European Commission

VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

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Mango and Lime value chain analysis in Guinea Bissau

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 the 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

Guinea Bissau faces substantial challenges in terms of economic growth and poverty reduction. In this context, agriculture remains the main sector of the economy, contributing up to 45% of the GDP, and representing more than 80% of employment and around 90% of the country's exports. Guinea Bissau's rural economy is mostly based on cashew production and the country is dependent on imported food products, including cereals, specifically rice in complement to domestic production. Although still embryonic, fruit VCs have a significant potential to diversify agricultural production and improve producers' income, complementing the production of rice and cashew.

The European Union Intervention

Cooperation between the European Union and Guinea Bissau is mainly focused on the development of the rural sector via transversal support to agricultural value chains (VCs). This support is mostly devoted to the rice VC but it also considers other agricultural VCs that can contribute to inclusive and sustainable development, such as fruits VCs. In this regard, mango and lime production are among the VCs that best combine this potential with the opportunities offered by the growing demand in the national but also regional and international markets.

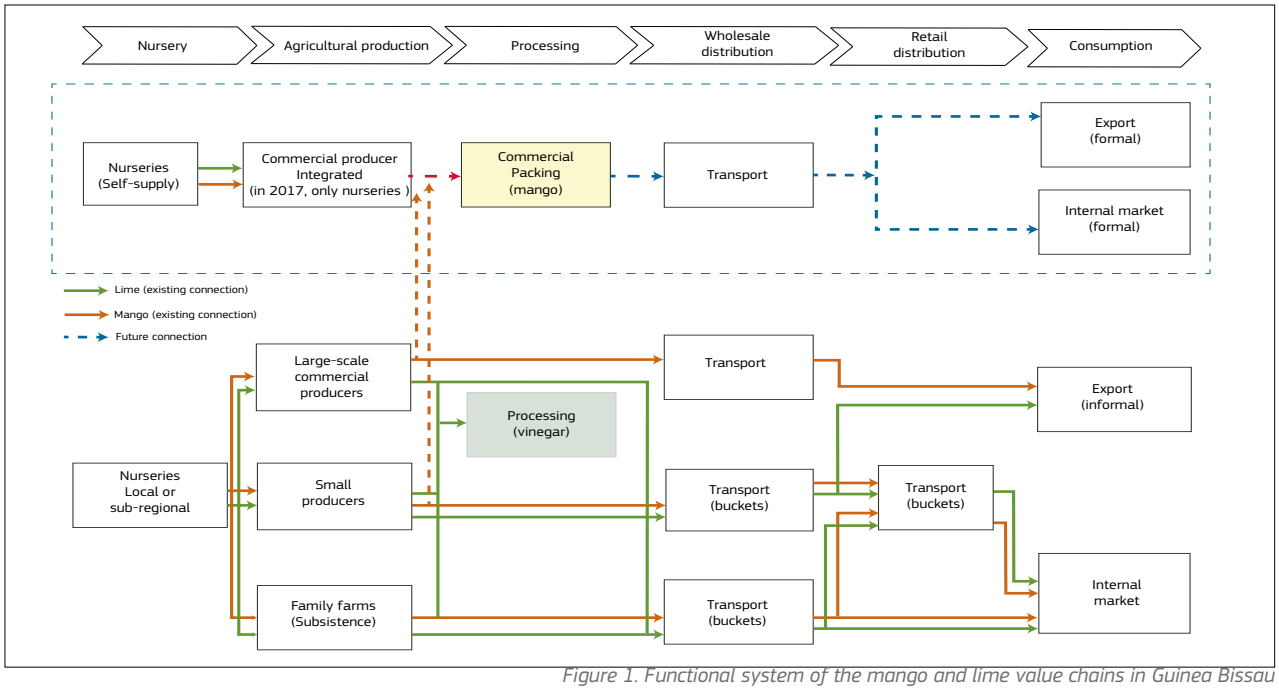

Figure 1. Functional system of the mango and lime value chains in Guinea Bissau

Functional analysis

Mango and lime VCs are relatively simple in terms of their structures and functional aspects (figure 1).

Mango value chain

The mango VC is characterised by primary production of various mango varieties, while agro-industrial processing is practically non-existent. Therefore, mango is entirely **commercialised fresh**, mostly by women (bideiras) who deal with the harvesting and transport in passengers' cars to the main market of the country.

Mango production in 2017 was estimated at around **9,000 t**, with losses up to 25% for the main variety, called "kent". This loss estimation does not include other varieties that, in the same year, experienced significant losses due to phytosanitary problems. Likewise, it does not include some varieties that although are less affected by diseases, they have little organoleptic appeal to be considered for export.

There are three types of mango producers that differ mostly by their plot size: large-scale producers (representing 43% of the production), small-scale producers (30%) and family producers (27%). Intermediaries are divided in four categories: local retailers in the rural area, semi-wholesalers selling to the Bissau market, retailers in Bissau, and exporters, all organised in an informal way. Most of the mango production is directed to the local market and to Bissau (64%), 22% covers auto-consumption and the rest is exported (14%), mainly to Senegal. The two most important regions for mango production are **Oio (representing 50% of the production)** and **Cacheu (20%)**.

Lime value chain

Lime VC includes production of **fresh lime and lime vinegar**, with the second being prepared in an artisanal way directly by producers. The variety mostly used is the so-called "lima de terra". The estimated production in 2017 was of **6,100 t**, considering a relatively limited loss of around 10%.

There are three types of lime producers: large-scale producers (representing 55% of production), small-scale producers (38%) and family producers (7%). The types of intermediaries are the same as in the mango VC. The two most important regions for lime production are **Cacheu (30%)** and **Tombali (28%)**.

The majority of lime production is transformed into vinegar (67%). The rest of lime is destined for self-consumption (2%), or exported to Senegal and Cape Verde (19%), while 12% is commercialised in local markets and in Bissau. Production of **lime vinegar in 2017** was around **1,600 l**, 90% of which was commercialised across the country, while only 7% was used for self-consumption and 3% for exports.

Mango and lime valorisation

Despite the fact that mango production is developed throughout the country, mango trees owners have scarce knowledge of the different varieties and of the commercial opportunities. Moreover, they are ill informed and equipped to fight the **fruit fly disease**.

Given the absence of a well-organised commercial circuit to collect mango from the most isolated areas, **a great majority of mango production is not harvested**, thus not generating income.

Lime production instead seems to have fared better, thanks to the **commercialisation of a product with high added value – vinegar** -, which has a strong demand in the local markets, and gives women a management role in the VC.

Economic analysis

Contribution to economic growth

Lime and mango VCs are profitable for all actors. Despite this, their **contribution to economic growth is marginal**, being 0.57% and 0.27% of the GDP for mango and lime respectively (Figure 2). **Even contribution to the agricultural GDP is limited**, being 0.86% for mango and 0.41% for lime. **Contribution to export is not significant**, being around 0.10% for mango and 0.09% for lime. Finally, there is **no contribution to public finance** because the two VCs are entirely managed in an informal way. These VCs face challenges to be internationally competitive. In fact, the domestic prices of mango and lime are higher than the international prices, with Nominal Protection Coefficients (NPC) and Effective Protection Coefficients (EPC) higher than 1 for both products.

Item / 2017	Mango	Lime
Total added value (millions FCA)	3304	1738
Contribution to the GDP	0.57%	0.27%
Contribution to the agricultural GDP	0.86%	0.41%
Contribution to exports	0.10%	0.09%
Impact on employment (number of jobs)	770 emprego	600 emprego

Figure 2: Economic indicators for the mango and lime value chains

Inclusiveness in the value chains

Value added is mostly concentrated at the level of intermediaries operating in Bissau (wholesalers and retailers), the main market (Figure 3). The contribution to wages is very weak in both VCs, mainly due to the fact that salaries are very low. They are often provided in the form of food or other basic goods. Governance is also very weak which limits the functioning and efficiency of both VCs.

The two VCs are quite similar in economic terms. Both chains are financially viable. **The share of value added is highly favourable to producers and retailers, but less favourable to salaried workers and public funds** (Figure 3).

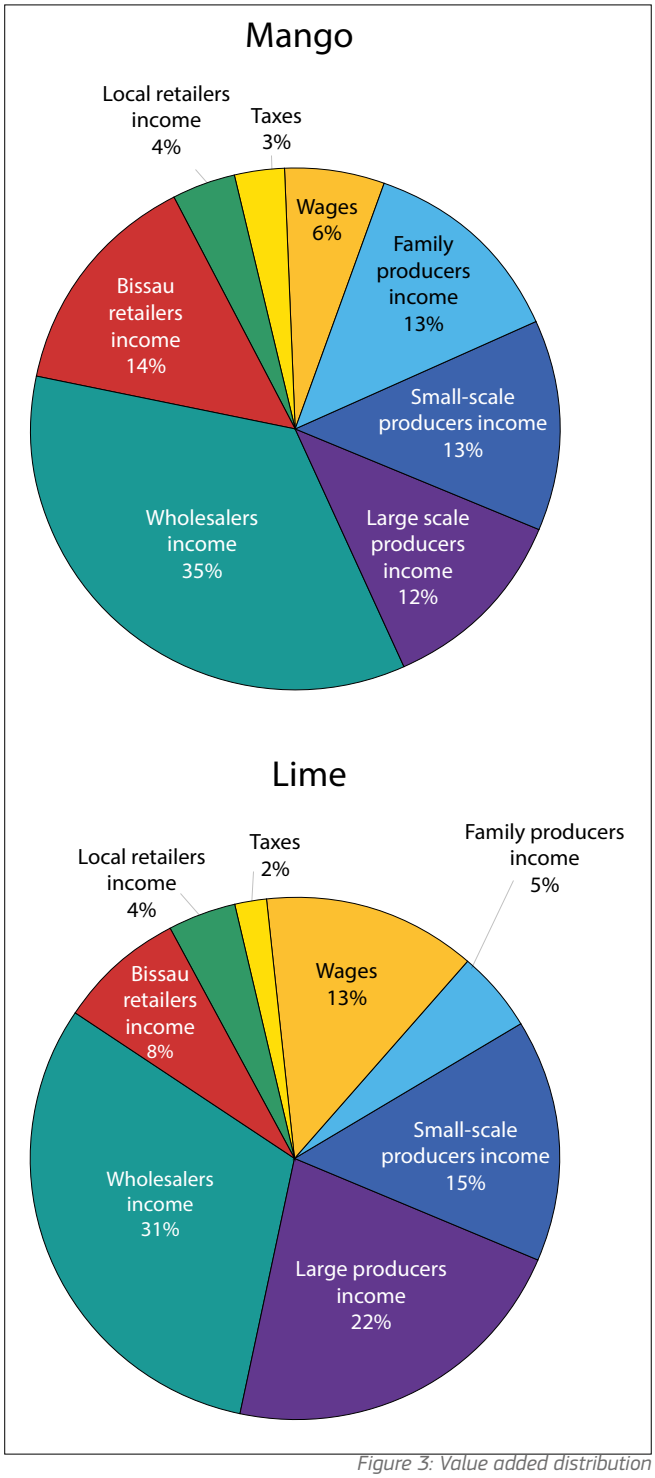

Figure 3: Value added distribution

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

The contribution of mango and lime value chains to the economic growth of Guinea Bissau is very low. Even though the two value chains generate profits for all the actors, they contribute marginally to the national economy, considering their weak contribution to the GDP, to the balance of trade and to employment creation. Moreover, the inefficiency in tax collection implies that the State does not have any substantial return from these two VCs.

Similarities in the two value chains are due mainly to the fact that mango producers are generally also lime producers. Given the negative impact of the fruit fly on the viability of mango production, there could be a tendency, at least in the short term, to reducing the agricultural areas dedicated to mango plantations. This tendency is particularly observed in those producers who keep struggling with phytosanitary problems as they are then pushed to expand more the areas of lime production to compensate for mango losses.

Social analysis

The social analysis takes into account, on the one hand, the sub-chain linked to subsistence producers and orchard owners who represent the dominant production systems in Guinea Bissau

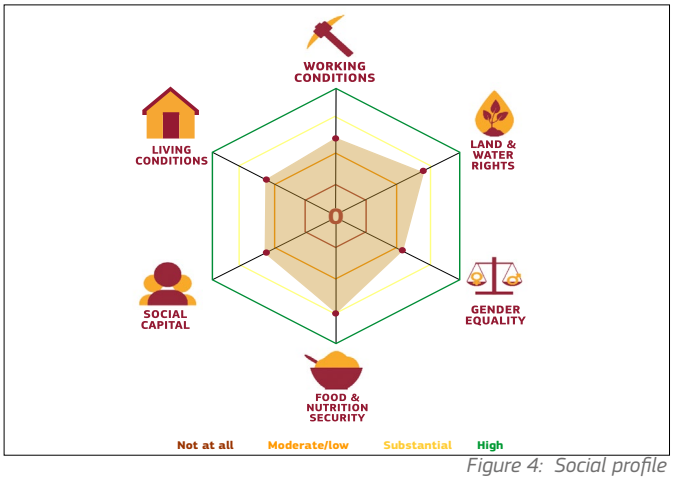

Figure 4: Social profile

On the other hand, the sub-chain linked to a company located in the main region of Guinea Bissau was prospected. Despite not being productive yet, the company has already some activity linked to the VCs, such as some installations of vivarium and facilities for the preparation of mango and lime grafts for export. The company impacts positively on the people working and living around, especially with regards to the working conditions (formal contracts covered by social protection schemes), the human capital (capacity building/ training for workers) as well as to the living conditions. The company also brings slight improvements in terms of social capital (working in partnership with a producers' association) as well as of food and nutrition security (mostly due to the fact that salaries are often in the form of payment for food products).

IS THIS ECONOMIC GROWTH INCLUSIVE?

Both value chains could be more inclusive with a better recognition of the share of the labour burden between men and women. Moreover, school attendance is put at risk by child labour in the VCs. Despite these challenges, mango and lime generate income that can improve food procurement and quality for families at certain periods of the year. Despite the promising improvement for employment and working conditions due to the emerging industrial company, the price of fruit on the market may in turn decrease, resulting in an increased vulnerability of small producers.

IS THE VALUE CHAIN SOCIALLY SUSTAINABLE?

The social sustainability of the two value chains differ especially in terms of the capacity of producers to deal with technical constraints (e.g plant diseases, varieties, losses), of market accessibility and of processing opportunities. Lime production guarantees better crop conditions, contributing to improving the quality of life of the rural population as transformation into vinegar found a market and is very profitable.

Working conditions	• Child labour in agriculture is considered as a family need from the social point of view but this challenges school attendance after the end of primary education. • The industrial company in start-up phase introduced improvements in terms of working conditions, promoting salaried employment, favouring the setting up of producers' associative structures as well as training to producers. • Despite this, the company has not yet succeeded in creating a relationship of trust with the owners of small farms, that blame them for negatively influencing the market prices.
Land and water rights	• Due to poor State intervention and to the absence of governance in rural areas, the social structure is highly influenced by the ethnicity, which determines the conditions for access to and use of water and land. • The overlapping of the customary and statutory law generates conflicts around land and water rights.
Gender equality	• Women are highly vulnerable. They are the ones to guarantee household food needs, the schooling of children, the family health while combining their work on the field with household work. • They undertake the majority of agricultural activities, but they are often excluded from paid labour. • Income distribution is generally disadvantageous for women because the low profit obtained in the local markets is handed over to men.
Food and Nutrition Security	• The rural population suffers, every year, from periods of food shortages due to depletion of rice reserves, that cash crops like lime and mango allow to fill. • Across the country, food is scarcely nutrient and diversified. Income generated from selling mango and lime allow households to buy some additional food, thus contributing to improve food quality during the production period.
Social capital	• The mutual assistance guarantee is based on the extended family. • There are some associative structures linked to the management of collective goods and some activities led by NGOs, but with no ambition to join synergies for higher risk entrepreneurship.
Living conditions	• Social conditions in Guinea Bissau reflect the poverty situation also captured by the general statistics on the country. • Rural areas, where more than half of the country population lives, lack basic infrastructures. • Housing conditions are precarious, with no electricity. Sanitation facilities are non-existent or rudimentary.

Environmental analysis

Environmental impact of mango value chain

Due to the relatively simple structure of the mango and lime VCs, their environmental consequences are overall not significant. **Greenhouse emissions derived from transport** to collect the products and sell them into the market **are the main drivers** of the environmental impact. In relation to human health, the major impacts are determined by the **carbon dioxide and sulphur emissions**, as well as by **heavy metal** (zinc and lead) for **soil exploitation**. Concerning the ecosystem quality, impacts derive also from the emission of carbon dioxide which contributes to global warming. In turn, ozone creation and acidification are linked to emissions of nitrogen oxide. Impact on resource depletion is low and determined overall by fuel extraction.

Other environmental concerns come from the use of chemical systems for the ripening of mango as well as from the ingredients used in chemical traps for the fruit fly control, both requiring proper application.

Environmental impact of lime value chain

Impacts derived from lime production are similar to those experienced in the mango VC. **The main driver is transport which is higher for lime vinegar**, this being transported to Senegal and Cape Verde. Contribution to climate change is the dominant impact due to transport but also because **lime is cultivated in an extensive way, without mechanisation**.

In this VC, pesticides are not applied, and fertilizers are scarcely used, as the processing for vinegar is done in artisanal way. **Water is of relative importance**, as lime production is quite sensitive to water availability and to avoid negative consequences on productivity, some form of irrigation shall be put in place.

Figures 5, 6 and 7 summarise the environmental impacts at each stage of the VCs in the areas of protection, for mango, lime and lime vinegar VCs production respectively.

Legend: red for a relative contribution greater than 50%, orange 5-20%, green if less than 5% and white if not applicable

Production of mango in GNB	Artificial ripening	Transport to the market of Ziguinchor (Senegal)	Transport to the market of Bissau	Monitoring/control of the fruit fly	Planting of orchard
Human health	0.13%	1.20%	98.6%	0.0%	0.02%
Ecosystem quality	0.06%	1.24%	97.8%	0.0%	0.09%
Resource depletion	0.02%	1.20%	98.8%	0.0%	0.0%

Fig. 5 Contribution of each step of the mango VC to the environmental impact on the three areas of protection

Production of Lime in GNB	Transport to the market of Ziguinchor (Senegal)	Transport to the market of Bissau	Orchard – production phase	Planting of orchard	Nurseries
Human health	70.7%	28.9%	0.23%	0.06%	0.03%
Ecosystem quality	67.4%	27.5%	0.30%	3.7%	0.92%
Resource depletion	70.9%	29.%	0.0%	0.0%	0.0%

Fig. 6 Contribution of each step of the lime VC to the environmental impact on the three areas of protection

Production of lime vinegar in GNB	Transport to the market of Ziguinchor (Senegal)	Transport to the market of Bissau (Guinea Bissau)	Transport to the market of Praia (Cape Verde)	Orchard – production phase	Nurseries
Human health	99.3%	0.02%	0.43%	0.11%	0.06%
Ecosystem quality	91.1%	0.02%	0.53%	6.6%	1.6%
Resource depletion	99.9%	0.01%	0.0%	0.0%	0.0%

Fig. 7 Contribution of each step of the lime vinegar VC to the environmental impact on the three areas of protection

IS THE VALUE CHAIN ENVIRONMENTALLY SUSTAINABLE?

In terms of environmental protection and quality, mango and lime production have impacts on human health, ecosystem quality and resource depletion that can be classified as very low. Consequently, whether from lime or mango production, the impacts are not significant, locally circumscribed and reversible.

That said, mitigating measures (such as good practices in the use of pesticides) or alternative systems to minimise the impact of the fruit fly, that are available, should be promoted and implemented more consistently and extensively. Training and capacity building on the techniques to efficiently fight the diseases that ravage these cultivations, particularly for mango, is a critical measure to take in order to reduce environmental damages. Finally, as transport of mango and lime is the main factor of environmental impacts, all public policies that can improve the regulation, reorganisation and renovation of the sector are positive, while recognizing the difficulties associated with changing transport models.

Conclusions and recommendations

From a strategic point of view, **various opportunities can be seized to improve and consolidate the development of the mango and lime VCs**.

However, in the mango VC, these opportunities are challenged particularly by phytosanitary problems coupled with a general fragility of the governance system (technical services provision, vulnerability of support associations and market informality). These weaknesses can be reduced by incentivising good practices in combatting the fruit fly, by improving the market perspectives and supporting the development of processing at the local level.

The lime VC has a significant advantage: globally, it is more profitable for small producers, partly thanks to the production of lime vinegar, and because the chain does not suffer from the same problems as mango in terms of market placement or phytosanitary issues.

Programmes supporting the mango and lime VCs should be focused on mitigating the highest risks, such as fighting efficiently and effectively the plagues for mango, which have to be addressed both at the national and transnational levels. Further risks dwell in the dominant informality and the lack of regulation of the two VCs as well as the general absence of efficient public policies in terms of technical and financial support to main actors in the VCs, especially producers, workers and associations.

The mango and lime VCs have a significant potential to increase production and exports, while creating social value and guaranteeing the environmental protection.

However, for these VCs to fully exploit their potential, **the following recommendations are suggested**:

1. Training and technical assistance to producers, especially on techniques for fighting the fruit fly, management of plant varieties in line with commercial opportunities;
2. Cooperative organisation of producers and intermediaries, creation of associative structures with a shared infrastructures management;
3. Innovation in the two VCs, new processing activities, improvement of quality, etc.;
4. Credit facilitation to invest in the production activities, installation of cold chains, transformation processes, etc.;
5. Fair and inclusive access to orchards and markets, to guarantee the sustainability of subsistence-oriented agriculture in support of most vulnerable communities;
6. Rebuilding of the local governance structures (formal and traditional) in order to facilitate the implementation of a common national plan in support of the production and marketing of lime and mango, with the participation of representatives of the different stakeholders within the two VCs;
7. Environmental sustainability: improvement of the effectiveness of phytosanitary control on orchards; wide dissemination of the good practices to cope with the fruit fly; reduction of the environmental impact of trapping systems used to control the fruit fly; improvement of the process of chemical ripening of fruits, substituting the artisanal practice of using calcium carbide with more adequate and environmentally sustainable systems, less risky for public health;
8. Incentive of public policies for promoting the modernisation of transport, as well as measures to periodically monitor the status of vehicles used in the sector, as transport is the main factor of green-house gas emissions derived from activities in the two value chains.

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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-

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