trase | TRANSPARENCY FOR SUSTAINABLE ECONOMIES

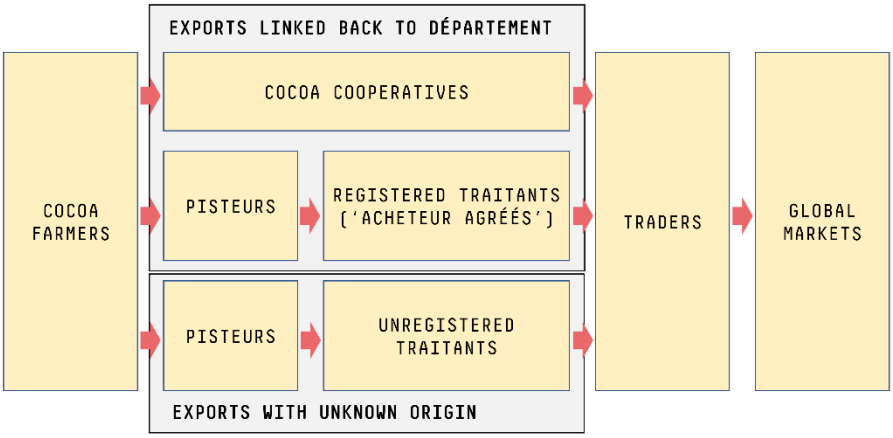
SEI-PCS Côte d'Ivoire Cocoa v1.1.0 documentation

07/04/2021

Overview

The Côte d'Ivoire cocoa SEI-PCS model links 2019 shipment data on cocoa exports per trading company and country back to cooperatives and the départements that they are located in. Overall, we link 43.6% (95% CI: 42.7-44.7%) of Côte d'Ivoire's exports back to a specific cooperative and département.

We estimate the volume sourced by each trader from supplier cooperatives in two steps. First, we identify the cooperatives supplying each trader using corporate disclosures from 2019/2020 by major traders and cocoa processors as part of the Cocoa Accountability Map and the Conseil Café Cacao's list of 'Acheteurs Agréés'. Next, we multiply the number of farms per cooperative by their estimated cocoa production (kg/farm/year). The data on cooperative size is taken from company disclosures where available (54% of cases). Where cooperative sizes are not disclosed, we Monte Carlo simulate the size of each cooperative. Similarly, farm-level sourcing data is not disclosed by companies, so we Monte Carlo simulate farm production (kg cocoa) using the KIT survey of 441 cocoa farms across Côte d'Ivoire.



Supply chain schematic

We quality-check our subnational allocation (i.e. how much is exported from each département) against a subnational map of cocoa production. This map is generated by combining [i] a remote-sensing map of planted cocoa area in 2019 developed by the European Commission's Joint Research Centre, and [ii] a cocoa suitability layer from Schroth et al., 2016. More detail on all the above data layers is given below.

Summary statistics

	2019
ICCO production estimate (1,000 tonnes)	2,154
Trase exported volume (1,000 tonnes)	2,006
Number of exporting companies	78
Number of exporter groups	73
Number of coops linked to shipping data	615
Number of acheteurs agréés linked to shipping data	20

Trade data

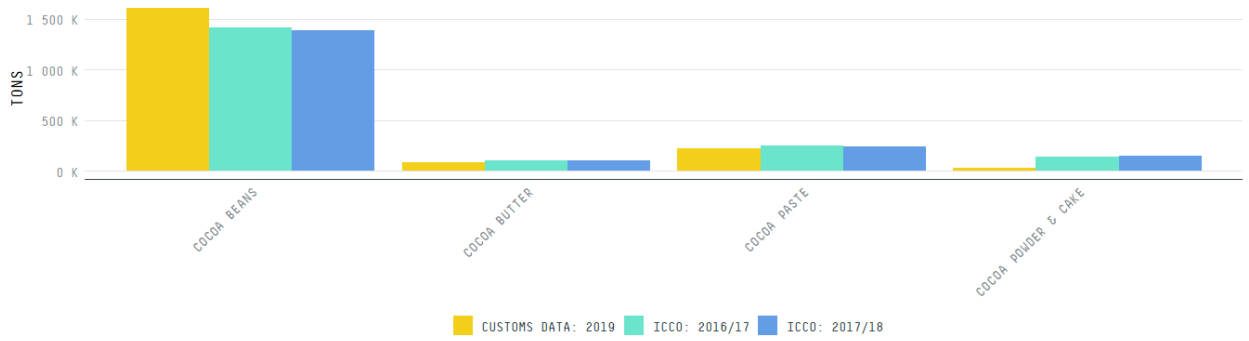
We use data on export shipments from 2019, covering the following HS codes:

HS6	PRODUCT	FOB (millions)	Tonnes
180100	COCOA BEANS	3573.7369	1611556.68
180310	COCOA PASTE	623.3612	218862.27
180400	COCOA BUTTER	374.4056	83433.34
180500	COCOA POWDER	55.0432	26745.29

This data includes the volume and value (freight on board value, FOB) of cocoa shipments per company and country. An excerpt of this data is shown below:

COLUMN	VALUE
DATE	2019-12-26
COUNTRY_OF_ORIGIN	COTE D'IVOIRE
EXPORTER	CEMOI
COUNTRY_OF_DESTINATION	POLAND
HS6	180100
PRODUCT_DESCRIPTION	– CACAO BRUT EN FEVES, QUALITE COURANT
WEIGHT_KG	25025
FOB_USD	55365.47

As a quality-check of the shipping data, we compare them against International Cocoa Organization (ICCO) statistics on cocoa exports in the 2015-16 and 2017-18 seasons (data on the 2018-19 season not available for analysis).



Comparison of 2019 shipping data and 2016/17 and 2017/18 ICCO data on exports from Côte d'ivoire. These data matches well, except that the shipping data underestimates the volumes of 'Cocoa powder and cake'. This is probably because our shipping data excludes data on HS code '180610' ('Cocoa powder, containing added sugar or other sweetening matter'), which was not included because the cocoa is mixed with other products and so the original cocoa bean content is not possible to estimate.

When tracing cocoa exports back to départements of production, we must first convert all products to kilograms of 'cocoa bean equivalents'. We used the conversion factors recommended by UTZ's accounting system (used for mass balance calculations). This conversion accounts for waste lost in processing.

HS code	Product	Conversion factor
180100	cocoa beans	1.0
180200	cocoa waste material	0.0
180310	cocoa paste	1.2
180400	cocoa butter	1.2
180500	cocoa powder	1.2

Production data

There is no official (government) publicly available data on cocoa production within Côte d'Ivoire. To calculate cocoa production data per département, we therefore used the following data sources:

1. Statistics on the yearly produced cocoa volume from ICCO.
2. A remote-sensing cocoa land-use map for 2019 from the Joint Research Center (JRC) of the EU.

3. A cocoa suitability map representing the suitability to grow cocoa per pixel from Schroth et al., 2016.

1. ICCO cocoa production data

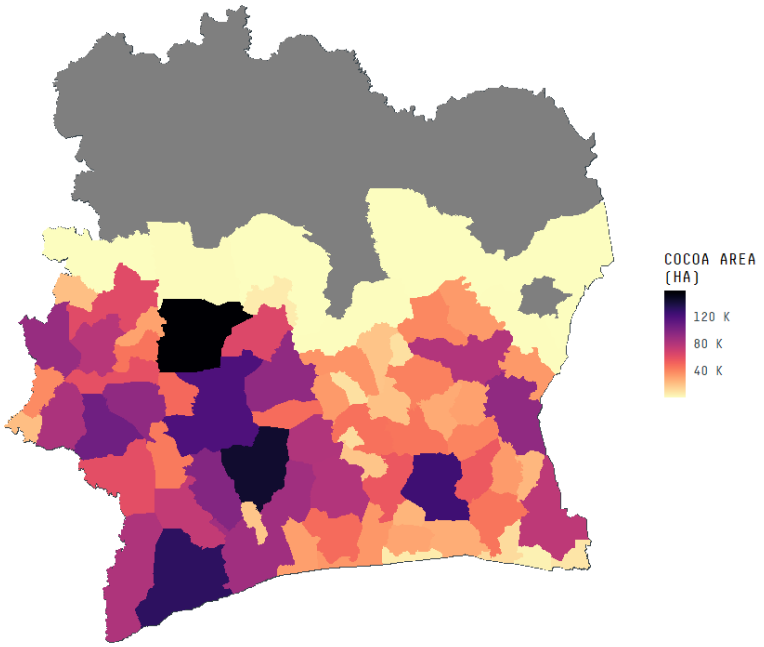
Apart from the export data discussed above, the International Cocoa Organization (ICCO) also publishes data on the cocoa production of the main cocoa producing countries, including Côte d'Ivoire. This data is published as production volumes per cocoa season (running from October 1st to September 30th) rather than per calender year. For comparison with 2019 custom data, we used ICCO production data from the 2018-2019 season.

2. Cocoa land use

We used a map prepared by the Joint Research Center (JRC) of the EU.

The cocoa map was produced using Sentinel-1 and Sentinel-2 satellite images of all the months of the year of 2019, geographic information on the location of Mondelez' Cocoa Life cocoa plantations and ground truthing data on cocoa, rubber, shrubland and closed forest. The data can be downloaded here

This data gives the following distribution of cocoa across the country:



Alternatives considered

In addition to the JRC map, there is also a 2019 land use map from Vivid Economics.

The differences between these two data sources in total land under cocoa are stark, with the JRC considering an additional 0.9 Mha of land under cocoa compared to Vivid Economics.

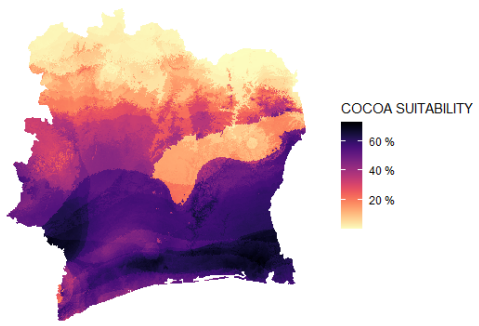
Methodologically, the JRC considered shaded cocoa plantations in their analyses, while Vivid Economics reportedly only included unshaded (full sun) cocoa.

Because of this, and since the estimate of the JRC (3684919 ha) approaches the FAO's estimate (FAOSTAT 2018: 4,015,394 ha) on area under cocoa production the best, we use the JRC data as our baseline data on cocoa land use in the Côte d'Ivoire.

3. Cocoa suitability

Schroth et al. (2016) produced a map of the current suitability of West Africa to grow cocoa. Based on climatic data and information on the ecophysiology and agronomy of cocoa in West Africa, each pixel (resolution of 927.66 m) is assigned a value between 0 and 1, ranging from not suitable to most suitable. This data is used to infer yield variation among Côte d'Ivoire's cocoa growing départements.

Evidently, many factors other than climatic suitability impact cocoa production (e.g. certification, use of fertilisers, use of pesticides…). Since these farm level resolution data are not available, we were restricted to using cocoa suitability.



4. Combining this data to calculate cocoa production per département

We allocated cocoa production to each département by weighting the cocoa area (in hectares) by its relative suitability for cocoa production.

First, we calculated the 'relative suitable area' (RSA) for cocoa in each département, as follows:

$$RSA_d = \sum_{n=1}^{i} area_n * suitability_n$$

Where d represents all départements, n represents all pixels under cocoa, $area_n$ the area covered by each pixel, and $suitability_n$ the suitability index (0-1) of each respective pixel.

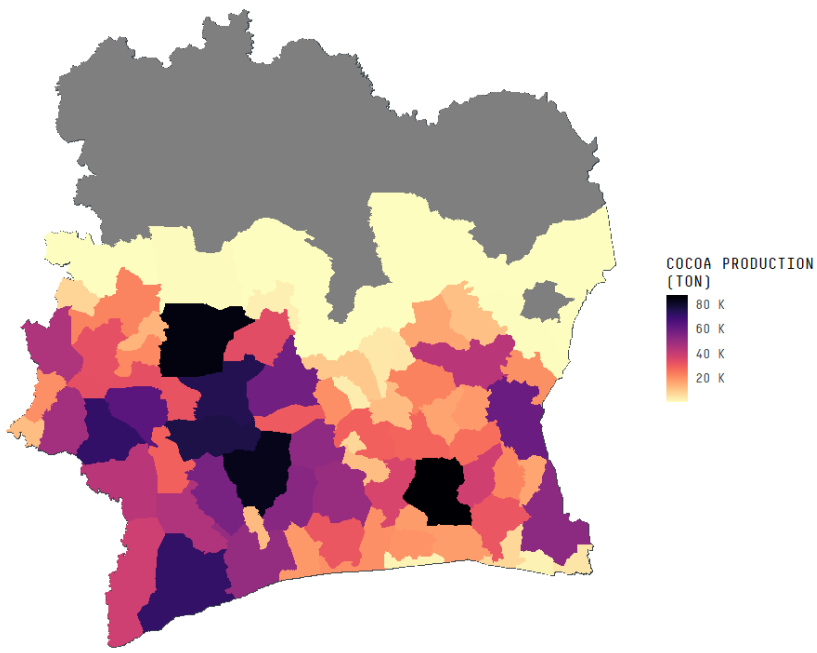
Second, we calculated $pRSA$, the cocoa production (in tonnes) per unit of relative suitable area:

$$pRSA = \frac{production_{ICCO}}{\sum_{d=1}^{j} RSA_d}$$

Where $production_{ICCO}$ is the total cocoa production volume (kg) of the Côte d'Ivoire (from ICCO statistics).

Finally, we calculate cocoa production per département by multiplying RSA_d by $pRSA$:

$$production_d = RSA_d * pRSA$$



Cocoa production per department in 2019

Asset data

In the Côte d'Ivoire, cocoa traders source a part of their cocoa directly from cooperatives and registered acheteurs (cocoa buyers who operate within different regions of the country).

Some companies disclose which cooperatives they source directly from, but not the volumes sourced per cooperative. We estimated these volumes per trader by multiplying the number of farms in each supplier cooperative by cocoa production per farm (in kg/year). More detail on this methodology is given below.

1. Cocoa cooperatives in Côte d'Ivoire

For the locations of cooperatives and their connections with traders, we used Mighty Earth's 'Cocoa Accountability Map'. The Cocoa Accountability Map includes information on 4,451 cooperatives across the country, listing their names and acronyms, contact information, certification, location, size (number of members and cultivated area), and a list of companies that are known to source from that specific cooperative. The latter comes from self-disclosures in 2019 and 2020 by several major cocoa traders and processing companies of the cooperatives from which they directly sourced cocoa. In the Cocoa Accountability Map, 710 of the cooperatives could be linked to the direct sourcing of one or more companies. Multiple companies can simultaneously source from one and the same cooperative. As such, the Cocoa Accountability Map includes 1,164 cooperative-company links.

The companies included in the Cocoa Accountability Map and the number of cooperatives they reported directly sourcing from are as follows:

Company	Number of cooperatives	Coordinates disclosed?
OLAM	198	No
BARRY CALLEBAUT	192	Yes
CARGILL	165	Yes
MARS	90	Yes
BLOMMER	79	Yes
NESTLE	76	No
FERRERO	71	No
HERSHEY	69	No
MONDELEZ	62	No
ECOM	44	No
TOUTON	34	Yes
CEMOI	33	Unknown
SUCDEN	25	Yes
COCOANECT	15	Unknown
TONY'S CHOCOLONELY	4	Yes

COCOASOURCE	3	Unknown
ALBERT HEIJN	1	Unknown
ALTER ECO	1	No
ETHIQUABLE	1	Unknown
PURATOS	1	No

2. Acheteurs Agréés

Besides selling their cocoa to cooperatives, farmers also frequently sell to so-called acheteurs, who also aggregate cocoa from multiple holdings, and then sell on to trading companies. Each year, the Côte d'Ivoire's Conseil Café Cacao (CCC) publishes a list of "Acheteurs Agréés", which includes the names of those acheteurs that are licensed to buy cocoa, the départements where they are allowed to buy cocoa, and the companies for which these acheteurs operate.

In most cases, companies themselves do not disclose which acheteurs they source from, but in four cases exporting cooperatives and trading companies were indicated as the employers in the list of licensed acheteurs:

4. Biopartenaire, as a subsidiary of Barry Callebaut,
5. CAP, Centrale d'Achat de Produits agricoles
6. Cyrian Côte d'Ivoire, exporting under Cyrian International
7. SACC, Societé Agricole de Café et de Cacao, an exporting cooperative that previously bought SAF and CIPEXI

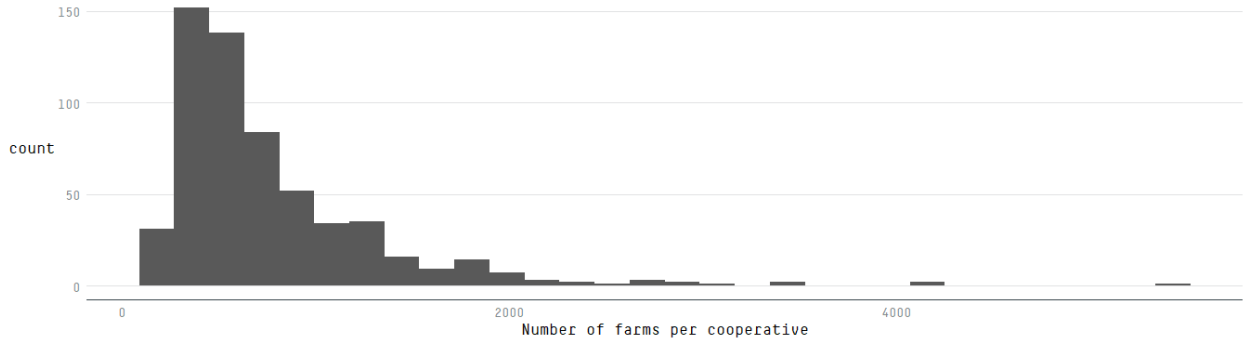
3. Cocoa cooperative size

As companies do not currently disclose the directly sourced volumes per cooperative, we must estimate this from the cooperative size.

For 440 cooperatives, the Cocoa Accountability Map or (one of) the trading companies themselves directly reported the number of farms per cooperative. In some cases multiple companies disclosed sizes for a single cooperative and Rainforest Alliance additionally disclosed the size of their associated cooperatives. Hence, a total of 591 cooperative sizes were reported.

Where a company did not report the number of farms purchased from for a given cooperative, but that number was reported by other companies, the cooperative was assigned the mean value of these disclosed sizes. For example, if companies X, Y and Z all buy from cooperative A and company X and Y reported 200 and 500 farms, the link between cooperative A and company Z was assigned a cooperative size of 350 farms (the mean of 200 and 500).

Finally, for the remaining 270 cooperatives which supplied a known trading company but where the number of farms was not known, we simulated this number using 1,000 Monte Carlo estimates (random sampling with replacement) taken from the list of disclosed cooperatives sizes. These sizes ranged between 145 and 5,394 farms per cooperative, with a median value of 591 and a mean value of 766 farms per cooperative.



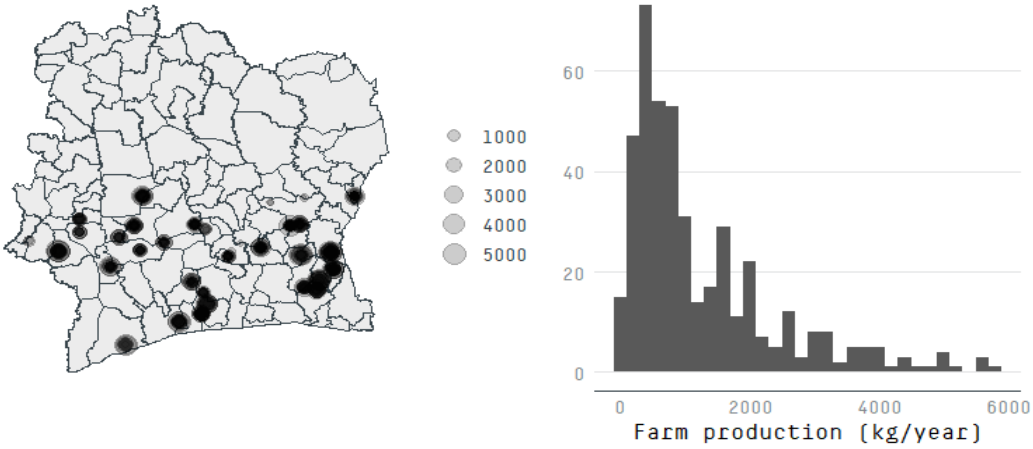
Histogram of the disclosed number of farms per cooperative

4. Cocoa production per cooperative

Next, we estimated cocoa production per cooperative.

Here, we used data from the KIT Royal Tropical Institute's 2018 report "Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire" which collected production data from 441 farms across the country. This data can be downloaded here.

Cocoa production per farm (kg/farm/year) ranges from 17 to 5,800 kg, with a mean of 1,225 kg and a median of 793 kg. The data is spread evenly over the cocoa growing regions of the Côte d'Ivoire, both from the geographical and from the production value points of view:



Observations of cocoa farm production in (kg/farm/year) from the Royal Tropical Institute (KIT) study

To assign a production volume to each cooperative-company connection, we randomly sampled (1,000 times with replacement) from the KIT farm production estimates, and summed across the number of farms supplying each trader.

For example, if a cooperative included 200 farms, we randomly sampled 200 farm production observations from the KIT data set and summed these 200 values to obtain the cooperative production. This was repeated 1,000 times to obtain 1,000 estimates of the total production of this cooperative. If the size of the cooperative was originally unknown, it was randomly assigned 1,000 sizes (see *3. Cocoa cooperative size*). To obtain the estimates of the total production of this cooperative, we sampled the KIT data once for each of those 1,000 sizes.

5. Direct sourcing volumes per trader

Cocoa traders buy cocoa from known farmer groups, i.e. cooperatives – this is usually refered as to as traders' 'direct supply chain'.

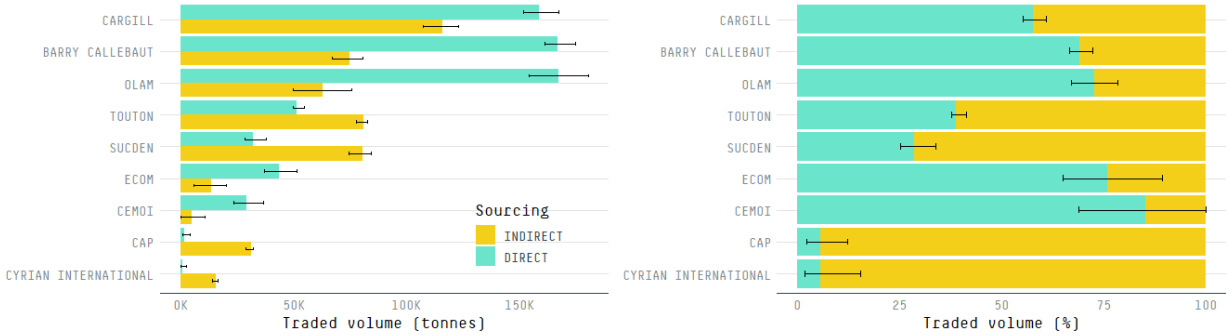
In addition, traders also have an 'indirect' supply chain. Here, cocoa is bought from intermediaries, "traitants", who aggregate cocoa from multiple sources, not necessarily known to the trader. In this process of buying and selling, the cocoa is mixed and repackaged, e.g. to fill bags to the volume required for export. Although some pisteurs may be licensed by the CCC (acheteurs agréés), there are many more that work unlicensed.

To estimate the volumes that are *directly* sourced per cooperative, per trader, we brought together the trader-cooperative links, and estimates of cooperative size and farm production, as described above.

We estimate the total direct sourcing volume per trader by summing up the volumes assigned to all of their disclosed cooperatives and/or of their acheteurs (yielding 1,000 direct sourcing volume estimates).

We can then estimate each trader's proportions of direct and indirect sourcing by comparing the estimated direct sourcing volumes with the exported volumes.

For cocoa cooperatives which export themselves (rather than selling to a trading company, which handles export), we assume that 100% of their cocoa is sourced 'direct' from member farmers.



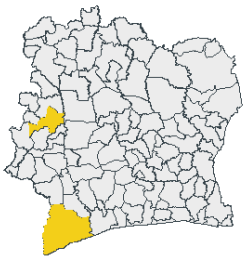
6. Direct sourcing volumes per département per trader

We can assign direct sourcing to each département based on the known geographical location of each cooperative and acheteur (as included in the Cocoa Accountability Map and the list of acheteurs agréés).
We assume that each cooperative and acheteur source cocoa from the département(s) where they are located / licensed to buy cocoa, respectively.
In most cases, this is a single département, though some of the larger cooperatives which export directly source from several regions across the country. e.g.:

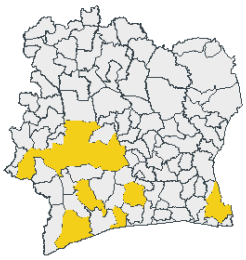
8. COOPERATIVE AGRICOLE WAGAJACA could be linked to two départements
9. SOCIETE AGRICOLE DE CAFE ET DE CACAO (SAC) could be linked to three départements
10. ECOOKIM, which is a union of cooperatives, could be linked to 14 départements

COOPERATIVE AGRICOLE WAGAJACA

SOCIETE AGRICOLE DE CAFE ET DE CACAO



ECOOKIM

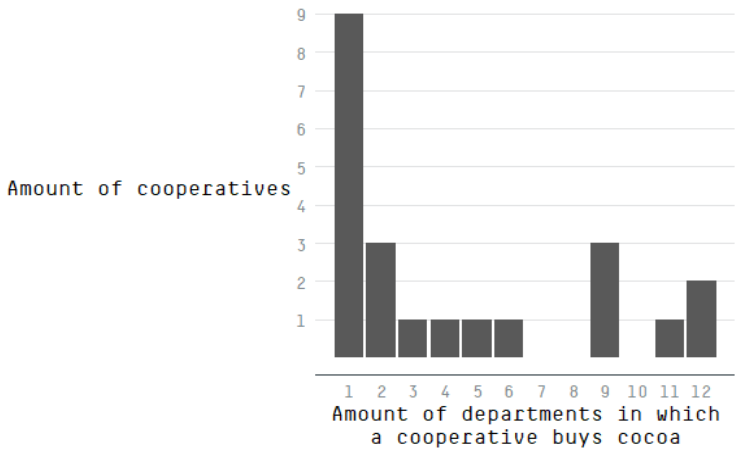


To get the direct sourcing volumes per département per trader, we divided the direct sourcing volumes proportionally over the départements, based on the proportion of farms the trader disclosed that are located in each département separately.

For example, if trader X buys from 2,500 farms in département M and from 7,500 farms in département N, trader X's directly sourced volume comes for 25% from cooperatives located in département M and for 75% from cooperatives located in département N.

Alternatives considered

The generality of the assumption that other cooperatives source from a single département can be tested by looking at the lists of acheteurs agréés, where 22 cooperatives are listed as buying from at least one acheteur. 9/22 (40%) of these cooperatives buy from acheteurs in a single département, 3/22 buy from acheteurs in two départements, and 10/22 that work in three or more départements. Overall, this suggests that we may miss some wider sourcing by cooperatives, though we do sense-check the exported proportion per département (to check that exports are not greater than production), finding a local excess in < 2% of cases.



Company data

We identified a couple of cases where company subsidiaries' names are used in the customs data:

11. Biopartenaire and SACO, part of Barry Callebaut,
12. Outspan and Unicao, part of Olam,
13. Zamacom, part of Ecom,
14. Armajaro, part of Africa Sourcing,
15. CIPEXI's and SAF's assets have been acquired by SACC (Societé Agricole de Café et de Cacao) in 2019.

The company disclosures on cooperative level sourcing were taken from Mighty Earth's cocoa accountability map.

Boundaries

Our data is reported per département, using official information from Côte d'Ivoire's BNETD (Bureau National d'Études Techniques et de Développement).

The Côte d'Ivoire is divided into 12 districts and two autonomous areas, which are divided into 31 regions and two autonomous areas. These regions are then divided into 108 départements.

Logistics

The road network/travel costs are not required for the current SEI-PCS model.