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VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

Mango value chain analysis in the Dominican Republic

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, businesses, society and environment.

The European Commission has developed a standardised methodological framework for analysis (https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-/wiki/1-vca4d-methodology). 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

Mango in the Dominican Republic is an important product in social and economic terms. Until recently, mango was not considered nor managed as a commercial crop (in marketing and technical terms), being mostly a wild fruit (with indigenous varieties) naturally growing in scattered trees in courtyards and farms.

Since 2000, mango started to be regarded as an interesting product for export and, after two decades of support and the creation of a national cluster, this value chain (VC) has developed, especially in terms of exports. Funding by the national government and international organisations has been key for its development.

The European Union intervention

The programme "Fortalecimiento de la Calidad para el Desarrollo de las MIPYMEs" (Quality Strengthening for the Development of Micro, Small and Medium Enterprises - MSMEs), implemented by the Ministry of Industry, Trade and MSMEs (MICM), supports the strengthening of the value chains of cosmetic products and of processed fruits, linked in particular to pineapple, mango and avocado. The objective is to improve the quality of production in MSMEs to increase their competitiveness in domestic and foreign markets and to contribute to a more inclusive and sustainable economic growth in the country.

The EU also has other programmes supporting the banana, mango and pineapple VCs and other sectors via small-scale rural projects, such as the one managed by the CODESPA foundation.

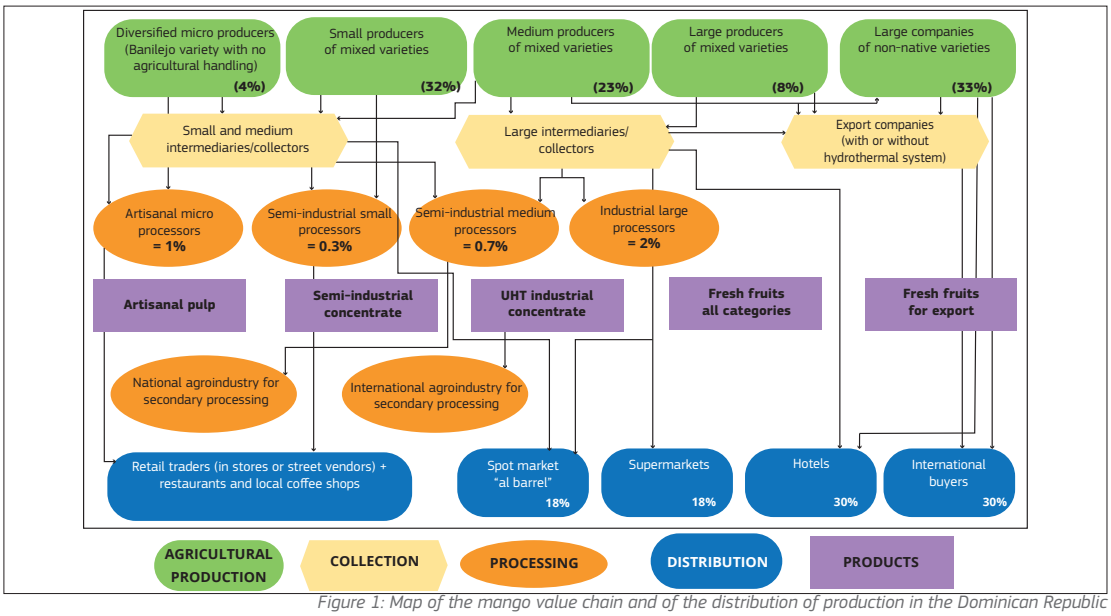

Figure 1: Map of the mango value chain and of the distribution of production in the Dominican Republic

Warning

This summary is extracted from the study on the "Processed fruits VCs (mango, pineapple)". Results are presented in two separate documents in order to highlight the figures of each VC.

Functional analysis

A diversified and extensive production, dominated by a few actors

In 2018, the **volume of mango production was around 56,000 t**. The total planted area is 3,200 ha, mostly located in the provinces of San Cristóbal, Azua, Peravia y San Juan, and, to a lesser extent, in the North-East of the country. Mango is cultivated in **commercial monoculture plantations** (of one non-native variety) as well as in **diversified farms with scattered indigenous mango trees**, meaning that many consider mango production as wild and scarcely seize it (generating losses).

There are **5 types of producers that differ depending on: the surface, the density of the plantation, the variety and the agronomic practices** (Figure 2). Few large producers control the majority of the planted areas of production. They are not in direct competition with the medium and small producers as they do not cultivate the same varieties. Most producers are organised in associations and produce for different sub-chains (Figure 1). These associations are assembled in the **mango cluster (PROMANGO)**, created by the **Junta Agroempresarial Dominicana (JAD)**, gathering more than 500 members (mainly producers). The cluster could play a more intensive role in providing support and technical advisory in a context where the public extension services are scarce and only devoted to sanitary control of the fruit fly disease.

Sub-chains differentiated by volumes and quality of the product

The classification of fruits is the first step to integrating certain sub-chains and aggregating value. Depending on the quality, fruits classified as premium, second rate or reject are sold at different prices in the sub-chains of fresh and processed fruits (Figure 3).

To export, certifications are demanded (GlobalGAP for European markets, the Food Safety Modernization Act in the USA, or organic). Exporters have strong interpersonal relations with their foreign buyers, thus having a guaranteed access to these markets. Export companies collect mango from small and medium producers and in some cases, they also finance its production. In the other sub-chains, intermediaries collect, gather and transport the fruit. Most of processors are supplied by intermediaries except for artisanal processors.

Premium fresh fruits for supermarkets and hotels	48% of the production. Sale by large intermediaries that are supplied by small intermediaries
Premium fresh fruit packaged for export (via sea transport)	30% of the production 7 exporters (some of them also producers). Two companies control almost the total volume exported. Only 1 plant with the thermic treatment necessary to export to the USA.
Non-classified fresh fruits for traditional markets	18% of the production
Agro-industrially processed fruit, in flash pasteurised mango concentrate by large companies for the domestic and export markets	~ 2% of the production, only one indigenous variety (banilejo) ~ 4 companies
Semi-industrial processed fruit in the form of pulp for the domestic and export markets	~ 1% of the production, different varieties 2 companies identified
Artisanal processed fruit in the form of pulp for the domestic market	<1% of the production, Number of companies unknown

Figure 3: Mango sub-chains in the Dominican Republic

Types of producers	Number of producers	Area (ha)	% area	Varieties	Production (t/year)	% of the production
Diversified micro-producers with scattered trees	550	275	9%	Indigenous varieties (Banilejo with no agricultural handling)	2,070	4%
Small producers	511	1,277	40%	Mix of indigenous and non-native varieties	17,783	32%
Medium producers	155	621	19%		12,973	23%
Large producers	10	200	6%		4,336	8%
Large companies	5	850	26%	One non-native variety introduced	18,429	33%
Total	1,231	3,223			55,591	100%

Figure 2: Types of mango producers

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Economic analysis

Profitability and financial viability

The activities of the mango VC are profitable and financially viable: the operating profit (OP) for the VC actors, including for a micro or small producer, exceeds a farm worker minimum wage, even if it is still low (compared to other VCs such as pineapple). Intermediaries obtain the highest OP, thanks to their significant role in the marketing of mango for the domestic and export markets. Non-producing export companies obtain the highest return on turnover.

Impact on the national economy

The total value added (VA) of the mango VC was estimated in 2018 at 2,003 million DOP **(€35 million)**, representing 1.4% of the agricultural Gross Domestic Product (GDP). Most of the total VA is direct VA, i.e. created by the VC actors. The direct VA is distributed mostly to producers (57%), traders (28%) and waged workers (15%) (Figure 4). The VC has a low indirect effect on other sectors of the economy, except for providers of domestic intermediate goods and services. **The rate of integration in the national economy,** i.e. the part of the value of the production that benefits national actors, **is high** (92%); meaning that only few goods and services need to be imported. Nevertheless, the VC has a low indirect effect on other sectors of the economy, as the activities need few domestic intermediate goods and services.

The **sub-chains that aggregate the most value** and that generate the highest operating profit per kg of fruit are those of **high-quality fresh fruits for export**, i.e. 44 DOP (€0.8). Operating profits per kg of fruit in the processed fruits sub-chains are also lower than those of the high-quality fresh fruits sub-chains for the domestic market.

The VC scarcely contributes to public finances: 35 million DOP (€612,000). **The VC has a positive impact on the balance of trade**: one third of the mango production is exported while few goods and services are imported. The difference between the mango exported over the goods and services imported is of 1,503 million DOP (€26 million).

Viability in the international economy

The Domestic Resource Cost (DRC) ratio of the VC is below 1 (0.1), indicating a gain for the national economy. In fact, this means that the economic value generated by the VC, measured at the international prices, is higher than the costs of the domestic factors used for production (labour, land, etc.).

The **Effective Protection Coefficient (EPC) is close to 1 (0.9)**. This indicates that the difference between the international and domestic prices (influenced by the national policies on prices) penalises the VC: the direct VA in domestic prices is 10% lower of the one calculated at international prices. This means that the **VC is slightly competitive and has a potential for export**: it could take more advantage of the global prices, currently favourable, given the fact that it is sustainable in the international economy.

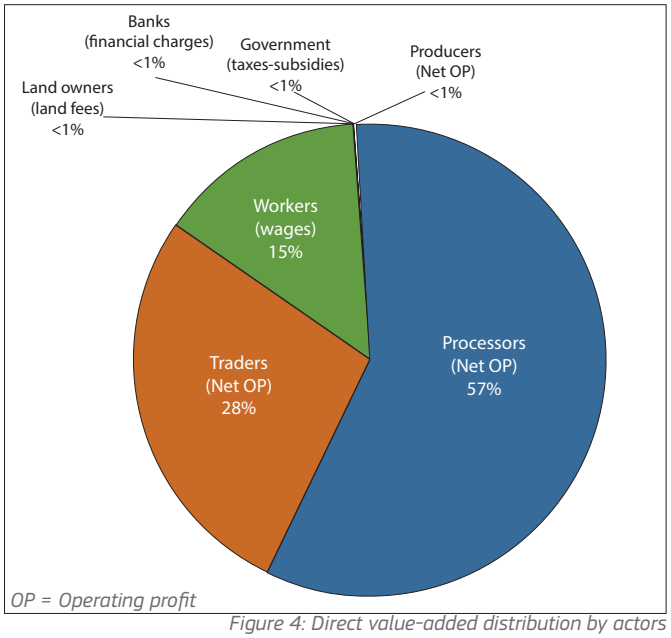

Figure 4: Direct value-added distribution by actors

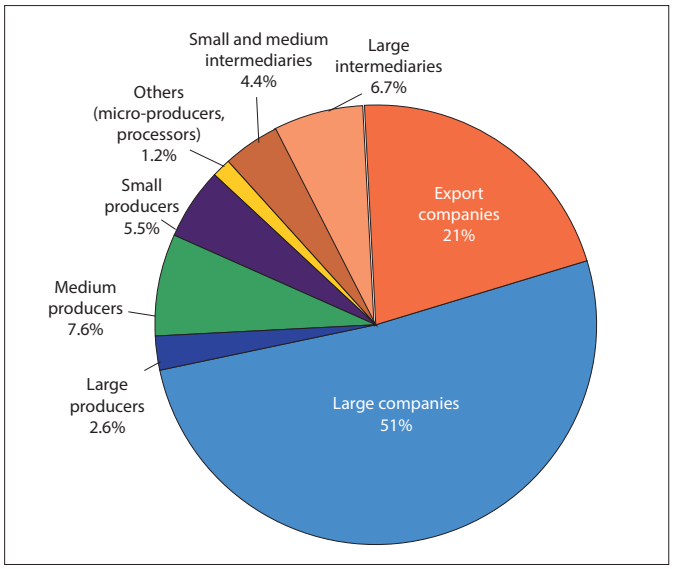

Figure 5: Net operating profits distribution by actors

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

The total value added of the mango value chain represents more than 1% of the agricultural GDP, being generated by only 0.5% of producers in the country (1,230 out of the 252,000 producers in Dominican Republic) and on 0.6% of the cultivated surface (3-4,000 ha out of the cultivated 700,000 ha). Overall, the national economy benefits from the positive impact of the value chain on the balance of trade. However, most of the volume produced remains in the domestic market, mainly in the sub-chains of high-quality fresh fruits, as processing is still limited (<1% of the direct value added). The return on turnover varies extensively according to the type of actor or sub-chain.

Social analysis

The table and figure 6 provide an image of the situation of the VC in the six strategic domains of the social analysis.

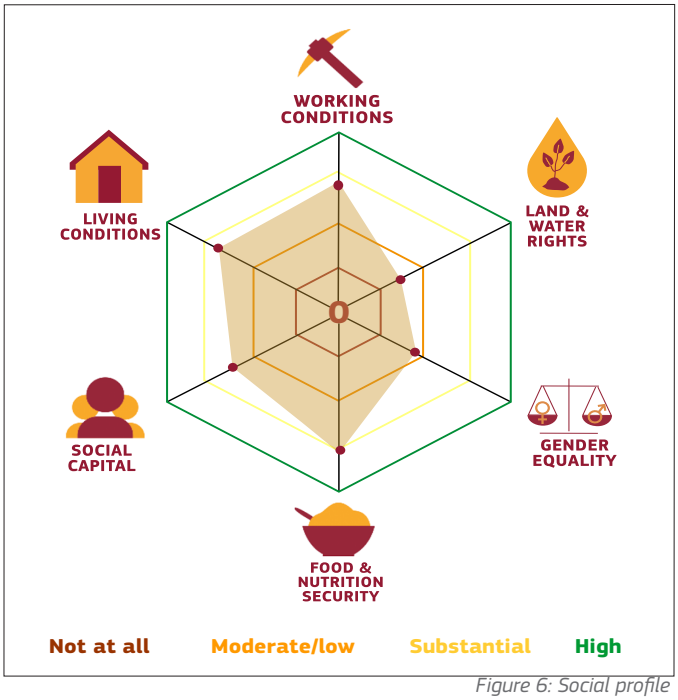

Figure 6: Social profile

IS THIS ECONOMIC GROWTH INCLUSIVE?

The income distribution in the value chain showcases a high level of inclusion for producers (64% of the created income), even though there is a strong concentration (more than half) of income (and generally of assets) in the hands of few large producers and exporters (Figure 5). The trend towards concentration in the value chain is a threat to its inclusiveness. This also applies to intermediaries, given the fact that medium and small intermediaries only benefit from little of the income created. Despite the trend being towards ageing in the VC, there is a potential for job creation which is attractive for youth, given the scarcity of other economic opportunities in rural areas. Finally, the participation of Haitians is significant in production (with opportunities for social mobility) and in the processing companies.

IS THE VALUE CHAIN SOCIALLY SUSTAINABLE?

The value chain has a positive impact on food security and living conditions even though its social sustainability is precarious. The symptoms of this precariousness are represented by the high barriers to access some sub-chains, the scarce availability of public extension services, the land concentration, informality and gender inequality existing in the different steps of the value chain. All these issues can exacerbate and marginalise the most vulnerable producers.

Working conditions	• Informality concerns most actors in the VC (work precariousness), jeopardising the access to markets, credits and supports. • Most of the producers and field workers do not have formal contracts nor social benefits.
Land and water rights	• After the land reform, access to land is granted with a property title, which obtainment is not orderly, thus impacting land prices and access to water. • There is a general trend towards land concentration, nevertheless the scarce land titling is a deterrent to large-scale foreign land investments. • There are some conflicts on access to water.
Gender equality	• Women have limited access to production assets and weak empowerment. • Few women in the VC are farm owners or workers, or owners of packaging and processing plants. • Women are the predominant waged workers for packaging and processing activities, especially in medium and large companies.
Food and nutrition security	• The increase of commercial mango plantations brought a significant improvement in the availability of food. • Even though a consistent part of mango leaves the production areas, important volumes are still consumed locally. • The local availability of fruit is high, alternating periods of scarcity and abundancy. • The VC contributes to the creation of local income used to purchase food.
Social capital	• Producers are organised in associations and in the Cluster which gathers more than 500 members (mostly producers). • Currently, there is little effectiveness in the collective action of associations and the level of entrepreneurship is weak. However, because exporters are a few, defining a collective strategy could be possible. • There is no trust relationship among producers and the other actors of the VC, neither among intermediaries and buyers from hotels and supermarkets. • Micro, small and medium producers have weak access to technical information due to the lack of adequate public extension services. Large producers have better access to support services thanks to their networks and their access to private consultants.
Working conditions	• The endowment in infrastructures and services (health, education) in production areas reveals the significant gap between the rural and urban areas, even though the situation is better than in other rural areas. • Even when there are health and education infrastructures and services (public and private), their quality is not adequate.

Environmental analysis

Impacts at the different steps of the value chain

The analysis of the sub-chains within the country borders reveals that the steps of **production and transport** represent **more than 85% of estimated damages** on the three areas of protection: resources depletion, ecosystems and human health (Figure 7).

Impacts according to the type of farm

In all types of farms, **field emissions** (derived from the use of fertilizers and phytosanitary treatments) represent the main contribution to **damages on human health and ecosystems**. Concerning the use of resources, impacts derive mainly from the **production of fertilisers**. Micro farms have low impact, thanks to consistent yields obtained almost entirely without inputs.

A scenario considering the **expansion of cultivation in forest areas** revealed that in case of deforestation, **the environmental impacts could increase by 50%** (due to the loss of carbon stock from biomass and soil). Thus, the promotion of large-scale cultivations could represent a threat to the environmental sustainability.

Impacts caused by intermediaries' activities and processing

Transport for trade operations are key for the environmental burden. By t of fruit, **vans used by the small intermediaries have more impact than the trucks of 22 t used by the large intermediaries**. This difference can be explained by the efficiency in logistics: on the one hand, by the load capacity that each vehicle can transport (more volume per journey means a smaller impact per t); on the other hand, by the frequency of return journeys with empty trucks (less for big trucks).

In relation to processing, **electricity for refrigeration is an obstacle** to the supply and costs of industrial products. Some companies are trying to develop the cogeneration of electricity and heat via the use of biomass. For small and medium artisanal companies that market frozen products, manual processing has practically no environmental impact, but refrigeration is a sensitive issue, as it remains of difficult access due to the costs of installation and the electricity consumption.

Impacts of the sub-chains

Comparing the impact per t of fruit used in each sub-chain, **the export sub-chain reports the highest damage inside the country per t of mango on the three areas of protection** (Figure 8). The damages are determined mostly by the **inputs used to produce premium mango as well as by the transport from the farm to the packaging units**. If impacts of the transport abroad till the port of destination are also considered, they multiply by three even if 87% of mango is exported by sea transport. **The sub-chain that has the least impact is the one of flash pasteurised mango concentrate**, as it uses exclusively the banilejo variety that has a low environmental impact.

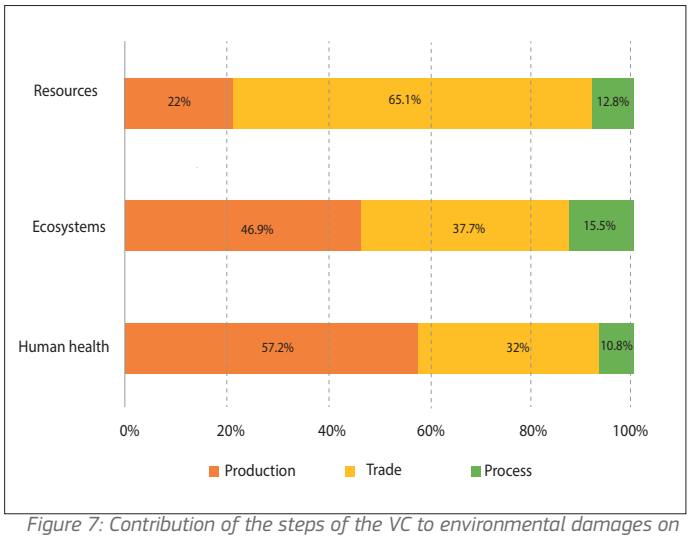

Figure 7: Contribution of the steps of the VC to environmental damages on the areas of protection

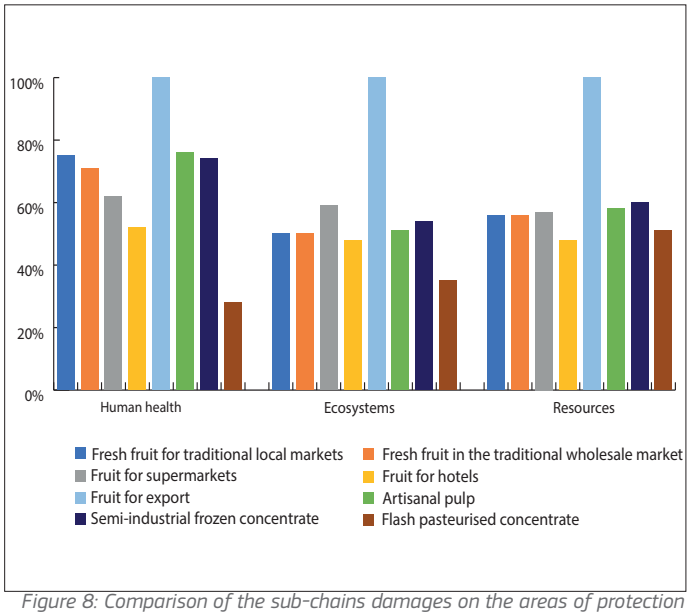

Figure 8: Comparison of the sub-chains damages on the areas of protection per t of fresh mango

IS THE VALUE CHAIN ENVIRONMENTALLY SUSTAINABLE?

Agricultural production and transport are the steps in the value chain with the highest environmental impact. Production and use of fertilisers and phytosanitary treatments are critical elements to improve the agricultural footprint and thus the sustainability of the value chain. Improved knowledge via technical support can make the use of inputs more effective and increase the productivity thanks to practices such as pruning. Another possibility is to reduce the use of agrochemical inputs and support the development of organic ones. Organic mango can be a relevant niche market in the short and medium term. Finally, another environmental challenge is to reduce the impact of small intermediaries that use vans for fruit transport to the local markets or artisanal processors.

Main findings

Activities in the mango VC are profitable and financially viable, with a positive impact on the national economy. However, a few actors manage the most value generating sub-chains. Inclusiveness is jeopardised by the weak role of producers' associations that did not manage to improve the access to profitable markets (export and domestic market of quality fruit) for small and medium producers. The latter are weakened by the informality in the sector, the land tenure conditions (scarcity of titling) as well as by the weak access to technical information.

Selling quality products inside the country requires addressing the barriers to market access

Domestic markets absorb most of the VC volumes and have a strong potential for value adding and, possibly, for including more producers. These markets are the development engine of the VC but not all actors can access them: the lack of trust towards intermediaries and the conditions of delivery and payment are critical barriers. The creation of niche products, also via certification, and the dynamic of public purchasing could generate new market opportunities for processed and fresh fruits.

Processing: gives value to some varieties and waste, and creates employment

Processing is pivotal for the **creation of employment, especially for women**.

Reducing or valuing fruit waste is key for the future of the VC. However, processing does not allow for the valuing of all waste because only some mango varieties (banilejo) are used for processing in the agroindustry due to the organoleptic requirements of manufactured products. Even though these varieties are considered as "wild", they have a high potential to create value (huge demand), both domestically and for export.

MSMEs processing mango are not easily identifiable, and they suffer from the informality and barriers to access markets (lack of relations with domestic and foreign buyers). Moreover, the costs of raw material (for both non-native and indigenous varieties) and of energy to maintain the cold chain (of frozen products) are high, since they do not benefit from the economies of scale nor the fiscal advantages as it happens for large companies. **Developing renewable energy sources** is a solution, as well as the valorisation of the mango discards from processing, that can also be used to add value by manufacturing other products (for example oils or animal feed).

Recommendations to improve the sustainability of the VC

Access to specific markets depends on **safety, quality and certification requirements**. Administrative procedures to comply with the national phytosanitary rules are complex and they are not perceived by many actors as a gateway to more benefits. **MSMEs** involved in processing and producers' organisations **should improve their organisational and management skills, with coherent and integrated marketing strategies**. Up to now, support mostly focused on technology, capacity building, and on infrastructures enhancement (for packaging), underestimating the improvements to governance and market access. Support to the VC should be holistic and consider economic, social and environmental impacts, so that investments are anchored to programmes promoting the inclusive and sustainable development of the VC.

The low contribution to the public finances, the low inclusiveness and the informality of activities are to be considered as strong weaknesses.

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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://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

This document is based on the report 'Análisis de la cadena de valor de las frutas processadas en la República Dominicana' by Pamela Katic (NRI), Sandrine Freguin Gresh (CIRAD), Ivonne Acosta and Jesus Santos. Only the original report binds the authors.