

SCPP Knowledge Brief

Polyculture Model for Plantation Commodities



RESULT HIGHLIGHTS

- >110,000 farmers trained in GEP (Good Environmental Practices)
- >147,000 ha of cocoa gardens maintained with better farm management practices
- >20% increase of shade trees and 12.5% increase in cocoa productivity*
- Diversity of plant species in the cocoa gardens increased to 3.87 from 2.61*
- Net-incomes derived from complementary commodities were 15-50% of cocoa income
- 24% reduction in GHG emission on cocoa farms
- Annual GHG emission reduction by 0.26 from 0.77 to 0.51 tCO₂e/MT GHG cocoa produced through more-efficient use of agri-inputs
- Carbon sequestration of 259 tC/ha through appropriate shade management system

*) Baseline and post-line comparison of around 55,000 farmers

SUMMARY

Ensuring stable and reliable supplies from smallholder farmers is a common challenge faced by global commodity companies. Smallholder farmers seldom adopt recommended practices or invest in their commodity, and sometimes even switch to other commodities.

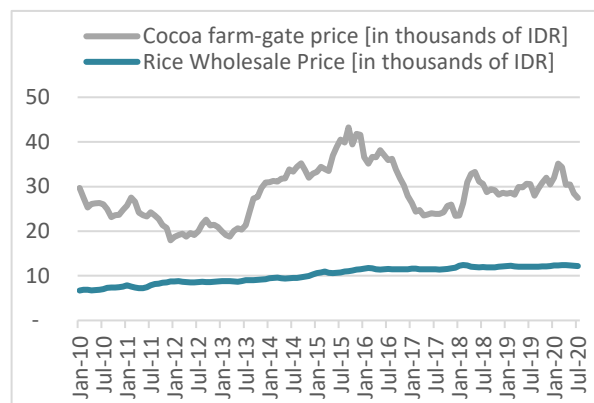
Price fluctuations and climatic risks (harvest failures) are a key constraint that prevents smallholder farmers focusing their resources on developing a single commodity.

To address this challenge, SCPP worked with partner companies to introduce risk diversification strategies through a polyculture production model. This solution was developed, tested and refined gradually, over several phases in the lifetime of the Program.

CONTEXT

Smallholder producers are susceptible to changes in global commodity prices that basically dictate farm-gate prices. In Indonesia’s cocoa sector, farm-gate prices are on average 10% lower than the global equivalent. In the last decade, Indonesian cocoa farmers experienced several boom-and-bust cycles; at its peak price level, 1kg of cocoa was worth above IDR40,000 (equivalent to 4kg of rice). However, at its lowest price level, cocoa was less than IDR20,000 (or 2kg of rice).

Such volatility is not only hurting farmers’ livelihoods; it is also deterring them from investing. Due to sudden price reversals, farm investments made during boom times could not yield the expected returns. During declining prices, farmers diverted their limited resources (i.e., labour and cash) from cocoa into other economic activities, leading to lower adoption rates of best practices. In worst cases, farmers cut down their plantation or replaced cocoa with other commodities such as oil palm and maize. In the long term, this can jeopardize the sustainability of cocoa supplies and downstream industries. Therefore, smallholder-based commodity supply chains need to have an integrated risk diversification element – a polyculture production model.

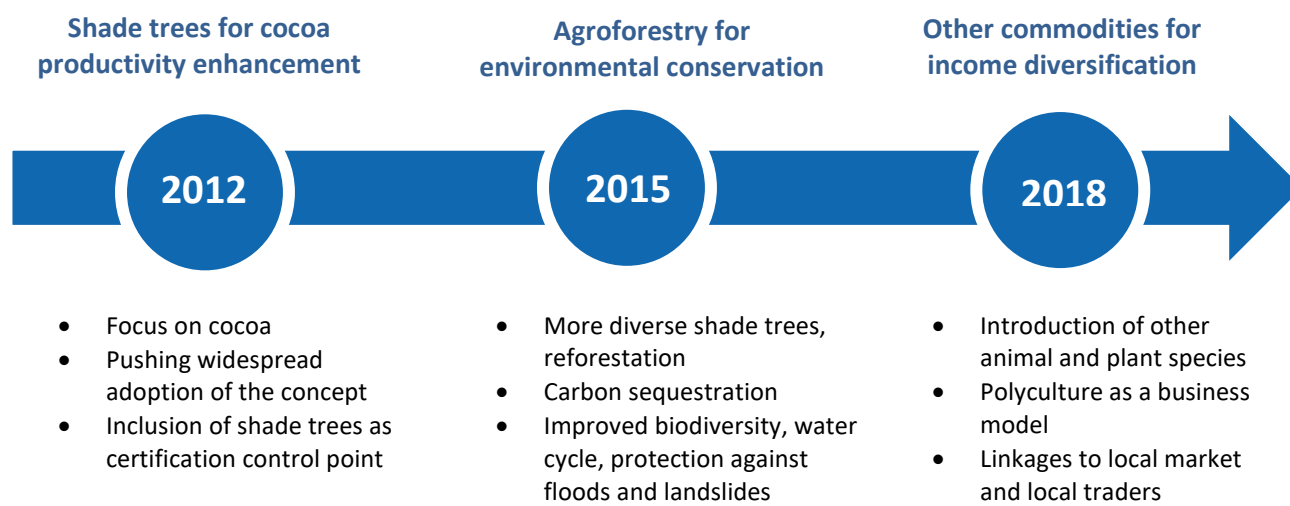


INNOVATION

Polyculture is an agriculture production model in which more than one species of plant and/or animal are cultivated at the same time and place (e.g., agroforestry, intercropping, agrosilvopastoral systems). Polyculture increases the adaptive capacity and reduces the vulnerabilities of smallholders through the following:

- Commercial benefits – risk diversification, multiple revenue streams and improved food security; and
- Agroecological benefits - reduction of pests, disease, weed pressure and weather risks, improved nutrition cycles, soil fertility and biodiversity.

Polyculture requires a mix of commodities with agroecological compatibility and complementary commercial values. It strives for production optimization, as opposed to the maximization of productivity prioritized under a monoculture system. It also needs to be integrated in the supply chain structures to ensure widespread adoption by farmers. SCPP went through a journey of innovation and iterative learning before arriving at the conclusion that polyculture is the more suitable production model for smallholder commodity farmers.



At Program outset, SCPP promoted the use of shade trees to increase cacao tree yield, as proven under pilots in the PEKA (Economic Development for Aceh Cocoa) Program. Planting and maintaining shade trees featured as a key topic in Good Agriculture Practices (GAP) training program. Most cocoa farmers had shade trees covering <15% of their field, far lower the recommended shading of 30-40%. Others had too much covering as the shade trees were not pruned or maintained properly.

Shade trees create favorable growing conditions:

- Improve microclimatic conditions: Protection from too much sunlight and heavy rainfalls, more stable temperatures and humidity.
- Increase biodiversity and provide habitats for beneficial insects and microorganisms to help keep pests and diseases in check.
- Maintain and improve soil fertility, particularly legume trees; and reduce erosion risks.

To further push the adoption, shade trees were then included as a control point certification. For example, UTZ standards required a minimum of 12 shade trees per ha. Recommended species were coconut and legume trees such as *Leucaena leucocephala* and *Gliricidia sepium*.

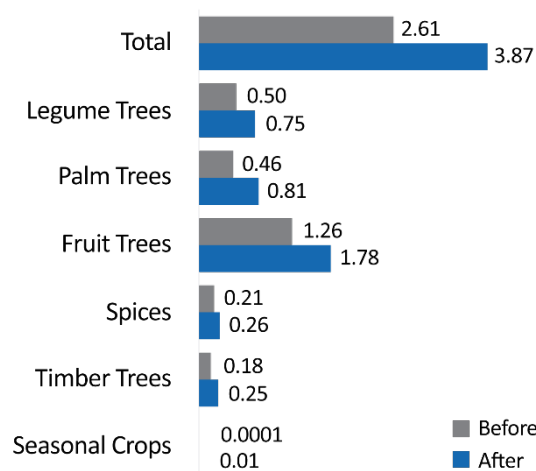


Thanks to SCPP training I realized my cocoa yield was so low because the shade trees were incorrectly positioned. After correcting this and applying the GAP, my annual cocoa yield tripled, from 266kg to 800kg per ha.

Hasriadi Hasan, cocoa farmer in Pidie Jaya, Aceh

In 2015, SCPP advocated for wider adoption of the agroforestry concept for smallholder cocoa production. Trees were not only to provide shade, but also additional incomes. More diversified species were introduced, such as fruit trees (durian or jackfruit for permanent shading; banana and papaya for temporary shading for young cacao trees). Baseline and post-line data from around 55,000 farmers showed the diversity of plant species had improved significantly. However, the integration of spices (e.g., cloves), timber (e.g., teak), and short-cycle seasonal crops (e.g., maize) was not yet a common practice among farmers.

Average Number of Plant Species by Category: Before & After Intervention



Agroforestry put a strong emphasis on climate-smart and conservation practices – key features of GEP training curriculum. Crop diversification was not only to enhance cocoa yield within the farm boundaries, but also to strengthen the resilience of the wider ecosystems. Farmer communities were mobilized to plant trees on deforested areas, particularly in hilly regions and along river basins, in order to increase water catchment areas, reduce risks of landslides, local floods and droughts. They were informed about the negative impacts of common slash-and-burn practices to clear forests, and the heightened climatic risks and harvest failures associated with uncontrolled logging.

Reducing carbon emissions is another key aspect. To reduce GHG (greenhouse gas) emissions, farmers were trained on composting organic waste, increasing organic material in the soil, applying chemical fertilizers and pesticides more efficiently using proper methods, mulching and planting cover crops. Shade trees provide important carbon storage, accounting for 22% of total carbon stock in cocoa gardens.

An evaluation on Cocoa Trace data of 60,000 farmers revealed that improved farming practices reduced GHG emissions by 38%, from 1.216 to 0.756 tCO₂e for every ton of cocoa produced.

SCPP Annual Report 2015



By making rorak (sanitation trenches) in the farm I can produce 1.5 tons of compost annually and save US\$80-100 on urea fertilizers.

Agustinus, cocoa farmer in Luwu, South Sulawesi

However, despite its perceived benefits, agroforestry's uptake by farmers was slower than expected. Some key constraints identified were:

- **Polyculture was not perceived and designed as a business venture.** Most cocoa farmers chose their commodity mix following local practices.
- **Limited resource availability.** In contrast, the establishment of polyculture requires considerable extra cash investments and maintenance efforts.
- **Conviction in intensive monoculture as the key supply chain development strategy.** Buyers and traders did not have any operational model for supporting farmers in their adoption of polyculture. However, as cocoa prices took another dip in 2017-2018 and pressure to exit the cocoa sector intensified, buyers increasingly acknowledged that monoculture is not feasible for smallholders and became more open to polyculture as a commercial model.

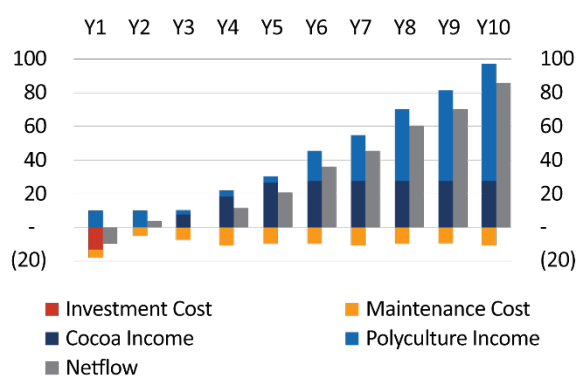
SCPP then introduced a stronger business perspective into agroforestry, leading to the formulation of polyculture models by initiating several pilots:

- **Introduce market orientation and simple cost benefit calculation in training programs** so that farmers can better design their commodity mix.
- **Empower and strengthen women's involvement in planning and managing polyculture as a family business** through *Transformative Coaching*.
- **Facilitate linkages to financial institutions.** Buyers, traders and farmers were supported in accessing small and micro loans (e.g., cocoa replanting combined with maize production).

A generic, simplified polyculture investment model was developed based on field data (polyculture for full cocoa replanting on 1 ha in 10 years: US\$1=IDR14,000, values are approximate). The model's total cost was US\$8,000, consisting of investment costs in Year 1 (US\$1,000) and maintenance costs (US\$7,000), whereas the total income was US\$30,000 comprising:

- Cocoa income (US\$13,500) starting from Year 3 and reaching the optimum level in Year 5 at US\$1,900 annually (annual yield of 950kg from 625 trees at 1.5kg per tree, farmgate price US\$2 per kg).
- Supplementary income (US\$16,500) from maize (Year 1-2), banana (Year 2 onwards), pepper (Year 3 onwards), durian (*Durio zibethinus*) (Year 6 onwards), Bitti wood (*Vitex cofassus*) (Year 10).

**Replanting and Polyculture Model:
Cash Flows in 10 Years [IDR million]**



The simplified calculation revealed both investment-worthiness and challenges. The investment had an NPV (net present value, discount rate 6% p.a.) of US\$14,000 and BCR (Benefit to Cost Ratio) of 3.5. However, the substantial upfront investment led to a negative cash flow of US\$700 in the first year. The additional monthly maintenance costs of US\$250 were also quite substantial for resource-limited households.

Some farmers were able to cope with these challenges by performing partial investments (e.g., for 10-20% of the total cultivation area and then repeating this in 3-5 years); others benefitted from integrating small livestock such as goats, for which there was strong demand in certain locations. Positive impacts on the local economy were observable in locations where market access was unproblematic.

Increasingly cocoa farmers sell additional commodities like coffee, copra and maize. Although their volumes are still small, they can make up to 20% of my trading incomes when cocoa prices and production are low.

Bakri, cocoa buying station in Bone, South Sulawesi



I feed my goats with the leaves of the shade trees and use their manure as fertilizer. With this integrated crop-livestock system, I can earn an additional US\$525 per year (around 20-30% of annual cocoa income). This helps stabilize my cocoa production and family income.

Haeruddin, cocoa farmer in Soppeng, South Sulawesi

KEY LESSONS

- Commodity buyers are the key driver of industry change. Demonstrate how polyculture addresses their pain points on supply stability and resilience.
- Calculate the profitability (i.e., costs and benefits) and build the business case of polyculture early on to all market players along the supply chain. Show how multi-commodity models help smoothen incomes and cope with price fluctuations.
- Identify models with agroecological compatibility to avoid water and nutrition competition; and alternative hosts for pests and pathogens.
- Women's role in managing household tasks, incomes and expenditures is indispensable. Involve them in planning and executing a polyculture model as family business [see *Transformative Coaching*].

WAY FORWARD

- **Polyculture is highly relevant and replicable for other commodities** facing similar challenges like cocoa. Swisscontact is well positioned to share its models and experiences with other global commodity buyers.
- **More structured multi-commodity off-taking mechanisms are to be explored** if polyculture is to roll out in the entirety of supply chains. For example, global commodity buyers can partner (1) with other large-scale commodity buyers (centralized model), (2) with multiple regional traders (regional model), or (3) empower their intermediaries to partner with local collectors and traders (decentralized model).