three types of processes: **1) Kopernik Solar Dryers**, **2) conventional drying houses**, and **3) open drying**. This study shows that beans processed with Kopernik Solar Dryer do not suffer damage from the open environment so that the quality is better than openly dried cacao beans

Quality standard	Evaluation method	Parameter	Kopernik solar dryer	Conventional dryer house	Open drying
Number of seeds	Manual calculation	Seed count	86 (A)	90 (A)	116 (C)
Cocoa SNI	Lab analysis	Water content	6,72	7,86	6,32
	Cut test to see the condition of seeds	Moldy	0%	0%	12%
		Purplish	0%	0%	2%
		Insect	0%	0%	1%
		Germinate	0%	1%	1%

Grouping based on seed size

Maximum moisture content received

The presence of abnormal seeds permitted

Seeds Grade	Number of seeds /100g
AA	< 85
A	86 - 100
B	101 - 110
C	111 - 120

7,5%

Seed condition	Max.
Moldy	4%
Purplish	3%
Insect infestation	1%
Germinate	2%

Cacao from Kopernik's solar dryer meets **SNI quality standards.**

POST-HARVEST PROCESSING

The drying process with **Kopernik Solar Dryer** takes place faster than conventional dryers. In addition, the use of a solar dryer is able to reduce the work hours spent to dry cacao.

Parameter	Kopernik Solar Dryer	Conventional dryer house	Open drying
Duration of drying	4 days	6 days	6 days
Rainy season drying	Yes	Yes	No
Daily activities	<ul style="list-style-type: none"> Remove and add cacao beans at the beginning and end of drying Adjust Exhaust 	<ul style="list-style-type: none"> Remove and add the cacao beans at the beginning and end of drying Flip cacao beans 	<ul style="list-style-type: none"> Remove the cacao beans Spread cacao beans Flip cacao beans Add cacao beans
Required working hours	30 minutes/day	1 hour/day	3 hours/day



POST-HARVEST PROCESSING

The target market for chocolate products for **the processing industry** in Indonesia is quite diverse with **varying prices**. With the consistency of quality and amount of production, farmers can **determine the type of market they want to target** according to their respective capacities. For example, small scale premium chocolate producers have an engine capacity of 5 kg, so the supply of cacao beans must not be less than the capacity of the machine.

Target	Manufacturer of premium chocolate			Manufacturer of commercial chocolate
Location	Lampung	Bali	Batu	Makassar
Types of products	Chocolate bars, Chocolate drinks, Cacao Nibs	Chocolate bars	Chocolate bars, Praline	Chocolate wafers, bean nougat
The purchase price of cacao beans per kg	IDR 60,000	IDR 12,000 – IDR 15,000 (wet seeds)	IDR 45,000	IDR 33,000
Product selling price (100 gr)	IDR 60,000 – IDR 90,000	IDR 90,000 – IDR 120,000	IDR 30,000	IDR 30,000



@krakakoa



@sorgachocolate



@mesujichoco



@mars

POST-HARVEST PROCESSING

In addition to the processing industry, the targeted market is consumers who like to consume chocolate products for health such as roasted cacao, where the beans only go through a roasting process.



Roasting dry cacao beans.



Product example:

Cau Cacao Roasted 100 gr

Price: IDR 45,000

Sales method: Online through e-commerce (Tokopedia)



- The results of interviews with coffee and chocolate entrepreneurs in Bali stated that the large market potential in the Bali area, due to the increasing number of shops selling organic food products including roasted cacao beans.
- Neatly and attractive packaged roasted cacao beans can be sold at a price IDR 20,000/100 gr.



The farmers are splitting cacao pod to collect the beans

CHALLENGES AND RECOMMENDATIONS

Aspect

Challenges

Recommendations



Mapping and Identification

- There is no clear data yet on the number of cacao farmers in Sintang, so it is still difficult to determine the type of support that can be given to farmers.

- Mapping cacao farmers using the Keling Kumang cooperative network spread across West Kalimantan.
- Checking the cacao planting program report from the government and community organizations.



Infrastructure

- The limitations of road infrastructure make long distances that are risky for wet beans, and make farmers' market reach very limited.

- Providing an efficient cacao bean pick-up schedule and route system.



Market

- The stage of developing cacao in Sintang District is still very early so there are not many markets to accept the cacao beans produced.

- Using appropriate drying techniques for dry beans production
- Sending dried bean samples to prospective buyers as one of the first steps to expand access to the market.



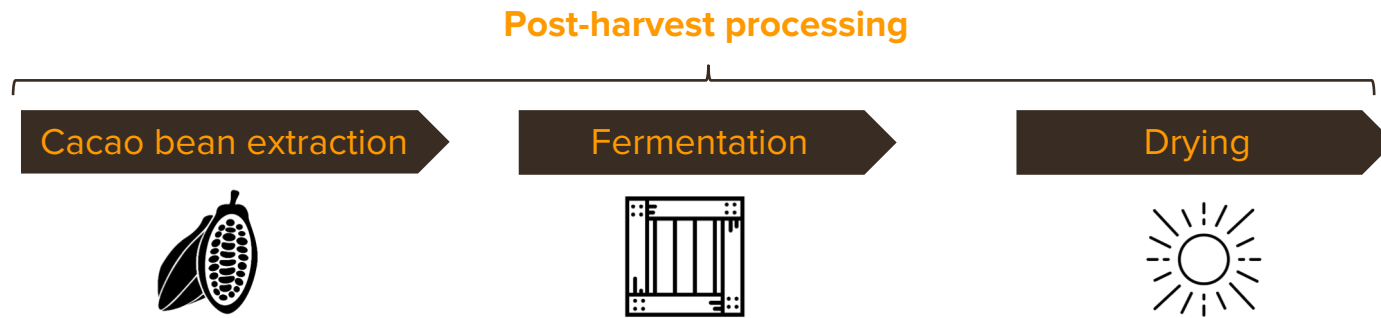
Processing

- The post-harvest processing of farmers is still not optimal.
- Fermentation and drying are not in accordance with the recommended process so that the quality of the cacao beans produced does not meet the criteria for premium beans.

- Training and use of tools for postharvest processing such as fermentation boxes and solar dryers.

CONCLUSION

Improved post-harvest processing - the fermentation process using a fermentation box and a solar dryer shows the absence of moldy, purplish, insect-infected, and germinating seeds. This illustrates an increase in quality compared to the results of drying in the conventional manner.



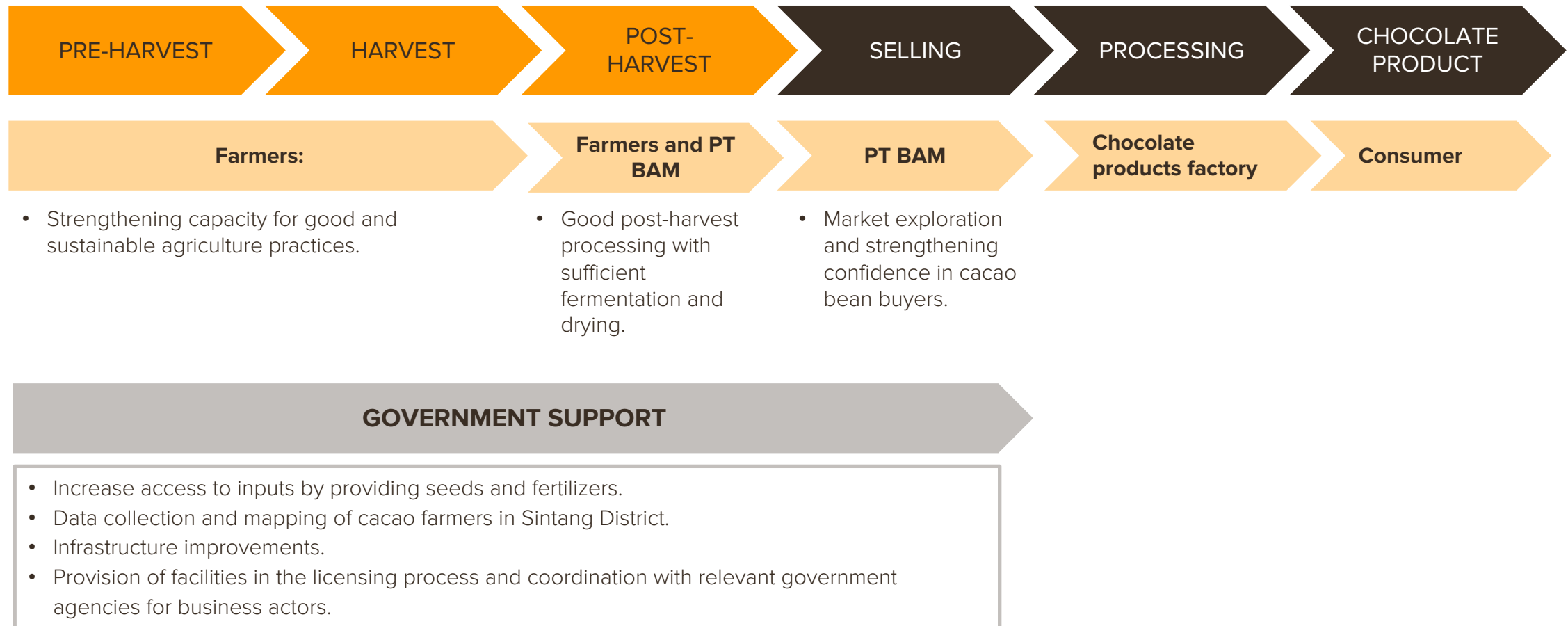
Dry cacao beans

ACTION STEPS:

- Kopernik solar dryer can be used as an alternative to the drying process to maintain the quality of seeds in the rainy season. Further testing with more seeds in the rainy season is recommended to determine operational standards that can be used to maintain consistency in seed quality.
- To determine market acceptance and the price to be obtained, it is necessary to test the sales of dried beans resulting from the drying process in this study.
- Estimated production capacity is also needed to convince potential buyers of a consistent supply of cacao.

CONCLUSION

Strengthening the cacao value chain - the development of cacao plantations in Sintang shows great potential given the unmet market needs for quality beans. Therefore, it is necessary to strengthen the capacity of each related party to produce high-quality plantations with good quality.



METHODOLOGY

ACTIVITY	METHOD OF COLLECTING DATA	METHOD OF ANALYSIS
<p>Cocoa value chain research</p>	<p>Primary data Interview:</p> <ul style="list-style-type: none"> • Farmers: 8 cocoa farmers and potential cocoa farmers in Sintang as well • PT BAM and KKG • Middleman • Cocoa experts • Cocoa processing industry: Sorga Chocolate, Krakakoa, Mesuji Chocolate, Kahiyang Coffee <p>Group discussion:</p> <ul style="list-style-type: none"> • Group discussions were held with representatives of the Sintang Regency government (the Office of One Stop Integrated Investment Services, the Forest Service, and the Agriculture and Food Crops Office) <p>Secondary data Study of literature and statistical data</p>	<p>Qualitative Analysis</p>
<p>Improved post-harvest processing</p>	<p>Primary data Experiment:</p> <ul style="list-style-type: none"> • Construction of Kopernik solary dryer, fermentation boxes, and drying of cocoa beans in Penyangka, Sintang <p>Secondary data Study of literature and statistical data</p>	<p>Quantitative Analysis</p>

RESEARCH LIMITATION
<p>Cacao value chain research</p> <ul style="list-style-type: none"> • The number of cacao farmers in Sintang is very limited and has not been identified, and there is no market in the area so that the middleman data is taken from Sekadau District. <p>Improved post-harvest processing</p> <ul style="list-style-type: none"> • The number of initial wet beans obtained is less than the minimum standard for fermentation (40 kg) so it is viewed the fermentation process is not optimal. • The number of seeds does not meet the maximum capacity of Kopernik's solar dryer so the drying performance when the solar dryer is full is unknown. • This experiment was carried out in the summer and there was no rain, the drying process can vary depending on local weather conditions.

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ABOUT OUR PARTNERS

To find what works, Kopernik collaborates with local partners to ensure the success of project activities.



Koperasi Keling Kumang is a cooperative based in West Kalimantan that provides responsible and sustainable financial services to reduce poverty and improve living standards of the community.



Lingkar Temu Kabupaten Lestari (LTKL) is a forum consist of and managed by a number of Regency Government representatives. Through this forum, it is expected that regional development can balance the economic, social and environmental aspects through the collaboration of stakeholders, with the support of LTKL members.



The Government of Sintang Regency is an autonomous region in the province of West Kalimantan. The government has a vision to create smart and prosperous communities by 2021 through the implementation of good governance and impactful activities to develop the capacity of communities.

ABOUT KOPERNIK

Kopernik conducts experiments to **find the best solution to reduce poverty**. We prioritize working towards achieving Sustainable Development Goals (SDG) targets with remote communities.

OUR VISION



Looking for the best solution in efforts to reduce poverty in remote areas.

OUR MISSION



A world where disadvantaged people living in remote areas can realize their full potential and enjoy a dignified life free from poverty.

OUR WORK



Through rapid prototyping and experimentation, we work directly with communities in remote areas, and our partners from the development, public and private sectors to reduce poverty