

Farmers Labs: Learning for the sustainable cacao farming

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1. Background

The cacao plantations are generally considered as a sustainable type of business, due to its large international market, which involves various industries such as food and confectionary manufacturers (Tan, 2017). Cacao is not only economically sustainable product, but as well socially and ecologically sustainable crop to help farmers develop the intercropping farm (VECO, n.d.). Recently, International Cacao Organization survey found that production in the cacao global market in 2015-2016 declined (Tan, 2017).

Accordingly, as the third largest producer of cacao in the world, Indonesia has the opportunity to fulfil the required demand gap by increasing quantity and quality of its cacao production, through empowering smallholder farmers, who own over 90% of cacao plantations in the country (DJP, 2014). The country can support the farmers and stakeholders through different programmes to practice sustainable agriculture. One of applied sustainable agriculture is the climate-smart concept, which involves increasing productivity by fermenting the cacao beans and reducing greenhouse gasses (GHG) emission by using organic fertilisers. This practice has been carried out by some group of farmers in Bali Province. Despite visible benefits from modification the type production, almost half of the farmers endure their traditional approach to agriculture. Immediately after harvesting, they aim at selling their cacao beans to middlemen in order to get quick money, without considering the sustainable market for their product and enhancing their own income (METI, 2015).

2. Rationale and importance

The traditional practice of the cacao farming has brought several environmental problems to the local environment. Improper use of the chemical fertilizers in the plantation causes damage to the local soil (Franzen & Mulder, 2007). At the same time, the cacao plantation is extremely vulnerable to the climate change. In the last 20 years, Takayama (et.al. 2014) investigated that precipitation in Bali has been decreasing and extending the dry season. Change of these conditions has been reducing agricultural productivity. Soil humidity and atmospheric variability determine the survival of cacao tree and its fruits. In 2016, farmers in Jembrana regency admitted that they lost about 50% of their cacao production in comparison to the previous yield (Budiman, et.al. 2017). Future climate projection showed that Bali is one of the most vulnerable areas in Indonesia with predicted increased temperature value of 2.6 C (Takama et al., 2014). Mentioned situation, as a result of climate change, can have the crucial impact on cacao plantations and farmers' future prospects.

All the mentioned above will have the impact at the global level. Changing mindset will lead farmers to practice sustainable agriculture system which is important as mitigation and adaptation strategy to climate change. The forests around the plantations provide ecosystem services for inhabitants and protect them from strong rainfalls and rising temperature. Unfortunately, usage of the inorganic fertilizers makes the soil more vulnerable to washing out crucial nutrients and minerals into deeper parts of the soil

profile, unreachable for the trees, (Rice, 2000). It also releases more GHG emission. Therefore, using organic fertilizers is required to reduce the amount of carbon dioxide emitted from a cacao plantation. In addition, utilizing agricultural waste for fertilizers and energy source is diversifying farmers' livelihood to increase their resilience to climate change.

2.1 Goals and objectives

Our goal wishes to focus on the sustainability challenge to change the mindset, mentality and farming behavior/practice of cacao farmers. The objective is to provide farmers with knowledge, awareness and skills about certified sustainable farming practices such as using good cacao varieties/seeds, organic fertilizers, better shade trees, grafting, fermentation process and intercropping. By changing their mindset, firstly the farmers are expected to realize the benefit of implementing advanced production method of the agricultural practice to replace the old inefficient farming system. The education can help to explain the positive impact of advanced agricultural science and technology to increase the quality of cacao beans.

Secondly, we want to alter farmers perception about incentives. Incentives are required to trigger the small cacao farmers' enthusiasm and get them more motivated in the farming, but it should come from their internal efforts. When the farmers have a better productivity of cacao beans, they will get more income to create a sustainable livelihood.

Thirdly, we expect farmers to understand the advantage of comprehensive utilization of resources, renewable energy use, recycling of resources and energy saving. It will assure rational use of agricultural resources, decrease the depletion of resources, to achieve sustainable agricultural development. The plantation system should reduce its carbon footprint by preventing the unreasonable use of chemical fertilizers and pesticides. A transformation from conventional farming to sustainable farming it is needed to reduce the greenhouse gasses emissions. It may become control measure helping to reduce the soil degradation. This vision will be delivered to the agriculture stakeholders through the social learning process.

2.2 Stakeholders

As the sustainability challenge focus on the creation of environmentally-friendly cacao beans production with an equal contribution of the local agricultural community as a whole, farmers in Bali (Indonesia) remain as the key stakeholders (players), to whom project is addressed. Many programs were involved in raising awareness of the farmers and helping them in the development of sustainable farming, which today are labelled with international certification. Sustainable farmers, who decided to change their production established cooperative of Kerta Semaya Samaniya (KSS) which works with local NGO Kalimajari and the local government on the certified sustainable cacao production. Several 'Subak Arabian' farmers' group system based on irrigation system territory also have joined the cooperative (METI, 2016).

Provision of certified products create higher demand for the goods and improve the economic aspect of farmers' sustainability. However, many farmers (unsustainable) want to cash their products immediately (to increase their income), they are not able to contribute any effort to increase the product quality, which is equal to higher cost achieved for the cacao beans. The main interest for unsustainable farmers is to increase their income, then with trust to local NGO, other benefits will be applied. With knowledge and adapting the production to the certification system, continuous demand for organic cacao beans will provide simultaneously cash flow and increasing profits.

For this particular group of the stakeholders (unsustainable farmers) incentives

are presented as a guarantee of better income (higher price for beans, without intermediate factor between farmer and buyer) and regular provision of profits (constant demand on the international market). While improvement of their income affects local governance, which will provide development of the regency (better health care, education for children, increasing tourism) or simply make agriculture more attractive for young people (to prevent them from leaving villages claimed as no future prospects, on behalf of cities). Although prosperities are highly ranked, the main barrier is created by unsustainable farmers themselves, which is quite unique while a usual case is about sufficient amount of funds. Farmers' motivation for change is lowering, as a result of beliefs about limited personal resources (efforts), low education or lack of confidence to be the starting point for improvement.

Sustainable farmers can operate as an expert group, who helps unsustainable farmers to develop pro-environmental actions. They can participate in trainings as consultants, who are from the close neighborhood of the unsustainable farmers. As an aware group of citizens, their involvement can be driven by self-motivation, combined with symbolic economic incentives for participation. As well, their status and reputation may increase, after familiarizing the rest of the community of the role they play in the sustainable, international agriculture.

Local Non-Government Organization-Kalimajari is second key stakeholder, because our project design will be implemented by them. The organization already has developed a program for local farmers, to raise their awareness about fermentation of cacao beans and benefits from adjusting agriculture type. Although these actions were conducted with sufficient success, not all farmers were reached. With adequate resources and innovative idea, they may continue their work as supporting consultants for the local farmers. Successful realization of the project would show a greater commitment of the NGO into local issues, build their reputation. Based on above mentioned, the government may be interested in starting the cooperation and financial funding (METI, 2016). Accordingly, NGO would be able to extend their administration, working range and empowerment, as well as involve into other projects. Constraints to get involved are represented by current limitations in human and economic resources to enhance their influence for a larger group of farmers to achieve prior benefits. Cooperation of local NGO with farmers and government need to be based on trust and reputation.

Local government in Bali aims into sustainable agriculture which may bring more tourists into the community. The regency is regarded as intense agricultural area, rarely claimed as attractive to visit (Sugandh, 2010). On these terms government supposed to support every movement targeting into the establishment of good agricultural practices (GAP) on the farms. Given that, they should provide full or partial funding for development and implementation of the projects for individual farmers. Due to their governance, provision of the connection between farmers and buyers should be established as permanent cooperation. The main perspective is higher income from agriculture for the region, further resulting in the economic and social growth.

Financial support through the partial foundation can be provided by appropriate institutions such as local or national banks and microfinance institution together with the government, Corporate Social Responsibility (CSR) or loans to the farmers and NGOs. Owners of local businesses should work for endorsement of the sustainable agricultural modernization, resulting in higher demand for common (food, clothes) and specific (seeds, eco-fertilizers) goods. The market exchange will grow and evolve for their profit. Increasing tourism will enforce necessary development of the facilities such as hotels or restaurants, while already existing ones first will reach higher income. Better condition of the local environment will assure healthy future for all generations living and settling in

Bali. The most important barrier, in this case, might be similar to farmer's passive attitude to changes, although involvement of young people and their future in the local community may overcome this constraint.

Last is university as farmer lab's monitoring and evaluation agencies, through the development and implementation of the sustainable development plan for qualitative and quantitative testing, supervision and evaluation. Mainly including the realization of the target, the completion of the activities and the measures to evaluate. Monitoring focuses on the development and implementation process, while evaluation is biased towards its results and benefits. The purpose of the monitoring and evaluation of the farmer's lab program is to change the old ideas of farmers, develop a good habit of planting, and actively promote sustainable development.

3. Strategy of change: The key principles for creating the design

Education and persuasive communication are appropriate methods to educate the cacao plantation farmers for accepting and conducting sustainable farming system. Conventional trainers only make use of traditional education method to deliver knowledge to non-educated farmers. This situation makes education ineffective to change farmers' performance (Feder, Murgai, & Quizon, 2004). It means that better quality of trainer is needed to bring advanced education method for the farmers. Sustainable farmers living in the area could be the best trainer for the unsustainable farmers since they understand the better socio-cultural challenge in the region.

Meanwhile, persuasive communication is based on soft skills and marketing skills to send a positive message (Stiff & Mongeau, 2016). Persuasive communication reinforces, intensifies, and priorities farmers to believe that sustainable agriculture is a great work to develop the economy in the local area. Through this strategy, it will build group cohesion among the cacao farmers and develop the commitment to a shared set of goals, to make a sustainable livelihood for their families and create a better future for the next generation. This approach can begin with recognizing a common realm and introducing new information that will help the farmers to further appreciate this commonality. The message is to convince the farmers, the accuracy of the particular selection and behavioral processes. This is often followed by the result, that people will change their opinions. The logical thinking from scientific findings is an effective way to express persuasive communication (Boundless, 2016). This will have the great contribution for farmers' introspection to make them rethink the importance and necessity of sustainable farming system and environmental impact compared to their old conventional farming system. Persuasive communications are often words that encourage action. The intention is to make people do something (often changing their behavior). Calls to encourage action are generally part of implementing decisions. The goal of persuasive communication is always about making a change, once the farmers are persuaded, they are willing to make a change to get higher yields, income and more comfortable living conditions. A persuasive communicator improves the farmers' awareness and raises the desire to consider that position. Effective persuasion requires persuasive goals and often depends on how the messages are assembled and delivered. For instance, a passive farmer who does not want to make a change and unmoved by appeals to emotion may be more willing to listen to rational arguments and facts.

Promotion of sustainable nature management and changes in pro-environmental behavior are an outcome, in terms of social learning in theory (Muro & Jeffrey 2008). This theory is supporting the idea of the interaction with others in social situations. Apart from that, people observe other people's behavior, causing people to behave similarly. After observing the behavior of others, people assimilated, especially if its observation

experience is positive or includes rewards related to the observed behavior, imitate that behavior. According to Wenger (2000), imitation ability which involves an actual reproduction of the observed activity can help the success of social learning. The principles of social learning are able to work the same way throughout the lifetime. Observation learning can be done at any age. New learning by the modelling process can expose to a new influential and powerful model that controls resources at the life stage. (Newman, 2007). Based on these general principles, learning can be done without the change in behavior. In other words, behaviorists say that learning must be represented by the permanent change in behavior. In contrast, social learning theorists say that their learning does not necessarily appear in their performance, as people can learn by observing alone. (Bandura, 1965). Learning may or may not cause behavioral changes (Bandura, 2006b).

Applied to the case study, social learning in Farmers Labs gives reinforcement, which means that the action imitated by the farmers is positive. Therefore, the action can reward others. Basically, the main strengths and weaknesses of social/observational learning depend on the model. According to this point, if the model produces appropriate and responsible positive behavior, the observer will imitate its positive behavior. So it is important to design proper model which fits with the local context. Transforming individual to the collective empowerment of the farmers is crucial to establish the holistic change in the agriculture system. Nevertheless, this will need extra work and cooperative supports from all stakeholders, which may need more organized structures and take longer time. Economic incentives are obviously good for the farmers, but it may make them more focus and dependent on this factor, without considering the environmental factor.

4. Programme design: Farmers Labs

To achieve goals and objectives of the project, our chosen strategies will be delivered through the following product, inspired by the concept of EVA Lanxmeer in Culemborg, Netherlands. This neighborhood was established by the society initiatives with environmental education and sustainable design as two main pillars (Hegger, 2007). Initial product design will adapt the EVA Lanxmeer concept to the case of cacao farmers community in Bali. The difference between them puts that cacao project as dedicated to building the sustainable farming neighborhood, instead of the urban neighborhood EVA Lanxmeer. Unlike EVA Lanxmeer, which created completely new area and buildings, this product will join the new empty space in the middle of concentrated farming areas, with the existing farms, into a new set up area. The location will connect the farmers to nature and show how ecology works. This will be a missing element from existing NGO's programme to complement the farmers. The main objective is to make the farmers start practice sustainable agriculture. Later, for long term solution, farmers' living spaces are expected to integrate the sustainable practices. The knowledge will not only be taught but also will be implemented in the area, such as the agriculture waste will be utilized to generate the energy in the area.

The idea is based on the creation of a new area setting, adapted as agriculture laboratory or farmer field school, to place mix strategies of environmental education and learning for sustainability. The strategies are also combined with the whole system approach to cooperation among stakeholders. The area existence will be derived from the government or financial institution support, as part of the NGO programme and cooperation with existing farms. The system within the area will be managed by the NGO, with active participation from the farmer's side, to shape and adjoin flexible goals. This idea is a win-win method, to work with the farmer's cooperation, due to the fact that another project (conducted by NGO) in Borneo showed rejection from the unsustainable

farmers when the whole project management is owned by the external actor. On the other hand, the farmers are not able, without sufficient capability manage the whole project (Van den Berg and Jiggins, 2007). To merge the proposed concept, farmers will be asked for the commitment to an implementation of economic incentives strategy. Two types of commitment can be distinguished. First, farmers in the initial pilot areas, which may be wealthier than others, will be asked for providing their farms to be part of the project. As incentives, they will receive help with volunteer workers on their farms, to produce qualified fermented cacao beans and other crops. They also will have access to the area in the Farmer's Lab dedicated for beans fermentation. Secondly, farmers outside the area will be asked to sell their unfermented cacao beans, to be fermented in the Farmer's Lab. In return, they will get the good price and opportunity to learn about sustainable agriculture practices.

The project area will consist of farming areas, processing facilities and learning spaces (Fig 1). The learning space will use the concept of open building without wall which provides opportunity for possible change during its lifetime (Sarja, 2003). This aims to let the farmers quickly able to connect knowledge from training with the practice in the farms. The farms will include one sustainable farm to be used as the collective farm with profit sharing system. The NGO will manage shared ownership of this farm with the farmer's group. The system aims to make both, sustainable farmers and unsustainable farmers work together as peer to peer learning for capacity building. This situation is expected to trigger the unsustainable farmers through the social learning process to respectively sustainable farmers in the area. The content of the training and social learning will be based on the component of climate-smart agriculture practices (Scherr, Shames, & Friedman, 2012). It will be delivered in three stages: (1) increasing productivity by following certified cacao farming practices, (2) utilizing agricultural waste in the circular economy model and (3) having climate-agriculture insurance to increase economic resilience. The design of the contents will be adjusted with the mission to internalize value of transition and system thinking for the farmers. The design could be supported by Climate-smart agriculture project conducted by Wageningen University and the University in Bali. Meanwhile, the processing facility will be a place to learn and doing post-harvesting process such as fermentation. The summary about the project can also be seen in this [YouTube link](#).



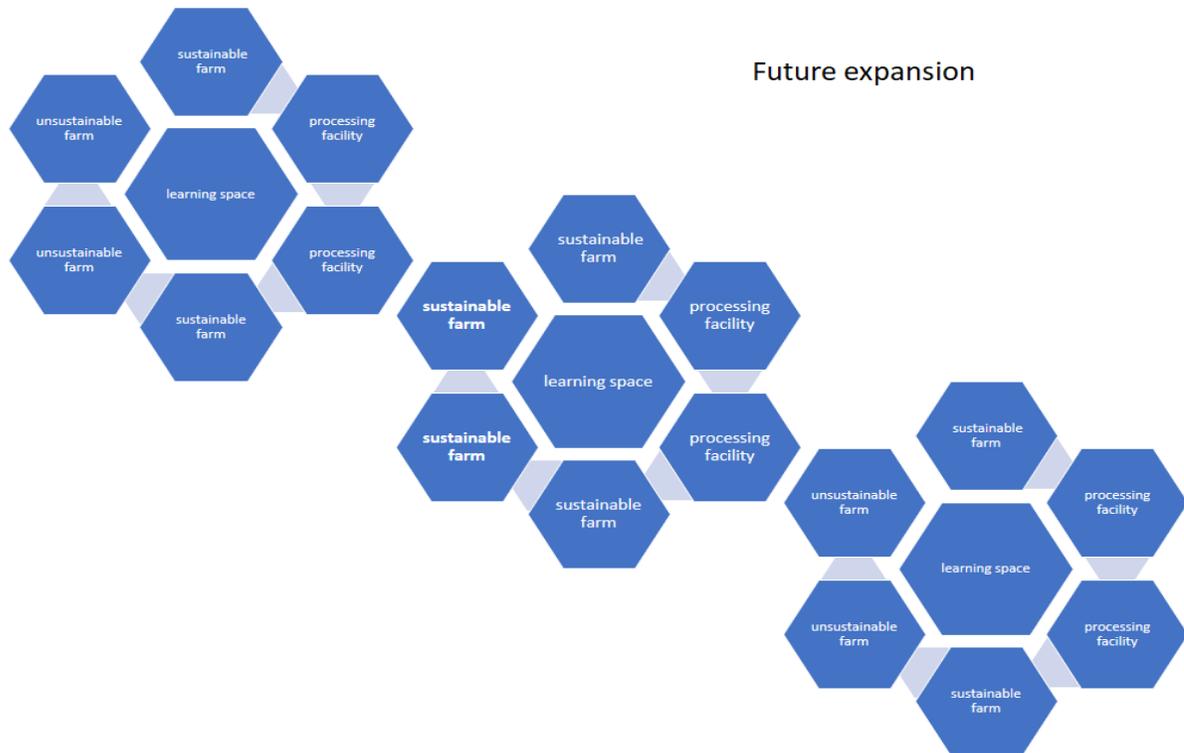


Figure 1 Area development planning

The pilot area will be located in the middle of concentrated farming areas, next to the farmers' house. The model of this area is expected to be imitated to the surrounding neighborhood to spread the impact. The design will adjust the pattern of existing farms, which are already practicing sustainable practices (sustainable farming) and others, which do not (unsustainable farming). The expansion plan will be connected with existing institution of farmers group, which is *Subak*. This idea will overcome the previous problem about the location of processing facility operated by the NGO and farmers' cooperative, which is far from the cacao farms.

Short term strategy in the area is to deliver the first stage of the content, where farmers are educated to increase the cacao productivity. The instrumental approach, such as advanced education method and persuasive communication will be applied. By exploring the theory in the learning space, practicing the techniques directly on the farms and the processing facility, the farmers will be introduced to good cacao varieties, sustainable farming practices, intercropping, post-harvest handling and fermentation process. This knowledge will be taught in a persuasive way by connecting it with local values. Bali has local wisdom principle of 'Trihita karma' which is creating harmony among human, environment and the God. This principle is used by the government to manage the sustainable development in the province (Pitana, 2010). Agriculture as one of the development agenda can fit with the value to find the balance between economy, social aspects, ecology and culture. This concept can also be seen as part of Gaia Education (Education, 2011).

For long term strategy, socio-economic structure of the farmers will be changed. By using different strategies, we will make them work independently from each other, to understand and implement the contents. This step will be based emancipatory and blended approach of instrumental and emancipatory. The emancipatory approach starts

by allowing the farmers to decide about the name of the area/place for their agriculture lab. It is expected to provide the sense of belonging for them to the place.

The project design intends to impel the farmers to bring values, knowledge and skills from the lab area to their own farms, so later they can independently practice sustainable agriculture. To achieve this target, blended strategy approach, such as social practice model is required. The unsustainable and sustainable farm areas will be designed to show farmers how to change system of old practices provision to the new system (Fig 1). It will be dedicated for social collaborative learning process among the farmers. It will also create social cohesion between unsustainable and sustainable cacao farmers. The collective farm's concept will make joint ownership to bring mutual benefit in terms of economy and environment.

The social practice model is expected to break the existing routines of the unsustainable farmers. The system within the area will provide the strategy to process de-routinization, from an evaluation of old practices to implement new practices. This strategy will be mixed with individual and collective empowerment framework (Pedro, 2006). The model will consider series of factors that promote empowerment: providing access to information in the learning space about the price of fermented beans, cacao value chain and industry. In order to attract farmers into increasing productivity, applying social inclusion through the opening call for participation for all local farmers group, and reinforcing farmer's cooperatives' ability to be open and transparent Institutions in managing processing facility in the area.

The content of learning is separated because it is difficult for the farmers to absorb all knowledge and changing the practice in the integrated way immediately. After the first stage achieved, the area can continue to the second stage, to design circular economy model for utilizing agricultural waste. The baseline of the farmers' group and the farmers' cooperative can be transformed into the local business. Currently, there is already local chocolate production in several villages in Bali (METI, 2016). This business model can be developed into the circular business model based on local cooperatives. This inquiry will work with the expert who has enough knowledge about a circular economy in Indonesia. In the last stage, climate insurance will again require same education strategy from instrumental to emancipatory approach like in the first stage. This part will be planned for long term.

For side activities, the learning space can also be used for transferring knowledge to future farmers generation. For instance, storytelling can be used to tell kids about sustainable agriculture. It can give stronger understanding and connection in the creative learning process ("Urban Environmental Education," 2015). Furthermore, the area can be expanded into ecotourism site. It will help the cacao plantation to connect to the market and the investor. In the area, the visitors can provide feedback, inputs and suggestions, such as voting or choosing which variety of cacao they want to buy and how much they want. It creates the opportunity for farmers to learn from wider public and helps them to determine the farming strategy.

To ensure the implementation, Monitoring and evaluation of the project will be conducted by the partnership with the University in Bali through the combination of constructivist and reflexive approach. Evaluation through constructivist approach starts from pre-defined goal (changing farmer's mentality) and collecting "stories" (surveys - interviews, municipality statistics, dialogue – participatory approach) to assess if the objective was achieved (Davies & Dart 2005). It determines domains which need to be monitored (starting to use fermentation process, using organic fertilizers, higher income from changed production farms), and present questions concerning those. Those indicators will measure the change in farmer's behavior. Stories will be collected, and analyzed in the first step by the university, to obtain more specific knowledge from

stories they can involve into direct dialogue with farmers. “Filtered” stories, will be used to select the most significant change within each of the domain. After each collection, feedback will be provided to all participants. Stories analysis will be conducted 1st year after implementation of the project. Meanwhile, dialogue as monitoring will be done every time after harvest period as the discussion to give feedback to progress being made by the farmers. After three years, the most important points from discussion and stories, with reasons of its selection will be combined into one document – as a feedback for project managers – local NGO. Next step of this approach is to quantify information achieved, which will be presented by percentage of the farms, which changed their product type into sustainable in comparison to the number who participated in the project. As well the quality of cacao beans will be monitored, together with the percentage of income increase. The final step, consist of whole process analysis to take into consideration what has been learned directly from using this form of evaluation and from obtained results.

5. Discussion: Why farmer labs?

We believe that the idea of the farmer's labs above will be able to promote the transformation of farmers, from practicing traditional cacao plantation to be sustainable farming. The farmer's labs would also support and encourage the sustainable development of agriculture in the area. The specific reasons for the argument are as follows. The labs will provide space for social learning for the individual farmer to give them knowledge and daily routine/experiences to change mindset and behavior and transform their practices. That personal empowerment will also trigger to strengthen the organization and leadership of the farmer's group and the NGO collectively. The setting of the lab's area will make those organizations to improve their management system, make a clear division of work, supervision and guidance to make collaboration effective, this institutional improvement will also happen when the area development planning is imitated by surrounding areas.

There are some key principles of our mixed approaches design which take into account cultural values of the farmers. The main approach which can be implemented to change the mindset of farmers is social practice theory, because it considers the cultural and ethical aspects. The importance of understanding the cultural routine and philosophy of farmers can help to change farming routinized unsustainable to sustainable. That is why we introduce the new mixed type of concepts to give them step by step plan, that empowers them to change their habits and see results in short and long period of time. The outcome is to make the farmers understand that education, communication and practical experience can improve not only economic condition but, also make the environment more sustainable, as well as the social progress for sustainable development.

The farmer's labs will make farmers close with sustainable farming practices. The labs will show and explain the differences between conventional farming and sustainable farming, in terms of technology, technique and materials. It will work to guide the cacao farmers to learn about the advantages of organic cacao farming. The practices will include improving cultivation techniques, interplanting model and land use economic efficiency per unit area. This improvement will provide quality standard services to improve the scale of cacao planting income. The labs will also cultivate the next generation of professional cacao farmers by promoting practical techniques for the farmers. The techniques of cultivating, better seedling, integrated nutrient management, standardized transplanting technology, field management, harvesting baking technology will effectively improve farmers' skills to comprehensively enhance the overall production level of cacao and expand the cacao business.

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