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SEI-PCS Paraguay Soy Version 1.2 documentation

SEI-PCS Paraguay Soy V1.2 uses government data and high-resolution satellite imagery to estimate subnational soy production, export records and secondary research to link traders to their silos and crushing facilities. These are combined using the methodology described below to link soy production at the district level to the port of export.

The model is heavily dependent on linear programming methods to optimise the movement of soy across the country. This is because there is no information within Paraguay's export records which give an indication of the subnational origin of the exported commodity, as is the case in the Brazilian soy model.

Data

Trade data

Customs data is used covering sub-commodities under the HS codes in Table 1 for 2014-2018. The customs declarations include information on the exporting company, the customs office, the first country of import and the mass of the export product in question. Customs Declarations are recalibrated by the Central Bank to account for the fact that much of Paraguay's exports are re-exported via Argentina, Uruguay and Brazil.

HS Code	Product
1201	Soya beans, whether or not broken
1507	Soya-bean oil and its fractions; whether or not refined, but not chemically modified
2304	Oil-cake and other solid residues; whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil
230250	Bran, sharps and other residues of leguminous plants, whether or not in the form of pellets, derived from the sifting, milling or other workings thereof

Table 1 HS codes used in SEI-PCS Soy Version 1.2

Domestic demand

Domestic demand for soy is not included in this model.

Production data

Soy production at the district level is derived from maps of the soy planted area (Global Land Analysis and Discovery, University of Maryland). Soy maps are only available for 2016 – 2018 and so the 2016 map is also used for 2014 and 2015. These maps are scaled by government department-level production and yield statistics to get an estimate for annual district-level soy production.

Logistics / asset data

Ports and customs offices

In total, 71 individual ports and customs offices associated with soy exports have been identified from the trade data. Each has been assigned a unique ID and coordinates from secondary research. Ports/customs offices were grouped in cases where there are numerous names for the same place.

Assets

Across Paraguay, 178 soy silos owned by exporters have been identified through secondary research. Each has been given a unique asset ID and coordinates and, where available, company ownership is recorded. Annual throughput is assumed to be the same for all silos and is calculated as the total amount of soy which is not crushed divided by the number of silos.

Seventeen crushing facilities have been identified as in operation in the period from 2014 to 2018. Each is given a unique ID and coordinates and company ownership is recorded. Data about the daily capacities of these crushing plants is used as a proxy for the annual throughput of soy in each facility [1, 2]. The total quantity of soy which is crushed nationally (according to Capeco) is distributed across all active crushing facilities according to their relative daily capacity [3].

Road network

A map of the road network was used to calculate a distance matrix [4]. This matrix uses the road network to link the points of export to soy silo or crushing facilities (assets) and then link these assets to the centroid of districts where soy is produced. This allows us to optimise the movement of soy within the country by distance travelled.

Company data

Each soy exporting company that appears in the export records has a unique identifying number which is used to identify all of their shipments as well as to link the company to any silos and crushing facilities they own.

Boundaries

Jurisdictional boundaries are sourced from the Government Directorate of Statistics and Surveys (DGEEC), which provides the departmental and district boundaries of Paraguay as of 2012 [5,6].

SEI-PCS Implementation

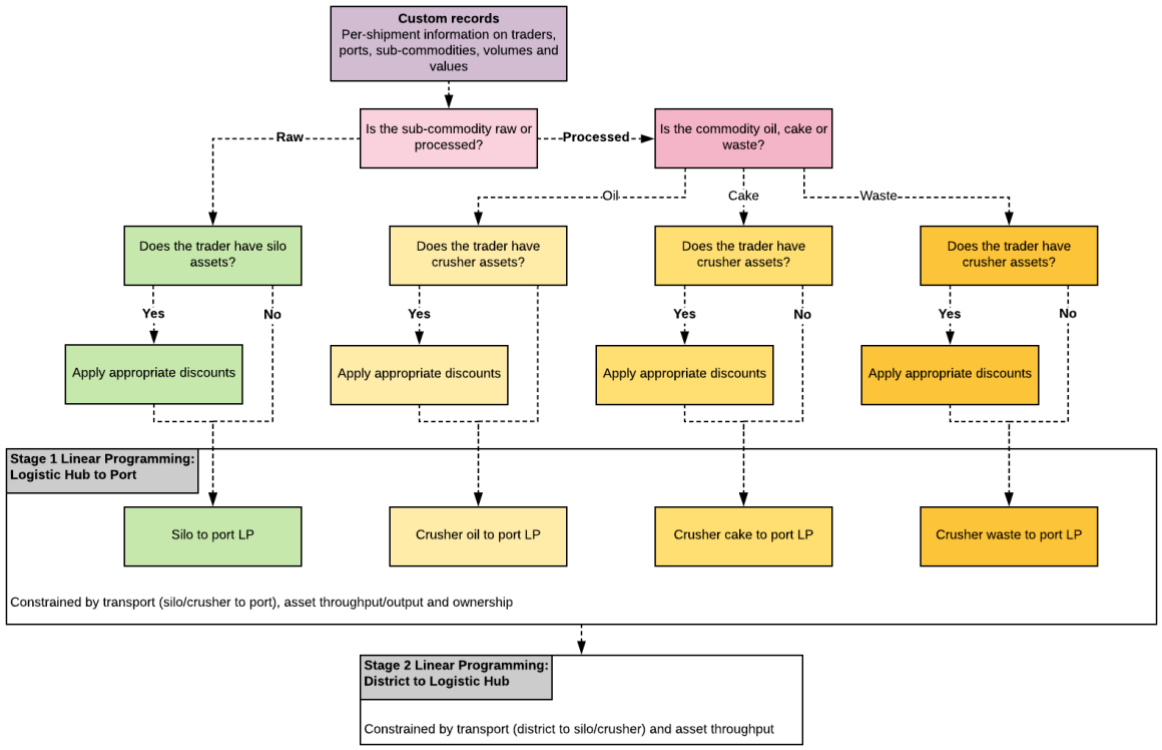

Figure 1 Decision tree for Paraguay Soy SEI-PCS v.1.2

1. Stage 1 of implementation consists of four separate commodity-based linear programmes which, based on distances travelled, optimise the allocation of a) soybean exports to soy silos, b) oil exports to crushing facilities, c) cake exports to crushing facilities, and d) waste exports to crushing facilities (see Figure 1). The allocation of exports to assets is constrained by a maximum limit to the throughput capacity of assets, namely annual silo storage capacity and crusher outputs of oil, cake and waste. Information on the ownership of crushing facilities and silos is used to allocate 'cost discounts' to the transport distances that link exports to these logistics hubs. Therefore, traders are more likely to source from their own silos and crushing facilities. The assumption underlying such 'cost discounts' is that exporters are more likely to source their exports from their own facilities than those of competitors.

2. Stage 2 of the linear programming then links silos and crushing facilities demand to districts of soy production. The linear programme optimises against distance travelled, with distances calculated from the road network linking soy silos and crushing facilities with the centre of districts of production. Supply from each district is constrained by its production, and demand from soy silos and crushing facilities is constrained by their annual throughput capacity. For soy cake, oil or waste exports, the input

of raw soy to crushing facilities, which is where the soy is processed, is then converted into outputs of oil, cake and waste in appropriate ratios [3].

3. Finally, the two stages of linear programs (exports to assets in Stage 1 and assets to production in Stage 2) are combined to link exports to districts of production. The results are aggregated to the department level. due to uncertainty in the accuracy of production data which is only available from the government at the department level.

Changes from previous version 1.1

- Updated the time series to include 2018.
- Model also uses 2016 and 2018 crop maps in addition to 2017 soy crop cover used in v1.1. for production estimates. The 2016 map is used as a proxy for 2014 and 2015. This improves the accuracy of our estimates for district-level production.
- Company ownership of assets is introduced into the linear programming for linking soy silos and crushing facilities (logistic hubs) outputs to exports. Where exporters own assets a 'cost discount' is applied to the distance, meaning that exporters preferentially source from their own facilities.

Limitations

- Road map: The road map used has inconsistencies with satellite data. This is a key area for refinement and improvement.
- River transport: Information on river networks that facilitate domestic transport of soy by barge have not been included in the cost transport matrix. The vast majority of Paraguayan soy is transported via lorry on the road prior to export. Barges are sometimes used to transport soy, particularly when rain and flooding make the roads which are typically used to transport soy are impassable. But without robust data about peaks in barge use over the time series, we have not incorporated river transport as a possibility in this model.
- Silo list: The next iteration of the Paraguayan soy model will include a more comprehensive list of grain silos than the one currently in use, which was assembled through secondary research. A comprehensive list of grain silos is available via The National Service for Plant and Seed Quality and Health to do this [7].

References

1. JJ Hinrichsen (2015) "Paraguay: capacidad instalada de elaboración de semillas oleaginosas al segundo semestre de 2015." Referenced at https://www.infocampo.com.ar/aumento-un-7-25-000-tndia-la-capacidad-de-molienda-en-el-mercosur/

2. JJ Hinrichsen (2018) "Paraguay: capacidad instalada de elaboración de semillas oleaginosas al segundo semestre de 2017"

3. Capeco (2018) Uso de la soja. Available at: https://capeco.org.py/uso-de-la-soja-es/

4. DIVA-GIS (2018) Download per country. Available at: https://www.diva-gis.org/gdata

5. Dirección General de Estadística, Encuestas y Censos (DGEEC) (2012) paraguay_2012_departamentos. Available at: http://geo.stp.gov.py/user/dgeec/datasets

6. Dirección General de Estadística, Encuestas y Censos (DGEEC) (2012) paraguay_2012_distritos. Available at: http://geo.stp.gov.py/user/dgeec/datasets

7. Servicio Nacional de Calidad y Sanidad Vegetal y de Semillas (SENAVE) (2019) Unidad de Registros. Available at: secure.senave.gov.py:8443/registros/servlet/unidad