

Value chain analyses assist in informing policy dialogue and investment operations. They help the understanding of how agricultural development fits within market dynamics. They permit an assessment of the value chains' impact on smallholders and businesses.

The European Commission has developed the methodological framework for analysis. It aims to understand to what extent the value chain allows for inclusive growth and whether it is both socially and environmentally sustainable.

The value chain context

Cocoa production provides jobs and income for the rural population, which remains predominant throughout Papua New Guinea (PNG). In the main regions of production, around 30% of households produce cocoa, while representing 15% of the number of households at the national level.

However, there has been a downward trend in the cocoa production in the last ten years, mainly caused by the appearance of the Cocoa Pod Borer (CPB) in 2006. Its

devastating effects on yields and the intensive labour needs to control CPB pushed many smallholders to abandon cocoa production. In addition, quality generally decreased after the downturn of plantations.

More recently, significant work is being done to tackle these constraints and cocoa production is planned to reach 100,000t in the next five years if major interventions occur.

The European Union intervention

The EU supports the sustainable development of the cocoa value chain (VC) in PNG with interventions, on the one side to reinforce links between small producers and agribusiness for easier access to markets, technologies and services; and on the other to enhance quality and income through certified sustainability practices. Women and youth are specifically targeted for training and engagement.

Under the 10th EDF, the EU granted €4.7 million to the Cocoa Component of the Productive Partnership in Agriculture Project (PPAP) with the World Bank. Under the 11th EDF, the EU is implementing the 'Support to Rural Entrepreneurship, Investment and Trade' Programme for an indicative amount of €85 million which includes actions in the cocoa VC.

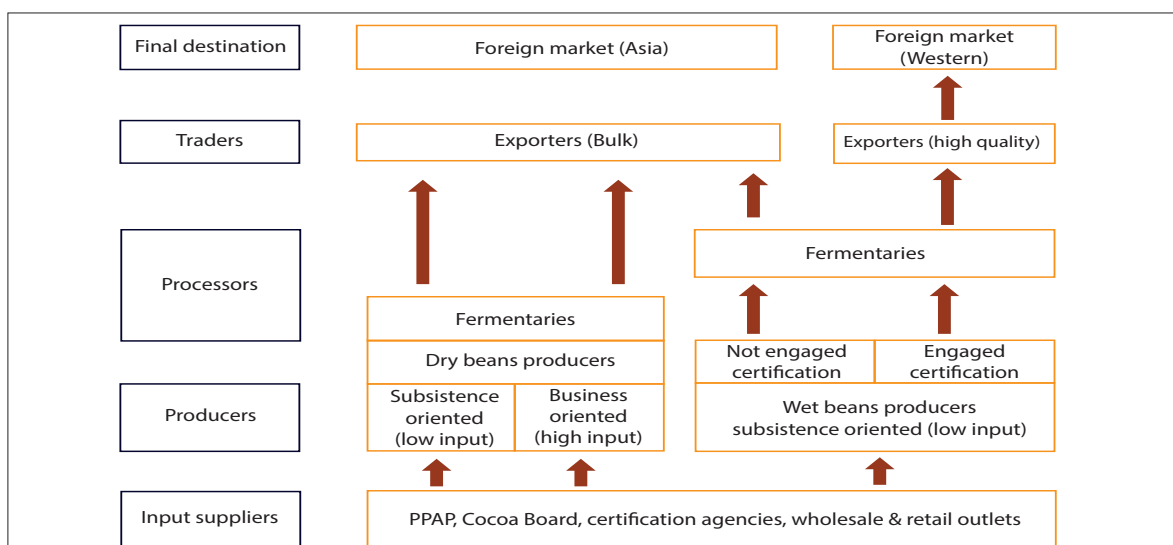


Figure 1 : Mapping of the cocoa value chain in Papua New Guinea

Functional analysis

Production trend

Around **one million people's livelihoods** depend on cocoa. Cocoa in PNG is estimated to grow on 130,000 ha in coastal provinces, as a monoculture or intercropped with coconuts or other food crops. The main cocoa regions are the Morobe-Madang-Sepik (MOMASE) provinces (accounting for more than half of the production), East New Britain (ENB) and the Autonomous Region of Bougainville (AROB).

Before the incursion of the CPB, national production was around 50,000 t per year. It decreased by 20% since 2008, with only **40,000 t exported in 2016**, almost entirely as dry beans.

The VC is characterized by the export of low processed and low quality products.

Farming strategies

Three types of primary actors are producing cocoa (Figure 2):

- **Subsistence-oriented wet beans producers**, who use low inputs and sell wet beans to fermentaries in the vicinity. A minority of them are engaged in a certification scheme, getting a better price for their products.
- **Subsistence-oriented dry beans producers**, who adopt a low input practice and have access to low-quality fermentaries, many of them being owners of a fermentary.
- **Business-oriented dry beans producers**, that engage in high inputs (investing in labour, pesticides) farming which generates significant productivity gains, transform wet beans into dry beans thanks to easier access to fermentaries and sell to exporters at higher prices. This category is still small.

Ease of access to fermentaries is a determining factor for producers to orient the production towards dry or wet beans. Both beans are mainly destined for bulk markets, but some wet beans also make it into the certified markets. In the business-oriented strategy, producers with access to fermentaries usually produce dry beans.

Downstream activities

The conversion of wet to dry beans passes through **fermentation and drying**, usually by burning firewood. When the smoke of drying kilns is in direct contact with the cocoa beans, the quality decreases and therefore the majority of dried beans are sold to bulk markets because of the risk of a smoky taste.

40-50% of around 20,000 fermentaries are not active. The number of fermentaries is higher in ENB and AROB as these provinces benefited from subsidy programs for fermentaries

Models	Subsistence-oriented (low intensity input)		Business-oriented (high intensity)
Types	Wet bean producers	Dry bean producers	Dry bean producers
Main location	East Sepik & MOMASE	ENB & AROB	ENB & AROB
Average surface (ha)	0.6	1.00	0.75
Number of households	102,000	43,000	2,900
Eq. dried beans yield (kg/ha/yr)	300	380	1,600
Pesticide inputs	none		moderate
Fertilizer inputs	none		none
Use of income	subsistence		partial or full reinvestment in cocoa
Road access	poor/not accessible	accessible to some extent	accessible
Cocoa varieties	Trinitario and hybrids SG	Hybrids (and some clones)	Hybrids and clones
External support	low/Cocoa Board	moderate/PPAP	high/PPAP
Total surface of active production (ha)	61,000	43,000	2,200
Total production (eq. dried beans kg/yr)	18 million	16 million	3.5 million

Figure 2 : Features of producers

since the 1980s.

Exporters mostly buy dry beans and do not have significant fermentation or drying equipment. Historically, there are about fifteen companies that export cocoa, but 75% of the cocoa production is exported by two companies. The biggest exporters have developed extension services to smallholders through PPAP funds or certification processes.

Governance

The Cocoa Board (CB) of PNG has a major role in regulating the VC. However, support to the VC is also provided by external financing and resources, notably by PPAP or by some export companies. The common vision of public and private institutions is to promote the business-oriented model and the parallel development of private certification schemes.

Certification

Two international standards, Fair Trade (FT) and Rainforest Alliance (RA), are present in PNG via Outspan for RA and Agmark for FT. Some large companies have their own certification system. Niche markets in Europe, Australia and New Zealand demand specific flavours and qualities, but a general poor quality of the beans coupled with high logistical costs and difficulties constitute major constraints for PNG cocoa.

Economic analysis

Profitability of actors

	Subsistence-oriented (low intensity input)		Business-oriented producers	Fermentaries		Exporters		
	Wet bean producers		Dry bean producers	Non-certified	Certified	Non-certified	Certified	
	Bulk	Certified						
Price (/kg €)	0.27	0.31	1.46	1.46	1.46	1.78	1.76	2.38
Net profit (€)	57	90	44	760	340	3,640	453,000	559,000
Value added /t (€)	221	225	1,297	1,338	560	722	87	454
Net profit rate (%)	41	43	8	43	12	28	9	17
% Final price at farm gate	18	17	83	83				

Net profit = Price – Costs (included depreciation)

Figure 3 : Economic indicators of the financial analysis

The production, process and trade of cocoa in PNG are profitable activities (Figure 3). However, the net profit of a typical subsistence-oriented wet-beans producer is low (despite high profitability rates) because of their small size. The net profit is remarkably lower for a subsistence-oriented dry-beans producer, that also has a low net profit rate. This is mainly caused by the depreciation costs due to the drying process (although the cash flow generated by the sale of dried beans remains significant). The net profit of a business-oriented producer is high but this is also due to the support by the PPAP. A certified cocoa producer has a slightly better financial performance because of a higher selling price and improved logistics.

With regards to fermentary owners, the net profit is higher for a certified rather than for a standard one. Similarly, the net profit is higher for a certified exporter compared to a non-certified.

Value added and income distribution

The total value added (VA) of the cocoa sector is around €64 million in 2017 and contributes around 3.8% to the GDP and 20% to the agricultural GDP.

The subsistence-oriented producers (around 150,000 households) generate 64% of the total direct VA of the cocoa VC (Figure 4) and obtain around 38% of the total net profit. A large part of the wages (64%) in the VC is created by these subsistence-oriented producers.

Macroeconomic perspective of the cocoa VC

The contribution of the cocoa VC to the public finances is negative as public funds subsidised by the CB are high while taxes are low. A large part of the cocoa production

is still informal and therefore not taxed. The ratio tax/subsidy stands at 90%.

On the contrary, the contribution of the VC to the balance of trade is positive with a surplus of about €64 million per year.

The VC is viable within the global economy with a Domestic Cost Ratio of 0.53 meaning that the economic value generated is higher than the domestic resources used by the VC, calculated at international prices.

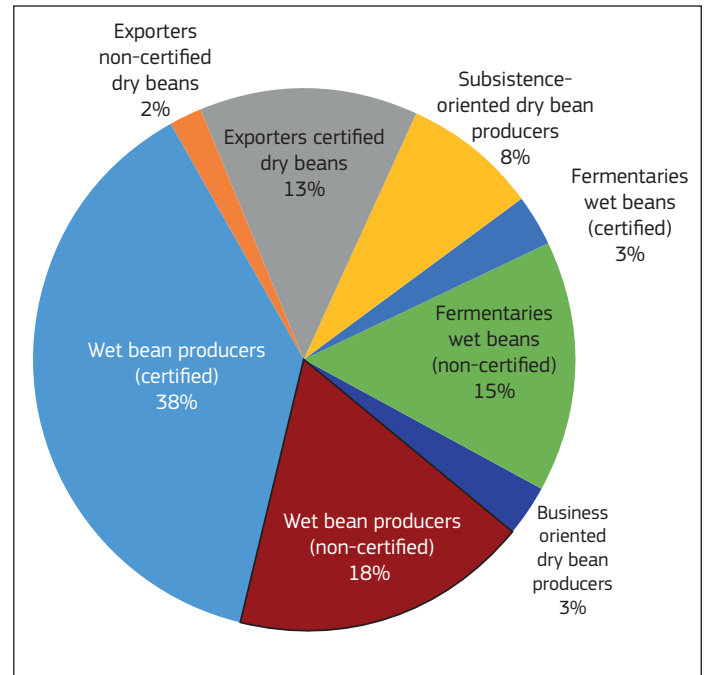


Figure 4 : Value added creation in the cocoa value chain

WHAT IS THE CONTRIBUTION OF THE VALUE CHAIN TO ECONOMIC GROWTH?

The net profit rate of the actors varies between 8% and 43%. Nevertheless, the financial profitability of the VC is linked to low intensity of inputs, or is heavily dependent on subsidies received by several stakeholders and on the exogenous variation of the cocoa prices in the international market, on which PNG has no influence.

Currently, the contribution of the VC to growth is substantial as cocoa generates one fifth of the agricultural GDP and is sustainable in the international economy.

Social Analysis

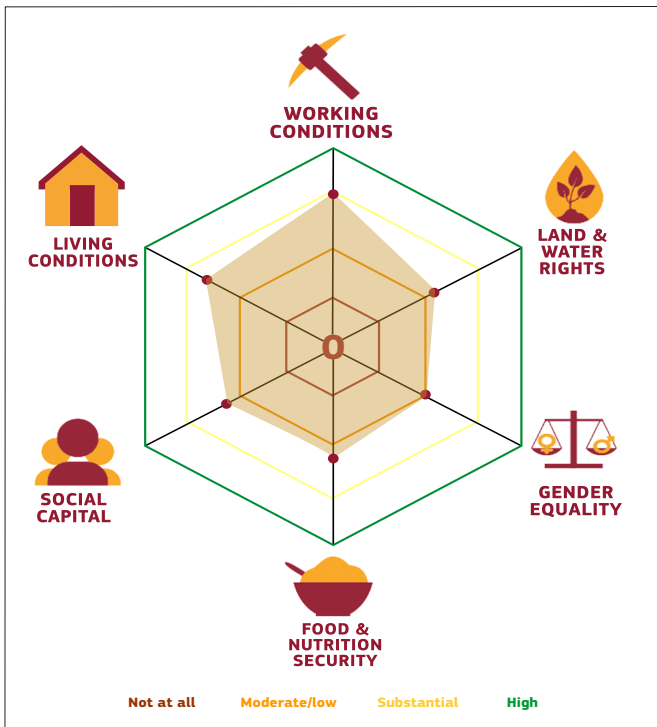


Figure 5: Social profile

Working Conditions	<ul style="list-style-type: none"> Workers' rights in terms of fair and enforceable contracts, effective collective bargaining, and job safety, remain relatively weak. Labour is mostly limited to household members. Other types of labour are based on notions of relatedness and reciprocal obligation. Cocoa is an attractive activity at smallholder level and provides important informal rural labour opportunities given the context of little available income alternatives.
Land and Water Rights	<ul style="list-style-type: none"> The existing legal framework that acknowledges customary land ownership comes with challenges (especially for investment and credit access) but is arguably the best guarantor for equitable tenure rights and access to land in practice. Formalisation of tenure rights (in contrast with local and informal customary practices) may complicate access for vulnerable groups and individuals.
Gender Equality	<ul style="list-style-type: none"> Women are not per se excluded from specific segments in the cocoa VC but are mostly in subordinate positions in decision-making, participation, control over income, and access to resources and services.
Food and Nutrition Security	<ul style="list-style-type: none"> Population in areas in which cocoa is a common cash crop are in a better position to withstand shock to food production and less at risk of long term food insecurity because of the cash flow derived from cocoa. Cash income from cocoa can be expected to alleviate challenges associated with nutritional diversity, although more awareness and attention especially to nutritionally adequate diets for children may be required.
Social Capital	<ul style="list-style-type: none"> Producer organisations are active in the cocoa VC. Many cooperatives face challenges because of inadequate knowledge and skills in management and lack of support or good relations with government institutions. Nevertheless, there is considerable promise in cooperative development and some success to alleviate constraints in marketing, land tenure insecurity, small land holdings, poor infrastructure, and lack of access to capital. Lack of trust generally affects interaction between government, public services, and small producers, and can negatively interfere in the establishment and operation of cooperatives of small producers.
Living Conditions	<ul style="list-style-type: none"> Income from cocoa is a major contributor to households' access to healthcare and education. Availability, access and cost of health services generally are not satisfactory in PNG. Housing and accommodation are not an urgent concern in rural PNG. Access to primary education is generally good, but limitations increase with higher levels of education, especially tertiary.

IS THIS ECONOMIC GROWTH INCLUSIVE?

The subsistence-oriented producers are the main beneficiaries of the profits generated by the VC because of their number and the financial profitability of their activity.

Nevertheless, cocoa production is small in volume and a moderate source of income for a large majority of rural households. Producing or trading certified cocoa positively impact revenues and profit. New business-oriented management systems would also increase the financial return from cacao production but it may be a risky specialization strategy for many smallholders.

In terms of employment, two forms of labour exist for the majority of the 150,000 small farmers: family labour, equivalent to 14,000 full-time jobs (including friends and relatives) and remunerated local workers, equivalent to 3,500 full-time jobs. Only export companies provide full-time (around 300 people) or part-time (around 200 people) paid jobs.

IS THIS VC SOCIALLY SUSTAINABLE?

The cocoa VC is socially sustainable but faces specific and general challenges. Cocoa is the most important income-earning crop for small producers in regions suitable for cocoa production, thus facilitating access to healthcare, education and to complement diets with purchased food. However, from a broader perspective, challenges include gender equality and access to infrastructure and services. In light of specific socio-cultural dynamics and increasing social differentiation and inequality, social inclusiveness is an important consideration for interventions to ensure the overall social sustainability of the cocoa VC. In practical terms, many communities in PNG exhibit a marked preference for collectively accessible and inclusive development. Any model targeting specific stakeholders while excluding others from support and benefits may become a risk for community cohesion and influence negatively the social sustainability of the cocoa VC.

Environmental analysis

Cocoa production in PNG is mainly characterised by monoculture, low mechanisation and low use of inputs. When analysing the main environmental impacts caused by the VC and within the PNG borders, these are concentrated in the cultivation phase. For all of the three types of producers analysed, the main impacts are: climate change due to land use changes, nitrogen losses, and land occupation. Fermentation, drying, transport and export processes have comparatively lower impacts.

Impacts on areas of protection

Human health: The main impacts of the VC on human health are linked to climate change, and to a lesser extent to fine particulate matter formation. The main variable of influence in the three production models is in the yield of wet beans. Yields differ because of management strategies and manual labour input. The use of insecticides only increases yields if there is a good combination of these factors.

Business-oriented dry bean producers are estimated to have lower impacts on general human health because of their higher yield and therefore more efficient land use. Nevertheless, in this model, insecticides can be toxic for labourers in direct contact with them for extended periods, because of the use of knapsack sprayers with limited protections.

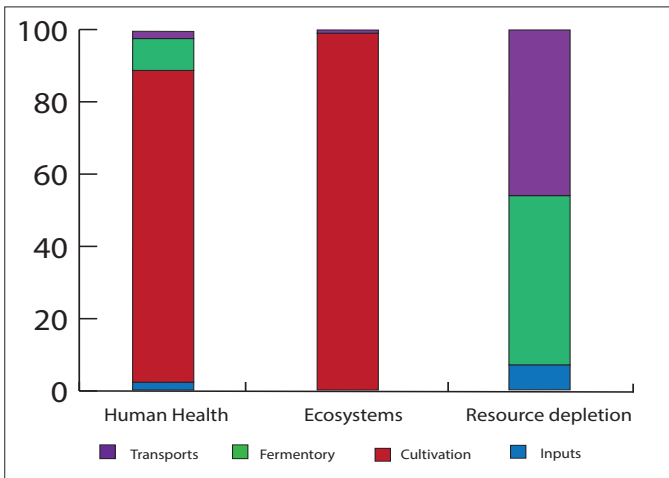


Figure 6: Contribution of the VC stages to the areas of protection

Resource depletion: Fossil resource depletion is much larger than the mineral one. This is typical in systems where fuel is used for transport of agricultural inputs into the cultivation areas and the use equipment is low. The difference between the subsistence wet bean production model and the others is explained by the longer transport distances in the East Sepik Province compared to ENB. Between the subsistence dry bean production model and the business-oriented dry bean model, impact on resource depletion is lower in the second because of higher yields, that results in less transport of seedlings to produce 1 kg of dried beans.

Ecosystem quality: Land use for cultivation is the most significant impact on ecosystem quality, contributing to global warming and terrestrial acidification. The subsistence wet bean production model has the highest impact, while the subsistence dry bean model has comparatively 21% less impact, and the business-oriented dry bean model has 80% lower impact because of differences in yields/productivity. In the business-oriented dry bean production model, insecticides have instead a marked contribution.

Impact at the stages of the value chain

Compared to the other VC stages, **cultivation causes the most environmental impact** because of the direct and indirect land conversion from forest to cocoa associated with all cocoa cultivation. For impacts on human health and ecosystems, the contribution of inputs, transport and fermentaries is relatively small. Resource depletion, which is dominated by fossil resource depletion, is instead mainly caused by transports and fermentaries (Figure 6).



IS THE VC ENVIRONMENTALLY SUSTAINABLE?

The environmental impacts mainly occur during the cultivation stage, while the following stages have comparatively low impacts.

The main strategy to decrease environmental impacts would be to increase yields. This can be achieved through a more efficient inputs use, without additional agricultural inputs. A next step would consist of including insecticides in an integrated pest management strategy, but not necessarily fertilizers. It should be noted that the negative impact of insecticides does not offset the benefits of increased yields.

To improve biodiversity within the cultivation systems, agroforestry is an option to explore. It could compensate the economic return to producers when the prices of cocoa are low. It should also be stressed that the net deforestation rate in PNG results in ecosystem impacts linked to cocoa. It is recommended to prevent land conversion in general and for cocoa cultivation specifically. Creating incentive structures that result in the allocation of more labour to a limited area of cocoa, while boosting production, is preferred over expanding the area under cocoa cultivation.

Conclusions

As a whole, the cocoa VC in PNG is relatively simple and is characterized by two products (dry versus wet beans) and two export chains (bulk versus certified markets). The VC is almost entirely oriented to the export of low processed products. The small domestic market restricts the opportunities to add value by processing a primary product into a marketable product such as making chocolate for local sales.

Factors influencing the decision of growing cocoa

Three major price factors influence cocoa producers. First, **the price of wet beans**: as it has been stable in PNG for the last few years, this is not a factor that pushes subsistence-oriented producers out from production. Instead, **for dry beans, the price is volatile** and almost unpredictable for small producers. Second, **the price of other competing cash commodities**: its increase may incite producers to divert some of their resources from the production of cocoa beans to other crops. Third, **the net income of producers** involving family labour: in most cases, it may not be attractive enough as it is under the minimum wage or lower than other job opportunities.

The extent to which rural small producers incorporate cocoa into their portfolio of livelihood activities depends also on numerous other factors: availability of family labour, household priorities, cash needs (for education or other entrepreneurial activities), access to and availability of land and other resources.

Certification is an asset

Certification has recently emerged in the PNG cocoa VC through the FT and RA standards, but **it is only reaching a small minority of producers and fermentaries** because of the lack of organizational capacity at producers' level. Two factors might limit the development of cocoa certification in PNG: firstly the fact that several international firms set up their own private labelling systems can create risks for the homogenisation of the certified market; secondly most of the PNG cocoa has a "fair average quality" that is hardly compatible with the requirements of many certification standards.

Which model to promote ?

The business-oriented model is promoted nowadays by the public authorities, PPAP and private companies. However, this model concerns only a small number of producers and has not enabled the total cocoa production to be boosted yet. Moreover, this model encourages households to specialise only in cocoa, which may be perceived as a risk for a large part of the rural population.

Subsistence-oriented dry beans producers of ENB and AROB have low financial profitability and decreasing yields, and fermentaries are in bad conditions. Moreover they are exposed to volatile international prices. The subsistence-oriented wet beans model appears as the most cost-effective and resilient, responding to the concerns and needs of producers.

To conclude, it is crucial to enlarge the perspectives of the business-oriented model to embrace a large number of producers in PNG with limited access to supports. Rather than just a "yield increase" of a single cash crop, **a multi-crop cocoa-based agriculture** favouring the integrated production of food and commercial products seems most suitable for a sustainable rural development in PNG. Special attention should be given to avoid deforestation, incentivising systems that limit area expansion.



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Agrinatura (<http://agrinatura-eu.eu>) is the European Alliance of Universities and Research Centers involved in agricultural research and capacity building for development.

The information and knowledge produced through the value chain studies are intended to support **the Delegations of the European Union** and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions. VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: <https://europea.eu/capacity4dev/value-chain-analysis-for-development-vca4d->

This document is based on the report "Cocoa Value Chain Analysis in Papua New Guinea" 2019, by Guillaume Lescuyer (CIRAD), Roel Helmes (WUR), Ivo Syndicus (independent expert), William Kerua (independent expert). Only the original report binds the authors.

