International Labour Organization

Agroforestry Skills
Kompetensia Agrofloresta

Funded by the European Union

AGROFORESTRY VALUE CHAIN ANALYSIS

Contents

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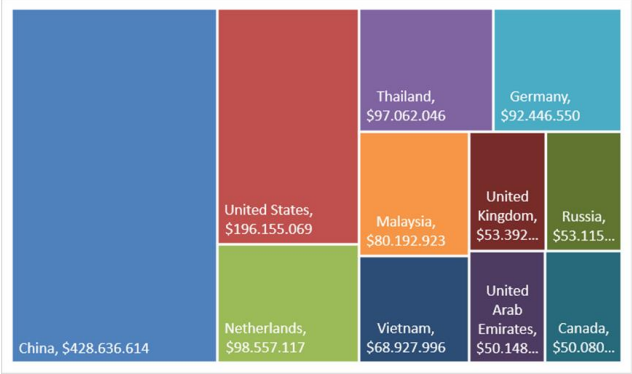
COCONUT

Market

The coconut tree, scientifically known as Cocos nucifera L., is predominantly cultivated by small-scale farmers in tropical regions, thriving in coastal areas from 20 degrees north to 20 degrees south of the equator, and at elevations up to 1,200 meters. It prefers highly humid environments, temperatures between 25°C to 30°C, well-draining soils, and is found extensively in the tropical zone, particularly along coastal regions.

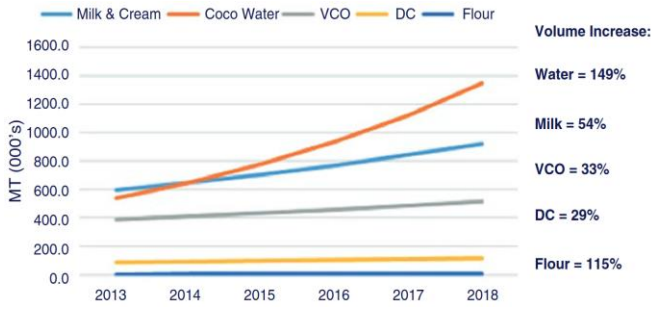
▶ Coconut top imported market values by countries 2021

Source: (OEC, 2021)



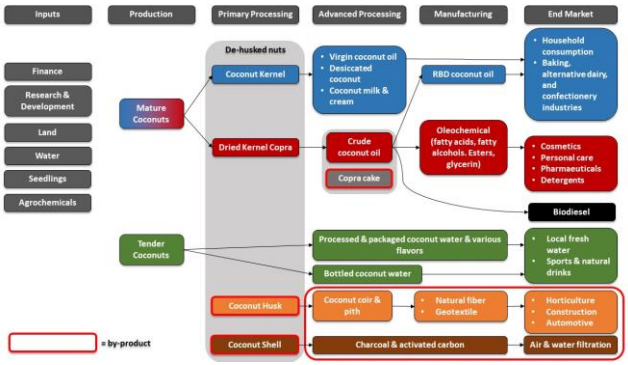
▶ Global coconut market volume from the Philippines

Source: (Salum et al., 2020)



Value chain

▶ Coconut value chain in the Caribbean



Current situation in Timor-Leste

Coconuts are widely distributed in most part of the regions particularly in coastal part of Timor-Leste. An estimated 30.000 tons of potential domestic coconut production may be produced in Timor-Leste annually, covering 12.000 ha of harvested area[1], with over 16,000 farmers involved in the coconut farming industry[2]. This kind of crop is valued as both a cash crop and a food crop, and it can yield a wide range of final products.

The majority of coconut trees that exist now were planted during the Portuguese and Indonesian time. Because of that most coconut trees in Timor-Leste are old and poorly cared – and this led to the low productivity (565 kg/ha), compared to the global average of 1,500 kg/ha. Fresh green coconuts and/or mature coconuts are gathered by farmers or household members, who may then sell them directly to the traders for distribution to the district or capital market. Occasionally, some farmers also handle primary processing, such as drying to produce copra.

Coconut growers confront a few difficulties to scale up the production level, including labor-intensiveness, old and tall coconut trees, a lack of knowledge and skills needed to process, a lack of market information and business connection, as well as shortage of processing facilities.

Coconut processors and exporters reside in the districts and in Dili. Currently coconuts is processed into copra, coconut oil, and virgin coconut oil (VCO) and distributed to both local and international market.

COCONUT

Current situation in Timor-Leste

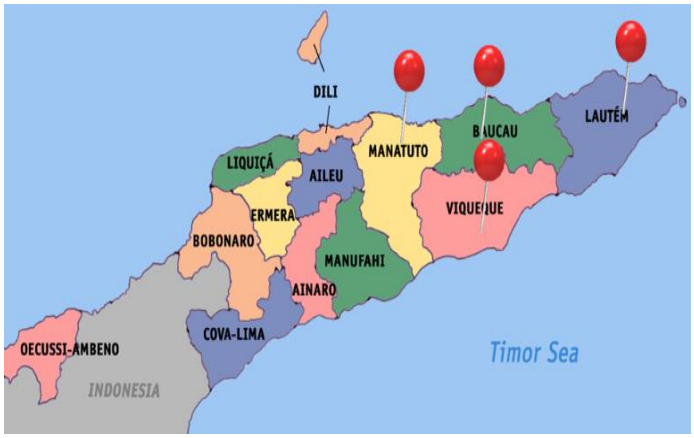
The exporters and processors of copra typically have a business contact or connection with foreign buyers. The processor and exporter purchased copra from traders in different municipalities, combining them all before shipping them to Indonesia. Apart from Indonesia, the Timor-Leste VCO market is beginning to grow internationally, mainly to Australia. Future expansion into European market is also possible[3].

The potential for processing coconut oil and VCO is not limited to the global market; it may also be leveraged to rival and supplant Timor-Leste's import of edible oil that worth about US$ 2 million a year[4].

Sources:

1. https://www.indexbox.io/search/production-coconut-timorleste/
2. https://marketdevelopmentfacility.org/wp-content/uploads/2023/06/TL-Market-Intel-Beyond-Coffee-agri-commodities-exports-potential.pdf
3. https://en.tatoli.tl/2022/05/04/cipriano-felix-souro-company-to-export-200-tons-of-coconut-virgin-oil-to-the-european/11/
4. https://www.timorleste.tl/wp-content/uploads/formidable/4/Timor-Leste-Strategic-Plan-2011-2030.pdf

Location



Circular business opportunities

▶ Circular business opportunities from by-products of coconut

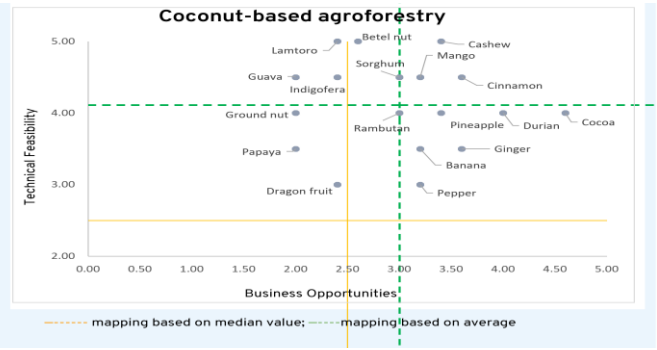
Coconut by-products	Circular business opportunities	Value chain stages
Dried kernel copra	• Copra cake for cattle feed*	• Production (on farm)
Coconut husk	• Coconut coir for cattle feed*,natural mat & rugs*, soil block*, cement/metal composite	• Production (on farm)
Young coconut leaf	• Craft*	• Production (on farm)
Coconut leaf bone	• Broom stick*	• Production (on farm)
Coconut shell	• Charcoal**, dietary supplement**	• Production (on farm)
Coconut tree stick	• Household furniture**, basic building materials for housing**	• Production (on farm)
Coconut root	• Herbal medicine*	• Production (on farm)
Cold-pressed coconut oil by-product (COB)	• Plant based drink & low fat ice cream**	• Advanced processing

Note: *=Applicable at the household level ,**=Applicable at the cooperative level

Agroforestry system

In the context of coconut-based agroforestry systems, intercropping means practicing crop diversification, growing a wider selection of different crops at the same time in the same field. This practice can create a more diverse, resilient, and sustainable farming system. There are about sixteen potential intercrop for coconut, including annual crops (ginger, ground nut and sorghum), semi perennial crops (banana, betel, papaw and pineapples) and perennial crops (cinnamon, cocoa, dragon fruit, mango, guava, pepper, cashew, rambutan and durian) (Samarakoon et al., 2023).

▶ Matrix of potential intercropping for agroforestry coconut value chain



COFFEE

Market

Coffee is grown in more than 70 countries, primarily within the equatorial region known as the "Bean Belt," which includes countries in Central and South America, Africa, and Asia. Tea may be the most widely consumed drink globally, but coffee takes a close second place in terms of popularity. While the exact origin of coffee consumption is uncertain, various stories suggest that its use could date to the 9th century (Sweetser, 2012). In terms of commerce, the coffee market is primarily dominated by two types of beans: the Arabica variety (Coffea arabica), accounting for roughly 60% of the market share, and the Robusta variety (Coffea Canephora), contributing to the remaining 40% (Bilen et al., 2023). This is despite the existence of over 130 identified species within the Coffea genus, along with seven subspecies (Davis et al., 2019).

When examining global production statistics, it's noted that coffee production worldwide surges past 10 million metric tons, with the cultivated land exceeding 11 million hectares. More than half of the world's coffee output, about 55.5%, comes from the Americas, with Asia contributing 31.9%. Leading the list of coffee-producing nations are Brazil, Vietnam, and Indonesia, along with Colombia among others, although more than 70 countries play a significant role in coffee cultivation.

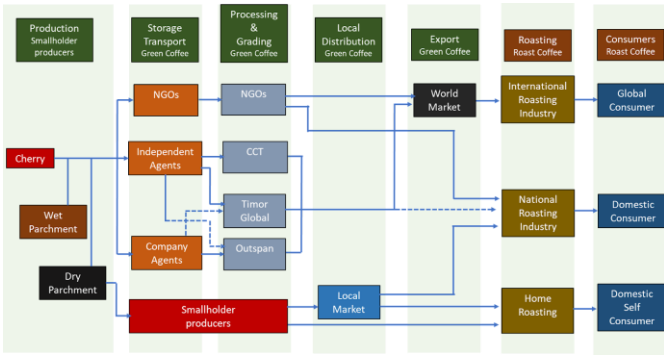
▶ Leading global coffee producers in 2019

Rank	Country	Area harvested (ha)	Production (tonnes)
1	Brazil	1,823,403	3,009,402
2	Indonesia	1,258,032	760,963
3	Cote d'Ivoire	953,972	67,697
4	Colombia	853,700	885,120
5	Ethiopia	758,523	482,561
6	Mexico	629,300	165,712
7	Vietnam	622,637	1,683,971
8	Uganda	469,364	254,088
9	Honduras	420,957	476,345
10	India	416,741	319,500
11	Peru	359,508	363,291
12	Guatemala	308,217	225,000

Source: (Bilen et al., 2023)

Value chain

▶ Timor-Leste coffee value chain



Source: (adapted from Henriques et al., 2012; Ministry of Agriculture and Fisheries, 2019)

Current situation in Timor-Leste

Coffee has been grown by farmers in Timor-Leste since Portuguese time. It is a commodity that provide revenues for the country as this is the main agricultural product that can be exported abroad. Currently coffee still become the main export for non-oil commodity in Timor-Leste. The production of coffee in this country is dominated by an estimated 44,000 small household producers which represent around 25% of the total population. In addition, coffee continues to be the predominant export commodity with exports contributing between 95% and 99% of the country's total export value in recent years. The value of coffee exported was estimated at USD10.7 million in 2015, rising to USD24 million in 2016 (DGE 2015).

In Timor-Leste coffee mostly produced by smallholder coffee farmers. The majority of coffee trees in this country are very old and therefore it contributed to the low production of coffee (300 kg/ha). So far there is no such new cultivation of coffee in large scale done by coffee farmers. The area of coffee produced by smallholder coffee farmers is ranging from 0.5 -5 ha; the labor used from planting to harvesting usually family labor.

After harvesting smallholder coffee farmers conducting processing activities which includes cured and milled to remove the fruit from bean. This can be done through wet or dry processing. Agribusiness firms such as CCT, Timor Global and others normally use machinery for wet processing; and smallholders' coffee farmers usually conducted this activity manually.

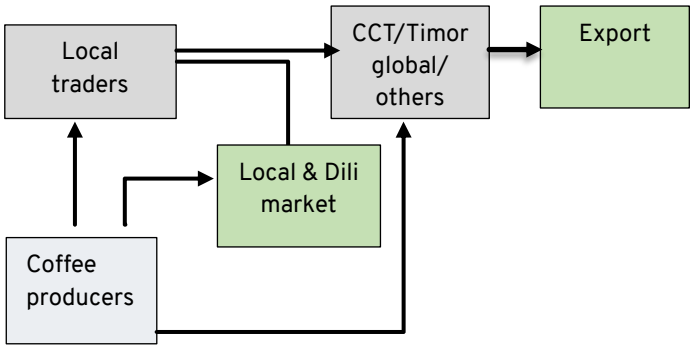
COFFEE

Current situation in Timor-Leste

More than 90% of green coffee beans in Timor-Leste are traded internationally. Trading firms such as CCT, Timor Global, and others play an important role in Timor-Leste's coffee. CCT normally buy green coffee from their members (around 28,000 members of CCT), then processing and ship the beans to the end market. Other firms like Timor Global usually purchase beans from individual growers then exported to other countries. There are a number of agribusiness firms that dominated trading of coffee beans for export. They are CCT, Timor Global, Peace Wing, Alter Trade, Parcic and others. There are a number of smallholder coffee famers who sell their produce directly to local and Dili market.

The varying prices of coffee products reflect the different stages of processing and value addition within the coffee value chain Details of the distribution of coffee is shown below.

▶ Supply chain of coffee in Timor-Leste

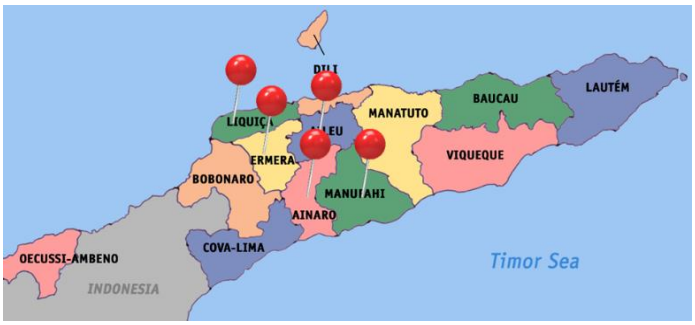


Circular business opportunities

Coffee by-products	Circular business opportunities	Value chain stages
Organic waste from pruning	Bioproducts* (organic liquid fertilizers and compost)	Production (on farm/farmer level)
Coffee cherry, cascara, husk, pulp, parchment, mucilage, and silver skin	Bioproducts* (Organic liquid fertilizer), biofuel**, fragrance/perfume**, drinks and food products*, bio pellet, biomass power plant or heating**	Primary Processing (farmer level)
Spent coffee grounds (SCG)	Biofuel, compost, fertilizer, fuel pellets, construction materials, reusable cups, substrates for mushroom production, and natural phenolic antioxidants	Consumption process (off-farm)

Note: * = Applicable at the household level, ** = Applicable at the cooperative level

Location



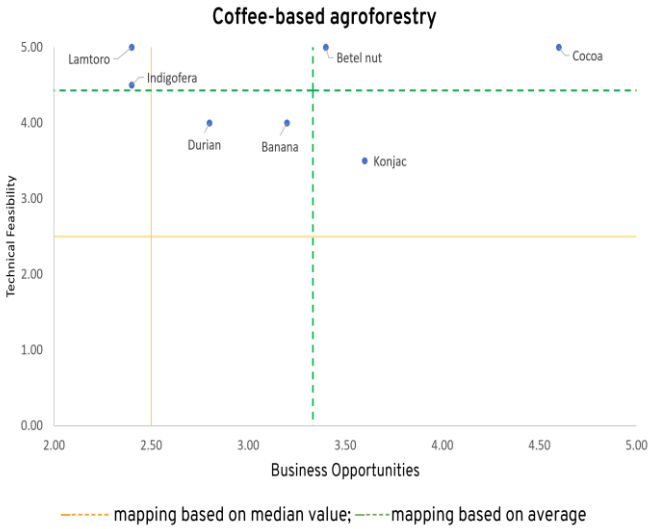
Municipio	Area (ha)		Production (ton)	No of producers
	Productive	Non-productive		
Ermera	20,800	11,200	5360	27,210
Manufahi	4163.25	2241.75	3560	12,420
Liquica	7777.25	4187.7	4050	7232
Ainaro	3417.3	2278.2	2540	6450
Aileu	1152	620	1040	1430
Bobonaro	563	406	950	1027
Covalima	18	12	460	41
Manatuto	227.5	72.5	450	N/A
Viqueque	N/A	N/A	N/A	N/A
Baucau	2	1	0.002	2
Lautem	12.9	88	0.005	10
Oecusse	2	3	0.002	5
Total	37,908	21,038	17,960	55,827

Area, Production, Producers and potential areas of coffee in Timor-Leste (2015)

Agroforestry system

The recommendations provided in this coffee agroforestry value chain consider both the technical feasibility and business opportunities. This recommendation focuses on identifying intercropping plants that are deemed most compatible with the coffee plant, which serves as the main plant in this context.

▶ Matrix of potential intercropping for agroforestry coffee value chain



KONJAC

Market

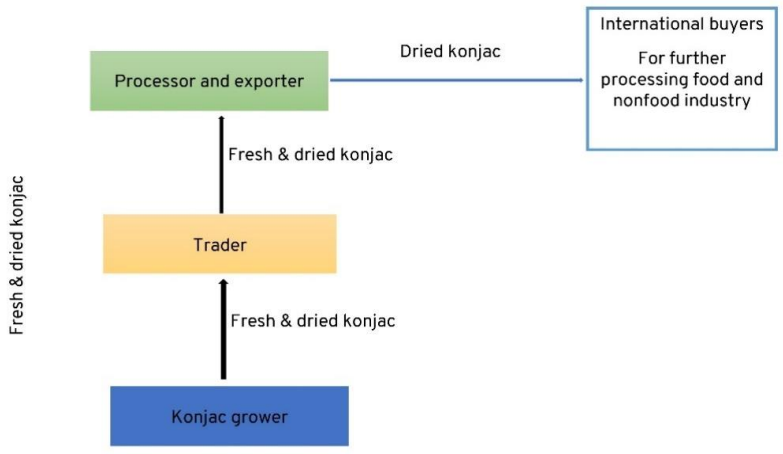
Konjac, a perennial plant native to Southeast Asia, is known as Amorphophallus Konjac. It is particularly valued for its starchy corm, which is rich in glucomannan, a water-soluble dietary fiber (Behera & Ray, 2016). Konjac flour is often used to produce low-calorie and low-carbohydrate food products. It is commonly used to make shirataki noodles, a popular alternative for low-calorie and low-carb pasta options (Rejeki et al., 2021). Konjac is also used as a glucomannan, gelling agent, thickener, and stabilizer in various food products such as jellies, desserts, and sauces. Accordingly, it is rich in soluble fiber, and konjac is commonly used as a healthy food supplement (Devaraj et al., 2019). In addition to healthy foods, konjac is used in cosmetic products. Konjac root extract is used in skincare products, particularly in the form of konjac sponge. Sponges are known for their gentle exfoliation and cleansing properties. Its natural properties make it an appealing ingredient for cosmetics, offering potential benefits such as hydration and skin conditioning. Konjac fibers can be used in the textile industry to produce biodegradable fabrics. This aligns with the growing demand for sustainable and eco-friendly materials for various industries.

Regarding present market trends, the demand for konjac remains limited to major industries. The Chinese government recognizes konjac as a strategically significant agricultural crop with promising prospects in both domestic and global markets (Chua et al., 2010). This has an impact on the market structure, which is typically characterized by a monopsonistic nature (see Riptanti et al., 2022). This has ramifications for the prices obtained by farmers and impacts their profitability encountered by farmers.

Value chain

The existing value chain for Konjac in Timor-Leste, comprise of three main components that include Konjac grower, trader, processor and exporter, and market segment (Figure 6). Konjac growers in Timor-Leste is dominated by a small holder farming and distributed throughout the territory. A few numbers of processor and exporter company are currently operating in Timor-Leste such as Same Diak Construction. The market segment for konjac is primarily for international market such as China, Indonesia and Thailand.

▶ **Overview of Timor-Leste konjac value chain**



KONJAC

Current situation in Timor-Leste

The scientific name for the Konjac plant, also known as maek in Tetum, is Amorphophallus Konjac, and it is native to Asia. This specific plant has been cultivated naturally or in the wild for generations in Timor-Leste, where it is used locally as both human and animal food. In 2016, Timor-Leste exported its first konjac commodity product to China. This particular plant became well-known and used because it contains glucomannan, a chemical substance that is frequently used in the food, cosmetic, and meat industry [1].

After the first export, more and more rural family become attracted to search and collect wild konjac, and began to farm konjac alongside with other commodities such as coffee because of its high price. The emergence of a few local businesses that acted as buyers and processors for konjac products to be further processed or distributed abroad contributed to the momentum.

In Timor-Leste, an estimated 1.200 farmers involve in the production of 1.616 tons of konjac annually, and it is valued as commercial crop rather than a food crop. Farmers sell their konjac product in a form of fresh and mostly in a form of slice dried (dried konjac chips) to the traders or directly to the processors and exporters based in municipality and Dili to further distributed into international buyers.

All of Timor-Leste's konjac products are sent as dried chips to international customers for further processing. China, Indonesia, and Thailand are the three primary destinations for konjac exported from Timor-Leste. Between 2017 and 2021, Timor-Leste exported 500-1600 tons of konjac, valued at 1.3 - 2.8 million US dollars. Konjac is the second largest export of goods in Timor-Leste (after coffee), in terms of value and it is suitable for many Timorese farmers [2].

The potential market for konjac is openly available for Timor-Leste. Konjac has a sizable international market, valued at US$ 922.5 million in 2020 and expected to grow to USD 1.8 billion by 2030[3]. The production of konjac is currently focused on providing supplies to international buyer for additional processing; in contrast to other crops grown in Timor-Leste, like coffee, it currently has no domestic market.

Sources:

1. https://marketdevelopmentfacility.org/wp-content/uploads/2021/03/Konjac-Farming-Guide-Web.pdf
2. http://timor-leste.gov.tl/wp-content/uploads/2020/10/EN-PRE_screen.pdf
3. https://marketdevelopmentfacility.org/wp-content/uploads/2023/06/TL-Market-Intel-Beyond-Coffee-agri-commodities-exports-potential.pdf

Circular business opportunities

Konjac by products	Circular business opportunities
Dried chips	• Low-calorie and low-carbohydrate food products • Shirataki noodles, a popular alternative for low-calorie and low-carb pasta options
Glucomannan flour	• Gelling agent, thickener, and stabilizer
Konjac root extract	• Skincare products, particularly in the form of konjac sponge
Konjac fibers	• Textile industry to produce biodegradable fabrics

Source: Value Chain Analysis for the Agroforestry Sectors in Timor-Leste, ILO, IPB, 2024

Location

VANILLA

Market

Vanilla cultivation involves the orchid being a semi-epiphyte, which means it requires the support of a host tree for growth, shade, and nutrient supply from decaying organic matter. Annually, the estimated global output of vanilla ranges between 2,000 to 2,300 metric tons. Madagascar leads in both the extent of area dedicated to vanilla and its production, with Indonesia being a notable but significantly smaller producer, yielding on average about 150 metric tons each year. Other countries contributing significantly to vanilla cultivation are Mexico, China, Papua New Guinea, and various nations in the West Indies. Both Uganda and Tanzania in Africa have seen a rise in their vanilla production, now reaching roughly 150 metric tons. The different varieties and applications of vanilla can be found detailed in Table below.

▶ **The different varieties and applications of vanilla**

Species	Growing regions	Flavor profile	Market
Vanilla planifolia	Madagascar, Reunion, and other tropical regions in proximity to Indian Ocean, Indonesia	Most common with the most prominent market acceptance. Nearly all Highest concentration of vanilla of all varieties. Soft, creamy endnotes, full aftertaste of dried fruits and cinnamon extract. Bourbon vanilla is marked by moderate Bourbon/rummy notes, slight to moderate resin, and slight vanillin	Most common with the most prominent market acceptance. Nearly all vanilla used in the United States is *V. planifolia*.
Vanilla pompona	West Indies, Central and South America		Production is rare, and the market is limited to pharmaceuticals and perfumes.
Vanilla tahitensis	South Pacific—Tahiti, Moorea	A quick release of initial flavor and relatively sweet, high-resin content, weaker overall flavor than planifolia. Moderate fruity, floral notes with slight vanillin and Bourbon/rummy notes.	High demand in France and Italy for ice cream making.

Value chain

The vanilla supply chain is characterized by the challenges of managing a high-risk crop and maintaining a stable supply. Addressing the increasing global demand for vanilla while ensuring sustainable production practices requires innovative approaches, as highlighted by (Watteyn et al., 2022).

Current situation in Timor-Leste

Most of the vanilla is cultivated by farmers in Timor-Leste who were previously engaged in plantation crops (Sendall & Gusmão, 2018). The existing plantation lands provide an environment highly suitable for vanilla cultivation. Plantation farmers are relatively receptive to vanilla cultivation due to its current high market value and the relatively easy maintenance and harvesting processes (Feintrenie et al., 2010). An example of combining coconut and vanilla plantations in Vanuatu indicates that farmers find coconut cultivation more challenging than vanilla. Despite the need for manual pollination to achieve a high success rate in vanilla fruiting, farmers still perceive coconut or copra harvesting as more strenuous. The introduction of vanilla to existing plantations also does not significantly impact the harvest yields of other plantation crops, making it a viable income diversification strategy (Feintrenie et al., 2010) and a transition towards agroforestry cultivation systems.

In addition to cultivation aspects, the marketing of vanilla also has advantages as its main buyers are existing coffee exporters. Therefore, vanilla marketing becomes easier due to shared marketing channels with coffee and relatively mature institutions. Timor-Leste's vanilla value chain itself is relatively short. As seen in Figure 15, the value chain is divided into two main chains before reaching consumers. The first chain is a large-scale chain involving exporters, international processors/packagers, and global food processors. The second chain is relatively smaller, involving suppliers to the food industry and small-capacity processors (boutiques).

According to Census 2019 the total production of vanilla in Timor-Leste was 163 tons of wet vanilla beans and the total number of farmers engage in vanilla farm is 1,200 farmers.

In addition, a study conducted by CNIC and Trade Invest (2020) in the municipality of Ermera shows that the production of vanilla from time to time is varying. For example, in 2015 it was around 700 kg, 2017 was 145 kg and 2019 rise to 6025 kg (CCT 2019). This study also reveal that one vanilla tree can produce an average of 1.8 kilograms wet vanilla. From the interview with a group of vanilla farmers in Suco Leimea Sorin Balun, it shows that from 225 vanilla trees can only produce 405 kg vanilla.

The opportunity offered includes:

- Vanilla provides significant price ($20/kg) and this offer opportunity to vanilla farmers to increase their income and improve livelihood.
- Opportunity to process wet to dry vanilla (fermentation) so that farmers can get better chance to high price of the product.
- Intercropping with coffee and also Konjac or other food crops – earn income and food security.

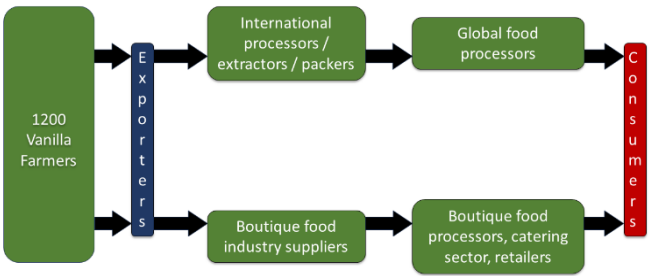
VANILLA

Current situation in Timor-Leste

In addition, the challenges faced are including:

- Low skill and management of farmers in managing vanilla farm.
- Price fluctuated and limited buyers
- Needs more labor in managing vanilla farm
- Lack of opportunities for value addition of the product

▶ Vanilla value chain in Timor-Leste



Source: (Sendall & Gusmão, 2018)

Circular business opportunities

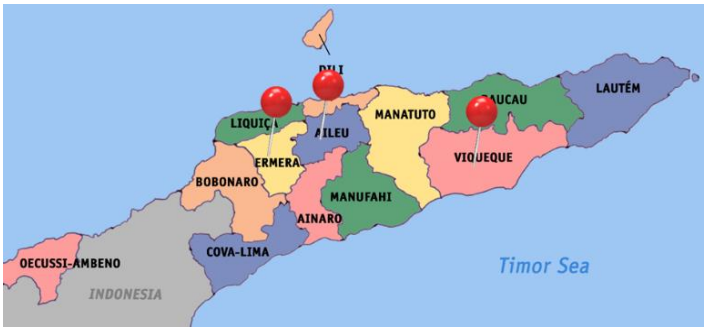
In our desk study, we identified 13 existing vanilla intercrops, categorizing them into annual, semi-perennial, and perennial crops. To assess their business potential, we employed three key indicators: value added, profitability, and market viability. Our findings reveal that coffee and cocoa scored the highest average, at 4.60, suggesting promising prospects. This is particularly encouraging given the established coffee plantations in Timor Leste, as noted by Sendall & Gusmao (2018), which share marketing channels and institutional frameworks with vanilla.

Additionally, cocoa exhibits significant potential due to its high value added, profitability, and market demand. While coffee and cocoa emerge as strong recommendations for vanilla-based agroforestry.

▶ Circular business opportunities from by-products of vanilla

Vanilla by-products	Circular business opportunities	Value chain stages
Vanilla pods	Secondary vanillin produced from pods enzymatic re-extraction	Advanced processing
Re-extracted vanilla pods	Animal feed	Advanced processing and waste management

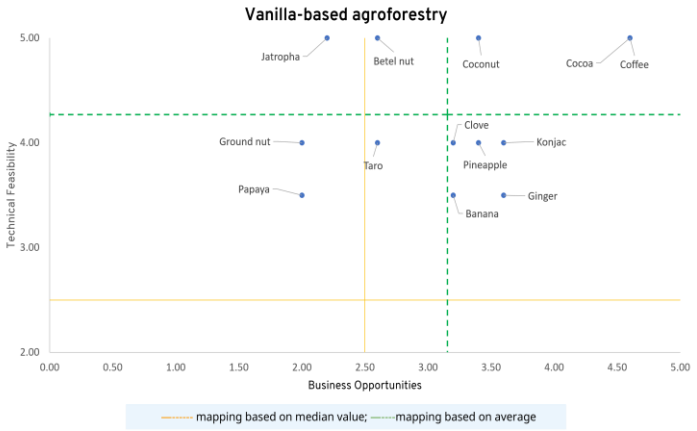
Location



Agroforestry system

Among the 13 intercrops identified for agroforestry vanilla systems, we highly recommend cultivating coffee, cocoa, and coconut. Additionally, crops such as clove, konjac, pineapple, ginger, betel nut, and banana, which are in the Recommended Quadrant, should also be considered. Based on the existing literature, these six plants still have technical (agronomic) feasibility and business opportunities. Therefore, further research is required to adapt agroforestry vanilla systems to specific local conditions.

▶ Matrix of potential intercropping for agroforestry vanilla value chain



About ILO

The International Labour Organization

The International Labour Organization (ILO) is the UN agency for the world of work. It was founded in 1919 as part of the Treaty of Versailles that ended World War I, to reflect the principle that universal and lasting peace can only be achieved if it is built on social justice. The ILO is the only 'tripartite' United Nations agency that brings together representatives of governments, employers and workers to shape policies and programmes for social justice and decent working and living conditions for all women and men. For this it was awarded the Nobel Peace Prize in 1969. The ILO is also responsible for drawing up and overseeing international labour standards (Conventions and Recommendations). This unique arrangement gives the organization an edge in incorporating 'real world' knowledge about employment and work into its activities.

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