COUNTRY ECONOMIC MEMORANDUM

for São Tomé and Príncipe

Background Notes

Note #10 – What are the obstacles to agricultural development in STP? A review of current agriculture production structure and potential[1]

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I. Executive Summary

1. **This note presents an analysis of the obstacles and opportunities for STP's agriculture value chains, assesses the main sector risks, and provides a series of public sector recommendations for increased private sector investment.** While the country will remain a net importer of food and agricultural products for the foreseeable future, a series of opportunities exist, some to increase import-substitution, others to expand exports. Given STP's land constraints and climate variability, importing food will continue to occur in the near to medium-term future to satisfy local demand. However, import-substitution opportunities will continue to offer prospects centered on the feedstuff-livestock chain and the horticultural sector, as well as some additional expansion of the palm oil industry. Export opportunities lie primarily in cocoa products as well as in emerging non-traditional agricultural exports, some strategically linked to tourism, especially eco-tourism already embraced by the government and by high-end tourist developments established in the past few years.

2. **Analysis of the competitiveness of existing and emerging rural supply chains in STP reveals a series of characteristics that allow to overcome the structural diseconomies of scale of a small island state.** These characteristics include among others: (i) high value-to-weight products, (ii) agricultural products that can be taken with tourists, (iii) low perishability and products that can be stored, (iv) climate change resilience; and (v) explore the country's uniqueness. Value chains that possess some of these key characteristics discerned from the analysis offer private sector opportunities, provided the enabling environment allows them to reach their potential.

3. **However, there are a series of challenges that need to be addressed in order to take advantage of such opportunities for private sector investments in the agriculture sector.** An initial key challenge for the sector is the adverse impact from climate change. A decline in average rainfall and an increase in

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the average temperature measured in STP since the 1950s have contributed to crop losses and a longer dry season increasing one of the major risks faced by farmers. Other challenges facing the sector include: (i) poor agrologistics, (ii) lack of agriculture trade promotion, (iii) price fluctuation (for cacao), (iv) animal and plant disease risk, (v) lack of unified agricultural policy, (vi) lack of information and data to guide public policy and de-risk private sector investment, (vii) land policies that do not allow for land to be used as collateral; and (viii) lack of adequate agriculture innovation support (research, education and technical assistance).

4. **Various existing and emerging agricultural supply chains clearly demonstrate continued economic and technical viability for export markets and for domestic food markets, but limitations need to be addressed for the sector to thrive.** Although with differences in structure, both domestic and export-oriented value chains possess some of the fundamental characteristics to maintain their competitiveness. The emergence of Agri-SMEs, farmer cooperatives, and value chains for export and domestic food markets has created a nascent agribusiness sector in STP. However, in order for private agri-entrepreneurs to continue and increase investments in the sector, key constraints need to be overcome, in particular: (i) the large yield gaps shown in STP's production data, (ii) difficulties identified by current agro-exporters in exporting their products, (iii) constraints identified by farmers in the management of sector risks, such climate and agrologistics, and (iv) lack of explicit agriculture public policies on sector development.

5. **An initial limitation that needs to be overcome is the currently low agriculture yields.** STP's agriculture land is limited and given the large yield gaps observed in agriculture products such as cacao and bananas, there is ample potential for agriculture intensification[2] as a way for sector growth.

6. **STP's agriculture sector development is and will be intrinsically linked to environmental services and tourism.** Given the close relationship between agriculture and protected areas in STP, and the benefit that organic and bio-friendly agriculture practices have on price premiums paid in export markets and tourists, the agriculture development policy and strategy for STP will need to focus explicitly on ensuring that environmental considerations are included in agriculture production and investment decisions. Environmentally friendly produced food (be it smart food, organic, nutrition smart, slow food, etc.) is, and can increasingly be, a source of value added and differentiation for STP's agriculture products. Also, the current image of STP being a country that produces high quality and environmentally friendly food is being facilitated in part by tourists visiting STP. Therefore, a policy and strategy to increasingly link local food production with tourist destinations (hotels, resorts, restaurants) will be an important sector promotion approach to product differentiation and increase demand from export markets.

7. **The sector analysis points to policy recommendations and priority public investments that can overcome such challenges and that can enable the private sector to seize those opportunities on a sustainable basis.** Recommendations from the analysis include: (i) measures to intensify climate resilience (water-harvesting and runoff capture, expand agroforestry, soil and water conservation techniques, improved collection and dissemination of local climate data, etc.); (ii) enunciation by the government of

[2] Agriculture intensification means an increase in agricultural production per unit of inputs (which may be labor, land, time, fertilizer, seed, feed or cash).

a renewed national agriculture policy and strategy (2019-2025); (iii) improvements in the cadaster and land market functions; (iv) inclusion of substantial participation of private actors along the various value chains to prioritize public investments in agricultural promotion, animal and plant health, and innovation; and (v) increased investment in innovation, plant and animal health risk management, and in improved access to basic agricultural and climate statistics.

8. **Finally, there is a clear knowledge gap in the agriculture sector of STP, founded on the lack of up to date sector information and statistics.** STP's last agriculture census was almost 30 years ago (1990), and the few household surveys that have been conducted since then did not provide a clear understanding of the farming community. This knowledge gap complicates policy and program design.

II. Introduction

9. **The present note is part of the Country Economic Memorandum (CEM) prepared by the World Bank for São Tomé and Príncipe (STP).** The objective of the CEM is to understand existing hindrances and feasible reforms recommended to boost private sector-led growth in key sectors. This note looks at agriculture as one of those key sectors (other sectors include fisheries and tourism). Although agriculture in STP is already mainly a private sector driven activity, public sector policies and programs have a substantial influence on the incentives for private investments and for sector growth. The government has clearly signaled the sector's importance as part of its national strategy and expressed its interest in ensuring that public policies and programs are addressing the main obstacles to growth as well as leveraging private sector participation.

10. **This note presents an analysis of the obstacles and opportunities for STP's agriculture value chains, assesses the main sector risks, and provides a series of public sector recommendations for increased private sector investment.** The initial section presents the context in which the agriculture sector in STP develops, followed by a section analyzing the competitive position of the various value chains, and an assessment of the main risks faced by the sector. The chapter concludes with a series of public policy and program recommendations to leverage private sector investments.

11. **While the country will remain a net importer of food and agricultural products for the foreseeable future, a series of opportunities exist, some to increase import-substitution, others to expand exports**. Given STP's land constraints and climate variability, importing food will continue to occur in the near to medium-term future to satisfy local demand. However, import-substitution opportunities will continue to offer prospects centered on the feedstuff-livestock chain and the horticultural sector, as well as some additional expansion of the palm oil industry. Export opportunities lie primarily in cocoa products as well as in emerging non-traditional agricultural exports, some strategically linked to tourism, especially eco-tourism already embraced by the government and by high-end tourist developments established in the past few years.

12. **Analysis of the competitiveness of existing and emerging rural supply chains in STP reveals a series of characteristics that allow to overcome the structural diseconomies of scale of a small island state as well as other disadvantages linked to poverty and legacies of its colonial past.** These characteristics include among others: (i) high value-to-weight products, (ii) agricultural products that can be taken with tourists, (iii) low perishability and products that can be storage, (iv) climate change

resilience; and (v) explore the country's uniqueness. Value chains that possess some of these key characteristics discerned from the analysis offer private sector opportunities, provided the enabling environment allows them to reach their potential.

13. **However, a series of challenges emerge that are particular to STP and that need to be addressed in order to take advantage of such opportunities for private sector investments in the agriculture sector.** An initial key challenge for the sector is the adverse impact from climate change. A decline in average rainfall and an increase in the average temperature measured in STP since the 1950s have contributed to crop losses and a longer dry season increasing one of the major risks faced by farmers. Other challenges facing the sector include: (i) poor agrologistics, (ii) lack of agriculture trade promotion, (iii) price fluctuation (for cacao), (iv) animal and plant disease risk, (v) lack of unified agricultural policy, (vi) lack of information and data to guide public policy and de-risk private sector investment, (vii) land policies that do not allow for land to be used as collateral; and (viii) lack of adequate agriculture innovation support (research, education and technical assistance).

14. **The sector analysis points to policy recommendations and priority public investments that can overcome such challenges and that can enable the private sector to seize those opportunities on a sustainable basis.** Recommendations flowing from the analysis include: (i) measures to intensify climate resilience (water-harvesting and runoff capture, expand agroforestry, soil and water conservation techniques, improved collection and dissemination of local climate data, etc.); (ii) enunciation by the government of a renewed national agriculture policy and strategy (2019-2025); (iii) improvements in the cadaster and land market functions; (iv) inclusion of substantial participation of private actors along the various value chains to prioritize public investments in agricultural promotion, animal and plant health, and innovation; and (v) increased investment in innovation, plant and animal health risk management, and in improved access to basic agricultural and climate statistics.

III. Sector Context

15. **São Tomé and Príncipe enjoys a tropical climate and natural resources that have produced a long history of tropical agriculture production and exports**. Although geographically isolated, STP benefits from abundant rainfall and land resources (fertile volcanic soils) that have attracted investments in agriculture since its discovery in 1471. Sugarcane was produced and exported during the 16th century until the arrival of the Dutch in 1641. Once the Dutch left in 1644, the island developed a sector of commercial farmers (local landowners) that produced various food products for local consumption. By 1800, Brazilian businessmen started investing in coffee production, consolidating landholdings throughout the 19th Century. By the end of the century, due to lack of labor, the focus switched from coffee to cacao[3] (which was introduced in 1822) since the latter required less labor. The peak of cacao production was reached in 1913 at 36,500 MT per year, after which production decreased and stabilized between 8 to 10,000MT/year until independence due to lowering of international prices and various plant health problems (WFP, 2018). This decrease in cacao production made room for coconut and palm oil production.

[3] Note that the term "cacao" is used to refer to the plant that produces pods which contain cocoa beans, whereas the term "cocoa" is used in this report to refer to the crop once it is harvested as part of the cocoa supply chain.

16. **Agriculture accounts for 5.1 percent of STP's GDP (2017), and its growth has been relatively stable over the past decades.** Agriculture GDP declined after independence in 1975, mainly due to the decline in cacao production, but recovered after 1991 (see Figures 3 to 6). Cacao production represented about half of agriculture GDP in 1975, but after independence, although cacao prices remained attractive in the international market, the sector was not able to maintain the production level because Portuguese landowners left the country and little know-how remained to maintain exports. Since 1991, agriculture GDP has been mainly composed of agricultural products for local consumption, with bananas and coconut making up for over 50 percent of agriculture GDP (2016) (see Figures 7 and 8).

17. **Agriculture production is dominated by smallholders with average landholdings of 3 ha per farmer and employs 24 percent of the working population[4].** It is estimated that 64,000 people in STP live in rural areas (or 33 percent of the total population). As per the 1990 Agriculture Census, approximately 8,000 families (or 25 percent of households) cultivated crops, and 12,000 of them (or 40 percent of households) had livestock. Although no accurate estimate is available since the agriculture census of 1990, there are an estimated 44,760 ha (47 percent of the national territory) under agriculture production (PNSAN, 2012), with most hectares being used for cacao production (FAOSTAT, 2016). It is important to note that in 1992, a land reform redistributed arable land (43,775 has) to agriculture workers (8,877 of them) who resided in the old cacao plantations, but who did not necessarily know how to farm (World Bank, 2014). Furthermore, in the past decades, STP has gone from having a majority rural population to a majority urban population This led to a continued decline in cacao yields, but an emergence of food production for local consumption (see Figure 9 to 12).

18. **STP's agricultural yields are systematically below the average of neighboring West African countries and other small island developing countries**. Average yields are significantly lower than benchmark countries[5] (see Figure 10 and 11), both for export commodities as well as for local food products). Although banana production yields have been increasing, there is no apparent catching up to benchmark countries which also have achieved higher yield increases during the recent decades. Average cacao yields in STP are one-fifth of the average of West African countries and one-fourth of the average of small island developing countries, while average banana yields in STP are still half of the average of small island developing countries and 60 percent of the average of West African countries. Although no updated data exists to undertake an analysis of total factor productivity nor detailed cost comparisons between STP and benchmark countries (last agriculture census was in 1990), based on secondary sources and stakeholder consultations, several factors have been pointed out as potential sources of the large productivity gap, including among others: (i) low quality of agriculture innovation services (agriculture R&D, education and extension); and (ii) high and unpredictable agrologistics costs.

19. **Livestock production is entirely focused on the local market and has been growing in importance.** Although beef and milk production has been stagnant and decreasing in recent years respectively, production of eggs and chicken and pork meat has been growing. However, these small-scale agroindustries are dependent on imported feed, as there is no local feed production. A recent analysis

[4] Data from the 2012 population census.

[5] Throughout this report, benchmark countries used include Small Island States as well as Western African countries as appropriate.

(WFP, 2018) shows that given STP's lack of comparative advantage in the production of cereals for feed, that importing such inputs is the most efficient option to maintain the competitiveness of STPs livestock sector.

20. **Farmer cooperatives and agriSMEs have been increasing their presence in the past decades**. In both export and local markets, several value chains have seen the emergence of farmer cooperatives, grouping smallholders to reach economies of scale in the purchasing of inputs, as well as coordinating sales. Several development partners have been supporting export-oriented cooperatives (such as the Participative Support Program for Family Agriculture and Artisanal Fishing – PAPAFPA, funded by IFAD), which have grown significantly in supply chains like cacao, representing more than one-fourth of the volume of cacao exported (World Bank, 2014). AgriSMEs are present in the agriculture and food sectors, focusing on export markets for cacao, chocolate, peppers, coffee, but also dried fruits. Even with relatively lower yields, agriculture exports are able to reach niche markets with higher margins, while local food markets pay attractive amounts for fruits, vegetables, and livestock products that are expensive to import.

21. **The importance of the agribusiness sector of STP is reflected in the constant and significant improvement of the country's Food Production Index[6] (FAOSTAT) over time and in relation to benchmark countries**. STP's Food Production Index (see Figure 12) reflect the increase in local production of previous imported products, such as the recent expansion in the use of greenhouses for local horticultural production. The future improvement in food production in STP will be subject to overcoming some important challenges in technical areas such as greenhouse growing operations. As the use of irrigation systems expands in areas where farmers are endeavoring to manage increased rainfall variability, drip irrigation installation and repair will require more advanced technical job skills. Increasing supply chain integration and incorporating more value-added processing present another challenge for increasing food production, but at the same time it could be a substantial area of employment growth both in the quantity of jobs and the proportion of skilled jobs.

22. **Food consumption patterns in STP have evolved as the population has become more urban.** Although part of the diet remains the same as before, with rice, bread, and fish maintaining a constant presence in terms of frequency of consumption, other parts have evolved. One of the largest changes has been the decrease in local palm oil consumption, with a substitution of imported edible oils. Another trend has been increased consumption of fruits especially bananas. In terms of meat consumption (see Table 13), there was an observed increase in the 1990s as incomes were rising, but in recent years (since 2000s) there has been a decrease in overall meat consumption frequency and volume, especially for consumption of pork and sheep meat (Espírito Santo and Pacheco de Carvalho, 2012).

23. **STP currently exports a total $9.2MM (2018) of products, the majority of which are agricultural (see Table 1).** Cocoa accounts for 89 percent of total national exports, excluding reexports, and all other agricultural exports equal an additional 11.9 percent (pepper, chocolate, coffee, copra, dried fruits, seeds, nuts, foliage and flowers). Together agriculture exports generate $9.2 MM, almost 100 percent of total exports, excluding reexports. As exports contracted starting in the post-colonial era and the population

[6] The index measures changes in production of a basket of key food products, both for exports and internal markets.

has expanded, the agriculture trade gap has expanded. The rebound in the value of cocoa exports has helped somewhat to reduce this agriculture trade deficit, but STP continues to be highly dependent on agriculture exports (as percent of total exports) in relation to benchmark countries, and particularly on a single crop (cacao); and also its food imports are a relatively higher share of total imports in relation to benchmark countries, signaling that the performance of its agriculture sector will have a direct impact on the overall trade balance of the country (both from the exports as well as from the imports side).

24. **Imports stand at $132.8MM (2018), of which 22 percent are food imports (see Figure 15).** Thus, total food imports are about $30MM compared to $9.2MM in food exports or a bit less than a third. So, while the prospects of becoming a net exporter are remote for the foreseeable future, the prospects for closing the net food import-export gap are less daunting.

25. **A significant development in food imports in the last decade has been the implementation of Agripalma, the large-scale palm oil company currently producing 12,500 MT equivalent to $7.5MM at current world prices**. This import-substitution equates to a two-thirds increase in agricultural exports. Current imports of cooking oils and fats stand at $3MM compared to the $7.5MM equivalent of palm oil.[7] Furthermore, the palm oil chain generates significant employment and secondary economic benefits. The company reports that currently 2,210 hectares of their total 4917 ha concession is planted in African palms. They have a new palm seed crushing facility under construction slated to begin operation in 2019.

Table 1. STP Import and Export Overview (2017)

Export Item	Percent Total Exports	Amount (US$ 000)
Cacao Beans	62.4	9,456
Chocolate	2.10	318
Coconut	1.09	165
Pepper	0.44	66
Coffee	0.34	52
Vanilla	0.16	25
Planting Seeds	0.12	18
Dried Fruit	0.10	15
Sea Food	0.05	7
TOTAL	**66.75**	**10,123**

Source: MIT's Observatory of Economic Complexity – OEC 2019[8]

26. **At current levels of agriculture productivity, most of farming households are below the poverty line in STP.** Around one-third of the population of STP lived on less than US$1.9 PPP per day, and more than two-thirds of the population was poor, using a poverty line of US$3.2 PPP per day.[9] In rural areas of

[7] Using the current 12-month average international price of palm oil of $600/MT yields a total value of $7.5MM for the 12,500 MT reported by Agripalma. This is in fact a very conservative price since the landed price of the oil they would have had to import as in the past would be still higher. The current value of edible oil imports is collected by the International Trade Commission as reported by the MIT Price Observatory, 2018.

[8] The MIT Observatory of Economic Complexity (OEC) consulted on February 2019 draws upon 2017 data. We have opted here to use the OEC data and software since it facilitates the analysis of import and export statistics for countries at a level disaggregated to the level of a dollar, presented here in thousands of dollars.

[9] World Development Indicators.

the south, poverty incidence reaches 84.5 percent and 73.7 percent in the Districts of Lembá and Caué. Also, within families with any income sources (excluding unemployed people and retired), farming households are the poorest, with an average poverty incidence of 68 percent (ENRP 2012-2016). To illustrate this point, the $3.2 PPP per day poverty line gives an annual equivalent of $1,168. If we take the current cacao prices ($3,000/MT of cacao beans), one hectare of cacao trees would yield an average of 400kg in STP, which generates an income for a family of $1200, slightly above the PPP poverty line for a single individual. Considering that the average household has six people, if the household does not have any additional sources of income and has the average of two to three hectares, this puts them below the poverty line with a relatively large gap (even when adjusted for PPP).

27. **Agriculture in STP is in very close proximity to environmentally protected areas.** Agriculture activities occupy 47 percent of the land, and almost 30 percent of the land is under environmental protection. The environmental protection laws and regulations (especially in the Island of Príncipe), as well as the high costs of agriculture inputs, have resulted in agriculture practices, which are often environmentally friendly, with little to no use of chemical fertilizers and pesticides. For instance, cacao and coffee production surrounds the natural forest, offering a buffer zone as these permanent crops use shade trees (see Annex 1). Production of cacao, coffee, peppers and other products is mainly organic. Fifty percent of the island of Príncipe and thirty percent of the Island of São Tomé are considered a Biosphere Reserve by UNESCO. Without any recent data on farming location and land use, the last estimates show that farms were concentrated in the Southern part of São Tomé Island, bordering the national park. Annex 2 shows the dynamic of local food production from the Center and Southern region to the northern part of the island where the main markets are.

28. **There is a wide and pervasive gender gap in the agricultural sector.** Agricultural employment is larger among older people and men, and empirical analysis has shown that female farmers are generally less productive because of cultural barriers, legal barriers to own assets, disadvantage to access inputs, markets and training (INPPEEG, 2017). In STP, women are relatively more involved in agriculture commercialization than men, while men are relatively more involved in agriculture production. However, women have less than fifty percent chance of obtaining agriculture credit compared with men, unless applying jointly with the husband. Women also have significantly less access to agriculture assets, equipment, technologies and land.

IV. Competitive position of main agriculture supply chains

29. **Supply chains are largely underdeveloped except for the traditional cocoa export crop.** Given the limited degree of product specialization and functional differentiation (inputs, production, processing, storage, shipping, marketing), there are few developed supply chains for local consumption. The greenhouse horticulture and poultry egg and meat production operations are incipient chains supplying particularly the roughly 120,000 total urban consumers. The more formally structured supply chains today are the export-oriented products dominated by cocoa complemented by emergent non-traditional exports. African palm oil in the south of São Tomé constitutes the major import-substitution product formally structured as a supply chain.

30. **A rapid rural reconnaissance and collection of existing secondary data has permitted a**

preliminary analysis of selected supply chains. A more complete analysis of existing supply chains will be required to assess private sector investment opportunities and risks as well as to prioritize the public-sector investments in the sector. Undertaking a more extensive analysis of a full array of supply chains would focus in greater depth on:

(a) Livestock production (predominantly swine, poultry, small ruminants);
(b) Horticultural production in the existing and notably expanding greenhouse operations;
(c) Agroforestry and fruit tree production, including traditional production and prospects for grafted varieties and tree nursery production;
(d) Emerging spice crops and potential essential oils;
(e) non-grain staples ("matabala" (taro)/rootcrops, plantain, breadfruit);
(f) Grain staples primarily focused on maize; and
(g) The local fishing sector including consideration of potential complementary aquaculture or mariculture.

III.a. Export Supply Chains

III.a.1. Cocoa and Chocolate

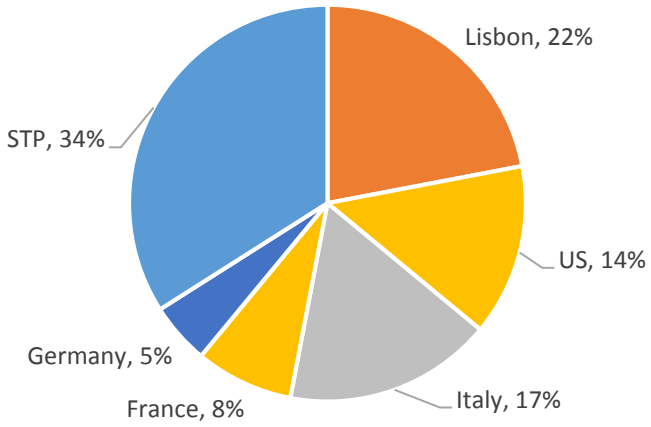
31. **Long-term farmer incentives to produce cacao in STP tend to remain robust.** By historic standards, cocoa prices – the main incentive for STP's cocoa farmers - have remained relatively high during the last five years, though a resurgence of Latin American production contributed to a temporary price slump during 2017. Cocoa demand in high income countries has remained high while production is being challenged around the world by increased rainfall variability and by major cacao plant diseases and pests, some of which may be exacerbated by climate changes. However, STP possesses special cocoa production conditions as the historically predominant producer into the early 20th century, including environmental advantages for organic production. Measures that could make cacao production more resilient to climate change offer a path for STP's existing and new cacao enterprises to expand value-added ventures.

32. **Value-added chocolate and cacao products offer expanded opportunities within STP for private sector investments.** All the world's cacao is produced by small-scale farmers in countries clustered around the equator, who are mainly price takers. Therefore, the chocolate industry has an interest to ensure that volatility in world cacao prices does not undermine the long-term incentives of smallholders to grow cacao. The World Cocoa Foundation (WCF), the principal trade organization that includes industry and producer groups worldwide, signed a declaration during its 2017 WCF World Conference committing to support a living income for cacao farmers, initially including farmer organization and empowerment programs. In 2018, COFCAO, a São Tomé cacao cooperative, formally joined WCF.

Box 1 - Claudio Corallo: An agribusiness company that embodies the crossroads faced by STP's private agribusiness sector

Claudio Corallo (https://www.claudiocorallo.com/) is a family agribusiness established in 1997 in STP and ran by STP citizens. The company has a total of 170 ha, produces world renowned cacao and chocolate, as well as coffee and other products. The company is also an important outgrower, buying cacao from over 600 smallholder farmers. Out of the more than 1000 Kg of monthly chocolate sold, more than one-third is sold locally, mainly to tourists (see chart below).

Figure 1 - Where is the chocolate sold? By destination market



Source: Report presented to World Bank mission by Claudio Corallo (2018)

This agribusiness marketing strategy mirrors quite well the overall agriculture sector of STP, where agroexports are important, but the local market is a key piece of the sustainability of agribusinesses. It also reflects how important the linkages between agriculture and tourism are in STP. Tourists not only buy chocolate in STP, but STP's chocolate attracts tourists and puts STP on the map as a tourist destination. The various articles about the best chocolate in the world produced by Claudio Corallo have caught the attention of chocolate and non-chocolate lovers. Tourists visiting STP flock to the chocolate factory to receive a guided tour and lesson on chocolate production and a tasting session. They do not only buy the chocolate, but they take the image of STP back home of a beautiful dual-island country with great chocolate. STP cacao and chocolate could not compete in international markets if it was not due to the high quality and ubiquitous premium of these products. Without tourists living that experience firsthand, there would be no premium; and without cacao and chocolate, potential tourist would not hear much about STP in the first place.

But even with this virtuous relationship between agribusiness and tourism, STP's agriculture sector is at a crossroads. The agribusiness case of Claudio Corallo exemplifies the situation. The agribusiness is an Agri-SME, with revenues at approximately US$500,000, and growing in the past years (same as STP's Agriculture GDP), but with shrinking profits due to costs, in particular to increasing production, financing, and agrologistics costs. Although the chocolate searches high premiums in the international cacao and chocolate markets, the costs of transporting inputs and final product, and the labor and financial costs are pushing the agribusiness to revert to just producing cacao beans. This movement towards value subtraction (opposite of value addition) is difficult to comprehend given that STPs comparative advantage is in high quality chocolate and other products. For example, the coffee sold by this agribusiness is not Arabica nor Robusta (the two main coffee varieties), but Liberica, which grows only in the wild and grows in these islands. This is a clear example of the country's comparative advantage.

Soft infrastructure would go a long way to address the issues at this crossroads. Without a functioning security scanner at the airport, chocolate (or any other agrifood product) cannot be shipped directly to Europe (currently they go through Angola), making export costs quite prohibitive. STP does not have a functioning warehouse receipt system, where farmers or agribusiness could obtain storage certificates that would allow them to access trade financing funds to improve their business' cash flow. Furthermore, agricultural public goods and services such as animal and plant health services, agriculture research and development, and rural infrastructure are very limited.

Export promotion and access to finance can also play an important role. Countries with a strategic view on the importance of their agriculture sector, invest in agricultural promotion as a public service to the sector

(and the country). It does not make sense for any single company like Claudio Corallo, to carry the burden of representing the image of STP in external markets by themselves. A systematic public sector agrifood promotion effort needs to be undertaken. More and more developed and developing countries are investing a larger share of their agriculture budgets in sector promotion. Like Claudio Corallo's agribusiness, there are quite a few others, which are also in the cacao and chocolate business, but also export peppers, coffee, and vanilla. Finally, the financing costs are not negligible in STP. Most credit extended by local banks are difficult to obtain by Agri-SMEs (even less by farmers), especially in favorable terms that are appropriate for long-term permanent crops like cocoa. Interest rates paid by this agribusiness to the local Bank over a period of 10 years represented more than 4 years of what the company made in profits. In other words, almost half of the profits went to pay for interests on loans. Reforming the system of guarantees and risk management (land tenure, insurance, warehouse receipts, credit track record) is key for unlocking agrifinance in STP.

Although this agribusiness, and the sector as a whole, is growing in STP, it is doing so slowly and will face a downturn if the sector's competitiveness trend is not reverted. Allowing for these types of agribusinesses to reinvest more of their profits in their own production and marketing system will go a long way in growing the economy. This can be done by providing basic agriculture public goods and services to lower production risks, costs, and to open new markets. But in the meantime, Claudio Corallo is faced with the decision of where to take the family agribusiness: to more external niche chocolate markets, or back to exporting raw product for processing in Europe?

III.a.2. Non-traditional exports: pepper and spices

33. **Specific buyer commitments to STP's black pepper assure production can expand substantially into the foreseeable future, while the cooperative structure is organized to scale up in response**. Experimentation with export-quality black pepper began with a Spanish bilateral assistance program over fifteen years ago, but the commercial viability became a reality only in the last ten years with the consolidation and expansion of the *Cooperativa de Exportação de Pimenta e Especiarias* (CEPIBA) cooperative[10]. As the data in Table 2 illustrates clearly, the cooperative has shown impressive steady growth. The output achieved in 2017 is nearly five times greater than its modest beginning in 2009, and 2018 is on track to increase another 35 percent to reach 23 tons. Figure 16 shows robust projections for the next five years again nearly tripling the 2017 output by 2023. Producer yield levels also achieved a nearly 500 percent increase over the same period. Cooperative membership has fluctuated but stands at 344 farmer families divided between twenty-two local member associations. While the parcels devoted to pepper are on average smaller than a hectare, a calculation of the gross revenue divided between the members shows an average of US$741 per farmer, a significant contribution compared to the average household income. These positive results positioned CEPIBA favorably to negotiate higher prices with the buyer in 2013 as part of an enhanced joint venture arrangement that has included the purchase and installation of major industrial pepper driers in the plant in rural São Tomé.

34. **European pepper buyers consider that STP has the potential to diversify into other spices they seek to support, notably turmeric, another high-value product**. Given the recent production and sales of spices from STP beyond pepper, there is a clear demand from European buyers who are even exploring

[10] The original name of the cooperative was "Cooperativa de Exportação de Pimenta e Baunilha Biológica," hence the acronym CEPIBA, but the export of organic vanilla has been suspended and the broader term "spices" added. The cooperative currently has 34percent of its members being women and 22percent of it total members are in Principe. From the members in the island of São Tomé, 3 districts concentrate the largest portion of members Mé-Zoxi; Lembá & Cantagalo.

using innovative transport arrangements such as sailing vessels from STP to Europe. Currently, within the "black pepper" (*pimenta do reino*) category, CEPIBA exports black, white, red, and "wild" varieties. The market potential for such other varieties is shown in Table 2, where the "wild" variety fetches prices nearly double and the red variety is triple the price of black or white. CEPIBA also exported small amounts of vanilla for some years but has discontinued because of yield problems associated with disease and ineffective pollination. Therefore, it is clear that with specialized technical assistance and experimentation, investments in production of specialized spices can greatly pay off in meeting the current demand from European buyers.

Table 2 - São Tomé Black Pepper from Start-up to Present

CEPIBA Pepper	2009	2010	2011	2012	2013	2014	2015	2016	2017
Production MT	3.38	4.37	5.81	2.59	2.89	9.67	7.92	13.15	17.0
Ave Yield dry Kg/Ha	53	69	85	37	51	144	107	222	239
Coop Member-Growers	307	272	290	150	245	195	237	284	344
AvePrice/kg Euro	4.0	4.0	4.9	4.9	7.3	9.5	10.5	12.5	12.5
Gross Revenue Euro	13,520	17,220	28,469	12,691	21,097	91,865	83,160	164,375	212,500

III.b. Local Food Markets

35. **The main local agricultural output are non-grain staples**. Plantains and bananas account for nearly three quarters of the volume of starchy staples, recording over 42,000 MT in 2016, followed by taro *("matabala")*, breadfruit, and cassava that collectively registered 15,000 MT. Widespread local production and consumption may imply the official agricultural data underestimates the total production somewhat. Establishing a reference price that reflects a representative value presents significant challenges for attracting private sector investments into this value chain, but to provide a rough comparison, the value of these staples represents what would be a wholesale value of some US$50MM with local vendors earning additional retail margins.

Table 3 - Evolution of national livestock holdings: 2010-2016

Livestock category	2010	2011	2012	2013	2014	2015	2016
Chickens	210,000	210,000	210,000	230,000	290,000	280,000	280,000
Pigs	27,643	27,657	28,210	28,230	29,350	31,105	35,319
Goats	25,750	27,718	27,660	30,668	32,508	30,825	30,643
Sheep	2,521	2,532	2,589	3,002	3,182	3,395	3,404
Cattle	1,000	1,000	1,048	1,158	1,262	1,349	1,362

Source: *Revisão Estratégica 'Fome Zero' – Horizonte 2030*, World Food Program, April 2018

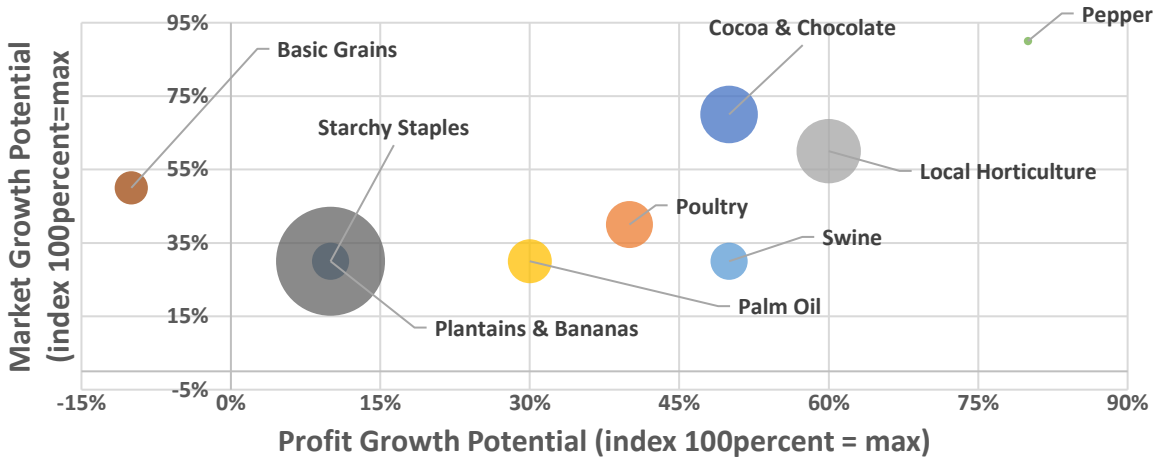
36. **The country is very heavily dependent on imports for grain staples (rice, wheat, maize), which conditions the livestock production in the country**. The production of maize has fallen below 1000 MT, thus the widespread small-scale poultry production business depends entirely on imported grain and oilseed-based rations, as well as on imported chicks. The maize requirement alone for that poultry ration is equivalent to 4500 MT. This, along with other local feedstuffs, supports the current production of 280,000 chickens, for egg and poultry consumption. Other livestock production is also modest as

summarized in the table above. Consumers rely primarily on fish for their dietary protein, with an average national meat consumption of only 10 kg per capita annually. While maize output has contracted, the incentives for private investment in import-substitution of feedstuffs remain robust for any producers who find cost-competitive feed solutions as part of integrated poultry or swine value chains.

37. **Traditional farmers and greenhouse operators supply the majority of domestic consumption of horticulture products.** Horticultural products, such as tomatoes, lettuce, and other garden vegetables, are the most perishable and least stable post-harvest goods, generally rendering imports non-economical. Overall imports only account for 22 percent of the total volume, though in less perishable items such as onions they import half of what they consume. The total volume of all these horticultural products currently reaches nearly 4000 MT annually. While the associated values are not reported, an aggregate estimate conservatively would not surpass a wholesale value of more than US$15 MM (Ministry of Agriculture/INE data). Enhanced efficiency in greenhouse water resource management technologies, such as basic hydroponics, offer opportunities for private sector technology transfer and equipment.

38. **Pepper, cocoa and chocolate, and local horticulture are the agricultural value chains with the highest market and profit growth potential.** Figure 18 provides a visual summary of the profitability and market growth potential of the respective STP agricultural value chains. Based on the available data and the authors' preliminary supply chain analysis, the synthesis offers a comparison of the relative size of the various chains and an estimate of competitiveness. It bears noting that the most promising chain is also the tiniest, its projected growth is to treble in size over the next five years. Similarly, other non-traditional agriculture products currently in an embryonic stage, such as the rainforest cosmetic or essential oil extracts still in R&D, may emerge in relatively short order given the niche market demand, resources applied to their development and the small size of the existing export base as presented in more detail in the following section.

Figure 2 - Value chain competitiveness analysis based on current value of production and 5-year projections



Note: Bubble size represents the GDP of that commodity
Source: Author's estimates based on WDI data.

III.c. Product profiles favoring STP competitiveness

39. **A basic country-level competitiveness exercise reveals that various existing, emergent, or potential rural supply chains possess characteristics that offer viable and sustainable advantages for São Tomé and Principe**. The following list synthesizes some of those characteristics that favor the competitiveness of an agricultural product in the country. As can be seen in Table 5 below,

- **High value-to-weight product ratios offset transportation diseconomies of small-scale production in a remote island**. Products of this profile make it financially feasible to overcome some of the challenges of reaching commercially viable volume thresholds.
- **Agricultural products that can be taken with tourists is a way to sidestep the logistical difficulties to export**. Agricultural and rural-derived products that appeal to tourists and can be consumed directly and feasibly transported by them as luggage or carry-on become "embedded exports" offering direct sales arrangements that make transport logistics, protocols, and expenses moot considerations.
- **Low perishability and products that can be stored are more competitive**. Robust perishability and storage profiles are ideal for accumulation of products after post-harvest stabilization and /or processing or semi-processing. Given the extended period over which product must be accumulated before reaching commercially viable shipment volumes, the stability profile of the product from a food safety perspective takes on critical importance.
- **For food security resilience, the key is compatibility with STP's household realities and tropical farming systems.** STP's high degree of dependency on imports for much of the food supply, and its vulnerability as a small island economy to external shocks in either production or import supply interruptions, elevates consideration of food security resilience amongst other product considerations. Not all products that will prove competitive for export or import-substitution markets need to be foodstuffs to favor household food security. Rather the key is compatibility with São Tomé's household realities and tropical farming systems. Products that allow families the time and space to produce or purchase foodstuffs include those that can be produced as a supplemental side business and those with cash value for small amounts in the local market.
- **Climate change resilience makes products more competitive**. As STP producers report increasing challenges from rainfall variability, drought and flooding, advantageous products offer resilience to climate change. This includes plant or animal production that offers anti-erosive or erosive neutral profiles, those that require reduced water intake or accessible water management strategies and those that exhibit less vulnerability to plant and animal health pests and diseases even in the face of climate change.
- **Characteristics that relate to the country's uniqueness and identity command a premium, turning these products more competitive**. High-value niche markets place a premium on products with appealing characteristics from an unusual or unique origin. Remote provenance can offer price advantages that more than offset the higher costs of procurement. To the extent that São Tomé and Príncipe continues to build a positive and distinct country image, even a mystique, such as epicenter of the historic cacao trade, and the pristine nature of the Príncipe Biosphere Reserve, it can lay claim to a unique identity sought after by various premium supply chains. This is immediately clear

regarding the demand of tourists for unique agricultural or rural products as gifts items and for consumption as part of their experience.

- **Positive social and environmental identity can also command a premium**. In addition to the demand for unique or unusual local identity, products embedded with positive environmental and/or social identity offer producers access to fair trade markets and to the added benefits of certification for any number of sought-after characteristics. The recently approved Biosphere apiculture code exemplifies this by establishing a framework that clearly anticipates harnessing the benefits of a one-of-a-kind (*terroir*) honey or royal jelly.
- **Explore the nostalgia market in Diaspora areas**. While STP has not been characterized by massive sustained out-migration, such as the case of Cabo Verde, a São Tomé diaspora exists particularly in Portugal and elsewhere in Europe accounting for the equivalent of an estimated 10 percent of the population. As such products that appeal to the "nostalgia" market may offer opportunities exclusively linked to local STP production.
- **Upward labor mobility.** Products that entail the adoption of agricultural innovations or ventures with foreign partners offering the transfer of new technologies represent highly attractive options for STP. While true in the case of any economy, the relatively undifferentiated post-colonial rural production base and the relatively high rates of literacy in STP argues for the prioritization of technologies that imply technical training and upward labor mobility.
- **Products that require less space but lots of workers tend to be more competitive**. Ventures that require labor-intensity, producing high output in relatively small rural expanses of land, match the STP factor endowment well, even more so when offering specialization within the supply chain. While the country exports small amounts of ornamental plants, an example of an allied labor-intensive production scheme found in other tropical countries is the production of high-value floral or ornamental certified seeds employing high levels of semi-skilled laborers in limited greenhouse areas.

Table 4 - Key competitiveness characteristics of STP's agriculture value chains

	Value-to-Weight	Portable by tourists	Low Perishability	Food security	CC resilience	STP uniqueness	Upward labor mobility	High Labor requirement
Cacao	X	X	X		X	X	X	X
Cafe	X	X	X		X	X	X	X
Basic Grains			X	X				
Peppers	X	X	X		X	X	X	X
Horticulture				X	X		X	X
Poultry				X				
Swine				X				
Palm Oil			X					X
Banana				X	X			X

III.d. Illustrations of Emerging and Potential Products Featuring Idealized Product Profiles

40. **The emergent non-traditional export, and import-substitution products already discussed above, have some or many of the characteristics that make them more competitive**. These incipient rural supply chains do not yet produce substantial volume, but their growth profile is significant.

- **Black Pepper is a rainforest product with a high value/ weight ratio, a highly stable, and favorable storage**. CEPIBA, the São Tomé black pepper producing cooperative established in 2010, now with over 300 members, has formed a joint venture with French spice importer "Hom&Ter". This has catapulted its production in the space of a few years, with buyers and producers expecting to continue the trend. Pepper has a high value/weight ratio, a highly stable and favorable storage profile after treatment with the already installed local sorting and drying facility. Furthermore, it fits within the Hom&Ter mission statement and philosophy with its strong appeal from an environmental standpoint, as a pesticide-free sustainable rainforest compatible plant, cultivated exclusively by small-holders many of whom are women.

- **Natural cosmetics and essential oils that have unique origin, high-value, readily stabilized with a positive environmental and social profile that appeals to both fair-trade and premium niche markets tend to be competitive**. The HBD Holding Group (HBD) has started to produce cosmetics made sustainably principally from Príncipe rainforest ingredients utilized directly in its hotel operations. This dovetails with prospects to use this approach to ramp up, diversify and export products tied to the unique origin, high-value, readily stabilized with a positive environmental and social profile that appeals to both fair-trade and premium niche markets. HBD operates a small laboratory for experimentation and continues prospecting with local informants for additional inputs, tapping into local and international ethnobotanical knowledge. These efforts are in an early stage, HBD having commenced its three hotel operations only over these past several years, but it is an integral part of their mission as high-end eco-lodges linked to the distinctive history and sustainable resources of the Biosphere Reserve. Forthcoming innovations such as extraction and distillation of fragrances to be incorporated into cosmetics for their customers, also could provide a path for spillover operations in essential oils, whether undertaken by HBD and/or other enterprises.

- **STP's chocolate has the unique identity of its pioneering status can be produced together with other local ingredients and readily becomes embedded exports**. Claudio Corallo (see Box 1), the pioneer and principal chocolate producer in the islands, has already produced a high-value alcoholic spirit distilled from fermented cacao pulp. While this recent innovation is not yet available in commercial volumes, preliminary market soundings all suggest a highly valuable new supply chain for various distilled spirits or liqueurs. Cacao pulp is traditionally a waste by-product without a current market value, offering an almost alchemist proposition to add value where there was none. Another innovation amongst others has been the firm's new lines of chocolate including other products sourced locally, most notably the liberica coffee variety. Although, liberica coffee only accounts for two percent of world coffee production, it is valued by coffee tasters as a distinct and a valued alternative to arabica coffee. Originating in Central Africa, its incorporation into an already distinct high-quality chocolate enhances its claim to unique identity, as well as an all-natural sustainable rainforest product helping small-holders, offering direct links to tourists as well as a traditional export. The enterprise overcomes the diseconomies of a remote small island production, converting these characteristics to virtues in the marketplace.

III.e. Synthesis of Supply Chain Competitiveness

41. **The cocoa value chain, including local high-quality artisanal chocolate manufacturing, continues to form the dominant agricultural chain positioned to expand as other non-traditional value chains begin to emerge**. Linked inextricably to its the unique identity, rainforest sustainability, and pristine pesticide-free growing conditions, this preeminent chain establishes a precedent for other emerging chains, collectively contributing to the image of São Tomé and Príncipe as a superior provenance in the world market place. The successful strategy of utilizing tourism, and particularly high-end ecotourism, as an essential part of the value chain makes eminent sense for the production of a small isolated economy. This strategy offers the additional advantages of overcoming some obstacles to export by utilizing direct sales as a form of embedded export, which in turn advances the perceived value and recognition of STP in the export market.

42. **Promising export value chains are: cacao spirits, cosmetics, and spices.** If cacao pulp spirits (aquavit) or other spirits or liqueurs proceed to the commercial scale, it will become the highest value export product yet and one with no post-harvest or shelf-life issues. Similarly, if the experimental amounts of cosmetics and/or essential oils emerge from the R&D efforts underway in Príncipe, the tourist marketing channels provide a realistic path to expanded production and establishing new markets gradually abroad. Meanwhile black pepper producers are poised to expand from their current small-scale commercial venture to steadily increasing volumes while considering diversification into other spices.

43. **Supply chains for import substitution are already established and expanding for key local food products (palm oil, horticulture, eggs, poultry, and swine)**. While self-sufficiency is not the goal, these chains collectively represent income and employment generation that rival or surpass the export value chains. These products are lower-value but offer large market volume accessible to a broad segment of producers, including those generating supplemental income. They obviate the need for penetrating challenging foreign markets and present fewer hurdles to entry or exit.

III.f. Linkage with tourism

44. **The robust expansion of tourism in STP has stimulated additional demand for agricultural outputs, particularly high-quality products**. Total international tourist visits have reached 29,000 annually, spending $52MM in country. Included in those expenditures are purchases of a full array of foods and beverages as well as some agriculturally-based gift products, most notably chocolate. The total direct purchases of chocolate by tourists in-country account for a significant portion of the total value of current chocolate exports.

45. **The main expected impact of tourism on agriculture production will be from increased exports and premiums paid due to tourists visiting the island and forming an image of high food quality from this origin**. It is not expected that increasing local food purchases by the tourism sector will drastically increase the volume of domestically produced food. Calculating an average tourist stay of four days, the current level of visits is equivalent to a mere 0.2 percent increase in the total (permanent) population of the island, albeit with a higher-income. Therefore, there should not be an expectation that the volume of food sold to tourists visiting STP will be substantially larger than the current food demand. However, given that the typical tourist profile pro-actively seeks to make gift purchases, including unique or characteristic

food items, the opportunity lies in ensuring the best quality of food for consumption by tourists and of gifts (such as chocolate, coffee, spices, etc.) to be purchased by tourists. This linkage is driving and will continue to drive an increased demand for food exports to the countries of origin of these tourists as well as for subsequent increases in tourists coming for STP's gastronomical offering. Therefore, private investment opportunities in linking agriculture to tourism lie in improving the quality of food products to be offered to tourists and eventually exported at premium prices.

46. **Having embraced ecotourism as a central theme of its national tourism strategy, the consumer profile of visitors increasingly leans towards those who value the most local and sustainable food content**. Nowhere is this truer than in Príncipe, which actively sought and received formal recognition as a UNESCO Biosphere Reserve for the island in 2012. This in turn was consonant with the decision in 2013 by the HBD Venture Capital (HBD) group to take on the mission of developing high-end eco-resorts in Príncipe. Highlighting local ingredients in developing a distinct gourmet organic cuisine, these resorts create an immediate direct demand for high quality agricultural products, but they also contribute to raising the prestige of these dishes and ingredients. Although Príncipe only includes 4 percent of the population of STP, its impact is disproportionate both on stimulating the demand for eco-tourists and on the creation of the country's identity as a destination and source of natural products. While still in the early and experimental stage development, some of these natural products hold considerable potential as eventual export items for tourists and overseas niche markets, reinforcing the positive identity of the country in high-end markets for natural products. The HBD-financed R&D allows them to supply their own resorts with small or experimental quantities on a trial basis with the expectation of future sales to a similar clientele abroad, perhaps initially through other high-end hotels.

47. **Manufacturing of new food product lines made from local ingredients, whether sourced or partially sourced in Principe or not, will likely continue to be based in São Tomé**. Even those tourists whose primary destination is Príncipe, begin and end their trips in São Tomé where international flights originate, typically spending a portion of their trips in São Tomé. This has generated one of the first agri-tourism destination in STP, where tourists visit the chocolate factory in São Tomé, participate in tastings and make purchases of a substantial portion of their total output. As other new natural products emerge from the experimentation stage in Príncipe, any manufacturing on a larger scale will likely follow the same pattern, thus reinforcing the symbiotic economic relationship between Príncipe and São Tomé islands. An example underway is the restoration of a colonial plantation (*roça*) by the black pepper consortium that would allow for agritourism related to pepper and other spices.

V. Agriculture Risks and Climate Change

48. **Precipitation and temperature are the two critical weather variables that create risks for private investments in agriculture.** During the period from 1951 to 2010, records show that mean annual precipitation has decreased at a rate of 1.7 mm per year. Similarly, March through May seasonal rainfall has significantly decreased since 1960 at an average rate of 10.5 mm per month per decade, while the extent of the dry season, "Gravana" has lengthened in recent decades. Concerning temperature, São Tomé and Príncipe experienced an increase of 1.5° C in average annual temperature between 1951 and 2010, while the island of Príncipe experienced a faster rate of increase in annual average temperature during the reporting period (World Bank, n.d.).

49. **There is limited information available to assess accurately the frequency and spatial distribution of damages and losses.** The number of disaster entries in the Emergency Events Database (EM-DAT) shows only three major events between 1900 and 2017. Two of them are epidemics (2005 and 1989) and one is a drought (1983). The consequences of 1983 drought proved to be by far the most catastrophic event in human terms. It is estimated that roughly 93,000 people were affected because of the precipitation deficit; this is 38.5 times the total number of people affected by the two major epidemics together. In that event, the central zone in Príncipe and east and northeast zones in São Tomé were the worst affected areas (USAID, 1984, cited by Carrasco, da Costa y Séca, 2017, page 32).

50. **The EM-DAT database may be underreporting other hazards causing significant impacts at both national and farm level**. In this regard, the World Bank Climate Change Knowledge Portal[11] points out that floods frequently affect this island nation and disturb many towns and communities along the coast (Praia Melão, Malaza, Santa Catarina, Ribeira Afonso). Likewise, heavy rainfall events and storms also cause soil erosion, landslides, decrease crop production and increase the risk of waterborne diseases. STP's farmers rated events such as animal diseases, price variability, and droughts with medium probability of occurrence and moderate impact when materialized. Excess rainfall is rated a low-frequency low-impact event.

51. **Risks arising from uncertainties and expected losses in the agrologistics system have been identified as the most important ones for the development of value chains and for the promotion of private sector investments**. Concerning underlying causes of risks, farmers and agribusinesses stated that logistics challenges are one of the key triggers of sectorial losses since they give rise to new risks, including farmers' exposure and vulnerability. In terms of frequency of occurrence and impact, farmers classified the agrologistical risks (see Table 6) as the most recurrent issues leading to the largest losses.

Table 5 - Underlying causes of risks and agriculture risks considered as the most important by farmers

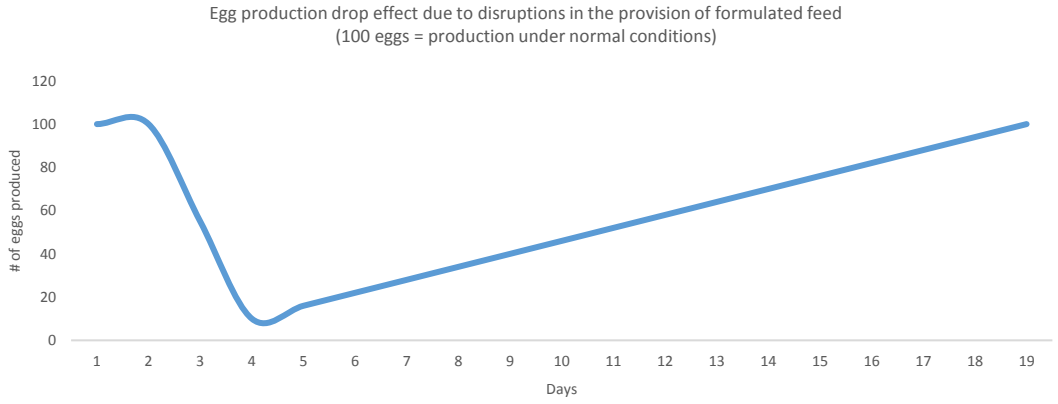
Frequency / Impact	Low Impact	Medium Impact	High Impact
High frequency			.- Agrologistics
Medium frequency		.- Animal diseases .- Price volatility .- Drought	
Low frequency	Excess of rain		

Box 2 - The case of Principe's eggs

Animal production, in particular poultry, has increased significantly in Príncipe, with growth rates of over 40 percent per year in the last few years. Despite this growth, agrologistics is identified by producers as the main driver of severe economic losses, in particular poultry producers. Given that chickens (and other animals) are fed through imported formulated feed, the reliability of the arrival of such productive input is critical. Logistics costs are not necessarily an issue, but producers mention that not knowing when their imported feed will arrive makes it very difficult to plan, and so at times (at least in a couple of occasions per year), formulated feed stocks are depleted in the island without being replenished due to long unexpected lags in cargo ships coming to the island from São Tomé. The graph below shows how egg production from a cooperative in Principle composed of 15

[11] Climate Change Knowledge Portal (http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=STP&ThisTab=NaturalHazards)

women who sell in local markets and hotels in the island, drops by 90 percent in just two days without formulated feed. After those initial 2 days, once chickens started to get fed again regular amounts in day 3, it takes more than two weeks for egg production to return to normal levels. This is equal to a revenue loss of more than 40 percent over the 20-day period. If this event happens two or three times a year, production losses associated with inefficiencies in agrologistics processes represents over 6 percent of value added by these cooperative and can put a strain on those smallholder farmers that do not have the financial resources to absorb such a shock.



Source: Interview with Principe's Farmer Cooperative (2018)

52. **The absence of in-country statistical disaggregated agriculture sector information creates large uncertainty and ambiguity in the level and types of risks (e.g. market risks, production risks and contextual risks) faced by private sector investors**. As a result of poor information on sectorial losses, for the purpose of this report, the FAO Cultivars Performance Database (1984-2016) on country's key crops was used to quantify agricultural losses and the most severe years. However, it is not possible either to identify investments (public or private) to manage risks in agriculture or to differentiate historical variations according to each management process. The analysis of the FAO data shows that the 2000s decade was a particularly severe period for the agricultural sector in STP, since it concentrates six out of the ten most severe years in terms of crop yields decline. In descending order, the top-five years with the greatest yield losses were: 2011, 2009, 2008, 2010 and 1991 (see Annex 3 for further details). Although it was not possible to trace back the root causes of production losses in these years, note that the country had a malaria resurgence in 2009 (Fiondella, 2010).

53. **Cassava production is risky compared with the rest of crops studied (see Table 6).** For the period 1986-2016, cassava's yield losses were registered in 9 out of 10 years with an average annual loss above 13 percent, and -47 percent of yield decline recorded as the worst crop season in 2008. Similarly, coffee production annual losses were above 5 percent. Although the loss frequency on coffee is around one third of cassava, the yield loss severity is 10 percentage points higher. This situation forces coffee producers to adopt risk management strategies in years with normal production conditions in order to cope with extreme crop yield declines in bad years.

Table 6 - Crop yield losses: 1986 and 2016

Description	Avg annual loss	Loss Frequency	Loss Severity	Worst Annual Loss
Cassava	13.5%	93.8%	17.8%	47.9%
Cinnamon (canella)	1.2%	81.3%	2.1%	6.8%
Cocoa, beans	5.3%	50.0%	9.6%	28.9%
Coconuts	2.6%	12.5%	10.0%	25.3%
Coffee, green	5.7%	31.3%	27.3%	92.0%
Maize	2.9%	50.0%	9.3%	33.3%
Oil palm fruit	1.2%	68.8%	1.6%	6.6%
Taro (cocoyam)	6.3%	81.3%	13.3%	28.9%
Vegetables, fresh	0.4%	12.5%	1.8%	4.4%
Yams	3.3%	81.3%	4.3%	21.7%

Source: Author's estimates based on FAOSTAT.

54. **Private investments in the cocoa supply chain must look carefully at the management of farmer-level price risks.** Cacao farmers identified price variations as an important source of uncertainties and losses. Currently, farmers grouped in cooperatives deliver their cacao to their cooperative's warehouse to be transported to Europe or the final destination market. However, the farmer is paid only once the product arrives at destination. Given the lack of warehouse receipts to be able to advance the payment of the delivered good, farmers are left to wait for two to three months between the moment the product is delivered until it arrives at destination. Meanwhile, prices vary, and farmers are left without certainty on their margins, disincentivizing investments in the sector. Although some buyers of cocoa beans offer fixed prices, others adjust their prices paid to farmers according to current market prices. This situation presents an opportunity for private sector investors to introduce more sourcing reliability by providing income stability in the supply chain through price hedging and trade financing (using warehouse receipts).

IV.a. Climate Change Projections and Climate-Smart Agriculture Technologies.

55. **Climate change is a risk to agricultural production in STP.** In a future under business as usual, climate change projections reveal unfavorable conditions for the long-term returns to agricultural sector investments given the emergence of plant pest and disease outbreaks, and the increased frequency of disasters. This situation embodies a serious threat against future sector growth and private sector participation in STP,[12] as well as other Small Island Developing States (SIDS), due to, *inter alia*, their limited agricultural land, their geographic isolation and the pressure on their limited resources (Mercer, et al., 2014).

56. **A recent study that analyzed the impacts that different climate scenarios would have on the production potential of maize, matabala (taro), cocoa, and pepper found crop decreases of more than**

[12] According to United Nations (2016, cited by Robinson, 2018, page 172), climate change may give rise to significant impacts, either individually or groups, communities, sectors, countries and regions.

30 percent in the most extreme scenarios. This analysis, which considers water deficit as the only variable with significant incidence on production potential, concludes that the corn production potential may shrink up to 30 percent in the northern regions of Caué and southern Lembá under a RCP4.5[13] scenario. Under a RCP8.5 scenario, a more dramatic crop yield reduction was found across all crops analyzed due to the occurrence of plant pests and diseases (Sin et al., 2017).

57. **Some agriculture practices and climate change projections could have a negative impact on current yields and may become risk factors for private sector investments in agribusinesses in STP in the future.** Although experts agree that STP's agriculture sector, especially its agroforestry, is largely organic and climate friendly, some recent studies[14] show that some oil palm and cacao plantations are exerting sizable pressure on forests, expanding the agricultural frontier and encroaching natural reserves. This situation could exacerbate the number of disasters hitting coastal areas with infrastructure and agricultural and fishery units highly exposed. In particular, for palm oil plantations, soil fertility and their organic matter content may be considerably reduced[15], which would lead to increased runoff due to the reduction of water infiltration rate.

58. **Given the vulnerability of STP agricultural sector to climate variability and climate change, it calls for private sector investments that increase resilience and reduce risks**. In this regard, climate-smart agricultural practices and technologies (CSA) may help achieve one or more of the following objectives: (i) increase returns on investments from private sector; (ii) improve adaptation and resilience to climate variability and climate change; and (iii) reduce Greenhouse Gas (GHG) emissions.

59. **Currently, there are several practices, technologies, and services that may help achieve at least one of the CSA framework pillars of agriculture in STP (Annex 4 provides a list of climate smart options)**. However, each option must be assessed in consistency with characteristics prevailing in each production area and with farmers' priorities.[16] Also, trade-offs must be balanced between benefits rendered by each option, their investment costs and the feasibility of implementation. Once this type of analysis is completed, an implementation plan that ensures a high percentage of CSA adoption could then be

[13] Climate change projections are generated using different climate models that simulate changes based on a set of anthropogenic forcing scenarios, referred as the representative concentration pathways (RCP). Four RCPs are used in the Fifth IPCC Assessment as a basis for the climate predictions and projections, including: RCP2.6 which indicates one pathway where radiative forcing peaks at approximately 2.6 W m^{-2} before 2100 and then declines; RCP4.5 and RCP6.0 are two intermediate stabilization pathways in which radiative forcing is stabilized at approximately 4.5 W m^{-2} and 6.0 W m^{-2} after 2100 and then increase; and RCP8.5 is a high pathway for which radiative forcing reaches greater than 8.5 W m^{-2} by 2100 and continues to rise for some amount of time (http://www.ipcc-data.org/guidelines/pages/glossary/glossary_r.html).

[14] Lima and Dallimer, 2016

[15] A research carried out by the Institute of Environmental Science and Technology of the Universitat Autónoma de Barcelona (ICTA-UAB) found that the expansion of oil palm plantations is generating negative consequences on the environment of several countries. One of the major issues are reported on soil fertility because nutrient demand exceeds the supply and the loss of fertile top soil given that the amount of shadows cast by oil palm trees restricts the growth of other vegetation (n.a., 2017).

[16] For guiding the selection of climate-smart agriculture (CSA) practices, technologies and services, the International Center for Tropical Agriculture (CIAT) has developed the CSA Prioritization Framework, which captures experiences/expertise from different stakeholders through a participatory approach.

developed, together with an M&E system to monitor achievements. Taking into consideration the hazards to which STP agricultural sector is exposed, some CSA practices, technologies, and services are proposed here for the validation and consideration for adoption by national authorities:

(a) **Develop water harvesting structures to collect runoff for irrigation purposes:** These types of structures help reduce runoff velocity, which in turn decrease the loss of fertile soils and mitigate the risk of floods downhill during the occurrence of torrential storms. Depending on their design, they could also be used to harvest rainwater for irrigation purposes during the dry season, or supplementary irrigation during the rainy season. This type of investments would help lower the variability of crop yields by ensuring the water supply required in all phenological stages of crops. This also would enable intensification of production, creation of jobs, and alternative protein sources (fish farming).

(b) **Adopt conservation agriculture consisting of practices aimed at preserving water and soil resources.** According to Partey et al (2018), conservation agriculture involves minimum tillage, permanent soil cover with crop residues and live mulches and crop rotation and intercropping. This type of intervention helps increase crop productivity because it reduces erosion rates, improves moisture retention and increases organic matter content in soils.17 In terms of risk reduction, the promotion of minimum tillage and no-till farming expedites the soil preparation process and sowing at the beginning of the rainy season.

(c) Combine agriculture and forestry in an Agrosylvopastoral system. This refers to the combination of trees or shrubs grown around or among crops or pastureland. This intentional combination of agriculture and forestry has varied benefits, including increased food security, climate change mitigation and adaptation. Furthermore, the management of tree density would provide additional income (firewood and charcoal production, water filtration, carbon sequestration and biodiversity). Depending on the agroforestry tree species used, they can provide important feed sources for livestock during droughts, generate food, improve soil productivity and provide crop protection from, inter alia, very strong winds.

(d) **Roll-out Climate Information and technical assistance services.** Complementing other technical assistance services, providing timely climate information and guidance can reduce the impacts of climate variability on agriculture. The generation of climate monitoring information and weather forecasts may inform decision-making relating to agricultural activities as planned and use resources more efficiently (e.g. reduce fertilizer usage, regulate water for irrigation purposes).

VI. Agriculture Public Policies and Programs

60. **STP has several public policy instruments that frames the incentive framework for private sector participation in agriculture.** Overall, agriculture in STP is developed by private sector actors (farmers, cooperatives, and firms), however the public sector (including development partners) plays an important role in providing public goods and services, as well as direct support to farmers and cooperatives with the overall goal of reducing rural poverty, improving food security, and the management of natural resources. There are key policy documents that guide sector interventions and investments by government and

[17] Obalum et al. 2012, cited by Partey et al., 2018, page 289

development partners, summarized in Table 7 below. The overall development policy document is the National Development Plan, while at the agriculture sector level, the Agriculture, Rural Development, and Fisheries Development Letter (CAPADRP), the National Food Security and Nutrition Program (PNSAN), the Sector Development Action Plan (PADES), and the Agriculture and Food and Nutrition Security Investment Plan (PNIASAN), provide the policy framework to guide interventions and investments.

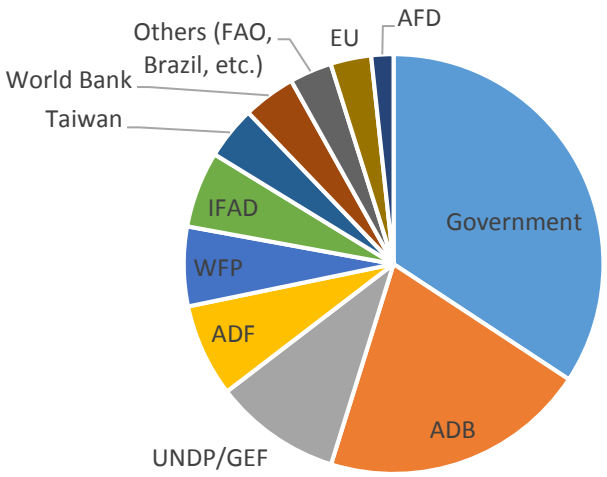
Table 7 - Main agriculture public policy documents for STP

Document	Objectives	Relevant policies for agriculture
1. **National Development Plan – 2017-2021**	Seeks to achieve sustainable economic growth, human capital and basic services, social protection and cohesion, and reforming public-sector institutions.	Supports transport and productive infrastructure development and climate change national policies.
2. **Agriculture, Rural Development and Fisheries Development Letter (CAPADRP) – until 2025**	To develop three programs in area agriculture, livestock/fisheries, and forests)	Supports the development of the sector through agriculture transformation, commercialization, infrastructure, land tenure, technical assistance and a special program for RAP.
3. **National Food Security and Nutrition Program (PNSAN) – 2013-2023**	Multisectoral approach to food security at the individual and community level.	A series of proposed interventions in agriculture intensification and diversification, value added and market access, school feeding, food security vulnerability and strengthening of institutions.
4. **Agriculture and Food and Nutrition Security Investment Plan (PNIASAN) – Approved in 2013**	Propose a series of investments (and identify the financial gap) to reduce food insecurity and increase agriculture growth.	
5. **Sector Development Action Plan (PADES) – 2007-2025**	Consolidate the programs, subprograms and projects proposed by the 17 different agricultural sector working groups.	Support the increase and diversification of agriculture and livestock production, use of forest and environmental resources, and support to rural institutions and fisheries.

61. **The lack of a unified agriculture public sector policy and strategy is problematic at the moment of defining the role of public and private sector in agriculture investments in STP.** While the series of documents (poverty strategy, development letter, food security and agriculture programs and plans) provide an idea of the type of interventions the government and development partners are willing to support in STP, they do not amount to an explicit policy position nor strategy on the role of the public sector. These documents in Table 7 above are useful when agreeing on interventions and funding, but they are a list of programs and projects often driven by development partners willing to fund them. In order to systematically work with private sector to promote agribusiness development and agriculture growth, there is an opportunity for the public sector to spell out its policy and strategy for the coming years in order to clarify expectations on their role and participation in the agriculture development agenda. Without such clarity, private investments in the sector will be suboptimal as investors will factor-in the risk of ad-hoc policies changing the returns to investment.

62. **Official development assistance grants to the government budget represented 8.7 percent of GDP in 2017, and donor support to the rural sector is 2/3 of total public expenditures allocated to the sector (ADB, 2015)**. The partners present in Sao Tomé (UNDP, IFAD, ADB, World Bank, and the UN System, some bilateral partners like Portugal, Brazil, France, China, etc.) play a key role in terms of agriculture development policies and investments and they meet periodically to facilitate information-sharing and synergy of development actions. Figure 19 shows the distribution of public expenditures in the rural sector during one calendar year (2015) between the government and the development partners with rural sector operations (agriculture, livestock, fisheries, environment).

Figure 3 - Public Expenditure in the rural sector of STP: 2015



Source: ADB, 2015

63. **The level of agriculture public expenditures seems to be below its appropriate level, and its effectiveness and efficiency need to be assessed for improvements.** Total public expenditures (current and capital) were approximately US$100 million (2017). The government spent US$1.2 million on agriculture in 2017. Although the actual number might be a bit higher due to budget classification and since some external aid is given in kind and spent directly by the donor, the current figure is well below the 10 percent goal of African countries in terms of the portion of agriculture expenditures over total government expenditures. In addition, the quality of such expenditures needs to be assessed given limitations observed in the availability of agriculture public goods and services. Specifically, it would be important to review agriculture public supports and expenditures such as: (i) the role and staffing of agriculture public institutions (quantity and job profiles of public sector employees); (ii) the budget allocation for delivery of key agriculture public goods and services; and (iii) the alignment of public expenditures and price support measures with sectoral policy and priorities.

64. **The Ministry of Agriculture and Rural Development (MADR) is a relatively new institution, well-staffed, and with a decentralized presence in each District and RAP**. The MADR was founded in 2014 and hosts some autonomous institutions that are also involved in agriculture development: (i) the Agriculture Research and Technology Center (CIAT); (ii) the Agro-Pastoral Development Center (CATAP); (iii) the Community Infrastructure Fund (FIC); (iv) the National Park Obo; and (v) the Sustainable

Agriculture Development Center (CADR). Although no official numbers were obtained, documents show that there are between 150 to 200 agriculture extension agents linked to CIAT and CATAP. Given an estimate of between 8,000 to 12,000 farmers, this gives a ratio of between 40 to 60 farmers per extension worker. This is quite a good ratio, particularly considering the short distances within the island. In RAP, the ratio is even better given that there are between 450 to 800 farmers in the island with 10 extension workers (5 for agriculture and 5 for livestock). However, even if the coverage ratios are impressive, the extension workers are paid very low salaries (100 percent financed by the government) and have no budget to move from the office in the city/village to the farm. This has forced a natural PPP arrangement, in which a farmer who wants to receive the visit of an extension worker needs to pay for his/her transport to and from the farm.

65. **Agriculture R&D and education priorities by the government focus on specific value chains and selected regions.** CIAT, which is responsible for public support to farmers for agricultural technology and plant and animal health, has limited budgetary and human resources, yet is well organized and demonstrates a high degree of professional commitment. Currently CIAT's capacities are restricted primarily to agronomic expertise and investments in institutional strengthening and agriculture research and extension are mostly dependent on donor funded projects, with a focus on family farming. No private sector input is involved in setting priorities for agriculture innovation investments and capacity building.

66. **Animal and plant health programs are funded based on specific threats and not on an overall system strengthening approach.** Funding for animal and plant health is allocated based on specific programs (avian flu, foot and mouth disease, rabies, Tse Tse fly, etc.). The allocation of such funding is not based on probabilistic analysis nor based on the participation of private sector participants in determining priorities and leveraging co-financing.

67. **Land policies in STP have created uncertainty for private sector investments in agriculture.** After the 1991 land redistribution, there have been a series of actions to undo some decisions and land rights, which have created uncertainty on land tenure. Although privatization of land is politically sensitive, options exist regarding long-term land concessions, as well as allowing for a market to trade such land use rights, creating a land market, even when land is not fully private. Today, land is not being used as collateral for financing, which handicaps the sector in terms of accessing funding for investments.

68. **Agriculture public information and statistics is a key public-sector deficiency in STP and an important drawback for assessing future private investments in the sector**. The lack of agriculture statistics on production, productivity, land use, input, and product prices have a direct impact on investors decisions, as they are made under uncertainty. Furthermore, public policies cannot be improved or evaluated since there is little data to assess progress, especially spatially disaggregated data at district and community level. STP has not had an agriculture census in more than 25 years (last one was in 1990), but a recent household survey included agriculture production information and will provide useful insights on the current state of the sector.

69. **Public policies towards rural infrastructure have focused on hard investments, but not on agrologistics.** Government and development partners have been investing in improving the rural road network of STP and ongoing investments have clear targets in terms of extension of rehabilitated roads. There are also important plans and targets to expand irrigation systems. However, there is no clear public

policy towards improving the agrologistic network beyond the hard infrastructure, such as port and airport services, warehousing, cold storage, safety standards for transport and storage, etc. Some of these limitations are inherent in being a small island economy that cannot achieve the scale required for most maritime shipping. This is even more true for Príncipe, which suffers from basic hurdles to on-load and off-load cargo. Trying to overcome these constraints, some exporters are exploring non-traditional shipping techniques such as contracting sailing vessels. The largest chocolate exporter uses the tourist direct-purchase mode to "ship" as much product as possible to sidestep export logistical bottlenecks.

70. **The current agriculture trade policy in STP does not produce significant distortions to domestic and export market potential but could be improved.** The tariff structure of STP is quite simple, and although accession to the WTO is not yet in the horizon, a reduction in tariffs on capital goods could promote further investments in agroindustrial activities. Furthermore, non-tariff barriers on sanitary and phytosanitary (SPS) issues are not systematically regulated or applied, introducing significant food safety risks for the local population and tourists, but also for local agriculture and livestock production, as the introduction of some pests or diseases could be devastating for the island as history shows. Finally, there are missed opportunities for STP in terms of exploring membership in the Central African Economic and Monetary Community (CEMAC) and the Economic Partnership Agreement (EPA) with the EU.

71. **Promotion of the agriculture sector in international markets is lacking.** Countries with an export-oriented agriculture sector oftentimes spend a significant portion of their budget on promoting its food and agriculture products abroad (the OECD average for public spending on agriculture promotion is 15 percent of total public expenditures in agriculture public goods and services[18]), opening new markets and helping the sector to manage the risk of changes in tariff and non-tariff barriers in current export markets. STP has an Export and Trade Promotion Agency (APCI) which has initiatives related to facilitate trade processes (single window) and export guides but does not actively seek to provide support in promoting the STP brand for food products in export markets, nor gets involved in supporting agribusiness with export challenges / opportunities.

VII. Conclusions and Recommendations

72. **STP is likely to remain a net importer of food and agricultural products, but there are several opportunities for increased private sector-led growth both on import-substitution and exports.** The chapter on agriculture supply chains revealed opportunities in import substitution in the feedstuff-livestock chain and the horticulture chain, while the expansion of exports is expected in the cocoa chain, and potentially also in the palm oil industry and in a series of non-traditional agricultural exports (NTAE). The NTAE prospects include the emergent pepper and spice value chain, promising products currently in development such as natural cosmetics, essential oils, and distilled spirits and liqueurs. The link between these products and tourism, especially eco-tourism, is vital and already embraced both by the government and by high-end tourist developments established in the past few years. Environmentally friendly

[18] Agriculture Public Goods and Services (as measured by the OECD' agriculture support estimates) include public expenditures made in rural infrastructure, animal and plant health systems, agriculture innovation (research, extension and education) and promotion of agriculture products.

produced food (be it smart food, organic, nutrition smart, slow food, etc.) is, and can increasingly be, a source of value added and differentiation for STP's agriculture products.

73. **Agriculture intensification in STP can have a significant positive impact on GDP, and ultimately on poverty, food and nutrition security**[19]. STP's agriculture land is limited and given the large yield gaps observed in agriculture products such as cacao and bananas, there is ample potential for agriculture intensification[20] as a way for sector growth. This paper estimates that if STP's agriculture yields reach the average yields of small island countries and/or West Africa, agriculture GDP growth could increase by more than 10 percentage points per year, and total GDP growth by about 2/3 percentage points.

74. **Based on the analysis of opportunities and constraints for private sector participation in the agriculture sector, a series of public policy actions and public investments emerge as priorities**. The main challenges are summarized below, and the subsequent tables provide recommendations on public policy actions and public investment opportunities.

75. **There are important risks and uncertainties arising from the agrologistics system and climate change for farmers and agro-exporters, which need to be addressed.** Risks arising from uncertainties and expected losses in the agrologistics system have been identified as the most important ones for the development of value chains and for the promotion of private sector investments. In the past, the GoSTP has focused on improving hard investments such as roads and energy infrastructure, yet there is no clear public policy towards improving the agrologistic network, including port and airport services, warehousing, cold storage, safety standards for transport and storage, etc. Soft investments, including post-harvesting handling and improved security and safety standards at port and airport facilities, are cost-effective measures that could support agricultural supply chains. Another risk to agricultural production is climate change, which could be mitigated through climate-smart agricultural practices and technologies (CSA) that can increase climate change resilience (including water-harvesting and runoff capture, expand agroforestry, soil and water conservation techniques, improved collection and dissemination of local climate data).

76. **Currently, there is a lack of explicit agriculture public policies on sector development.** A unified national agriculture public sector policy strategy could improve policy and program design and attract private sector investment. STP's agriculture sector development is and will increasingly be intrinsically linked to environmental services and tourism, including through (i) a close link between products and tourism, especially eco-tourism, and (ii) physically close relationship between agriculture and protected areas in STP. The agriculture development policy and strategy for STP should therefore ensure that environmental considerations are included in agriculture production and investment decisions. Furthermore, a policy and strategy to increasingly link local food production with tourist destinations (hotels, resorts, restaurants) will be an important sector promotion approach to product differentiation

[19] For instance, for a family of 6 people that is producing cacao in 3 has (average landholding), the agriculture income from such production at current smallholder yields is not enough to put the family above the poverty line. By increasing cacao yields threefold (which would still be lower than the average of STP's benchmark countries), this would put the family above the poverty line.

[20] Agriculture intensification means an increase in agricultural production per unit of inputs (which may be labor, land, time, fertilizer, seed, feed or cash).

and increase demand from export markets. The agriculture public sector strategy should ideally be supported by a public expenditure review of the agriculture sector, including expenditure effectiveness and efficiency. STP allocates 1.2 percent (2017) of its public budget towards agriculture, which is well below the SSA target (10 percent).

77. **There is a clear knowledge gap in the agriculture sector of STP, founded on the lack of up to date sector information and statistics.** STP's last agriculture census was almost 30 years ago (1990). Some household surveys have been conducted, however they have not provided a clear understanding of the farming community. The lack of agriculture statistics complicate policy and program design, and have a direct impact on investors decisions, as they are made under uncertainty. A series of analysis and assessments would be needed to better advise policy makers on the appropriate sector reforms that can unlock the private investments in agriculture. The recent household survey includes agriculture production information, which will provide an overview of the current state of the sector. A series of analysis and assessments would be needed to better advise policy makers on the appropriate sector reforms that can unlock the private investments in agriculture. Some of these studies include:

- **Agriculture Support Analysis (Agriculture PER, farmer and commodity support, etc.):** This analysis intends to evaluate the fiscal and price supports that arise from public policies and programs, in order to benchmark them with relevant countries, and assess their effectiveness and efficiency to provide policy recommendations to government.
- **Analysis of agriculture productivity, income and farmer decisions (using HH surveys and promoting Ag census):** Given the low levels of productivity and the large number of farming households estimated to be under the poverty line, an in-depth analysis of the sources of such low productivity and low income is required to tailor policy and program interventions to the characteristics and entry points at the household level.
- **Agrologistic analysis to identify bottlenecks and opportunities to reduce transport/storage costs and reduce losses:** Some of the value chains analyzed as part of this report point to the large amount of the overall production and marketing cost represented by agrologistics, but also the large amounts of uncertainty within the agrologistics systems produce sizable losses to private sector. An in-depth analysis of the agrologistics of STP would be necessary to identify and prioritize improvements.

Table 8 - Public Policy Recommendations

Policy Objective	Policy Action	Next steps
Increase the amount of public expenditures going to the agriculture sector to levels closer to regional benchmarks	▪ Increase the budget for agriculture development from the current 1.2% towards the 10% SSA benchmark.	▪ Undertake an agriculture public expenditure review to assess the areas for increase in expenditures and improvement in effectiveness/efficiency of spending
Establish a clear medium-term agriculture policy and strategy, in particular**, outlining the approach towards private agribusiness development**	▪ Approve an adopt a national agriculture policy and strategy (2019-2025)	▪ Technical assistance support to MADR to undertake stakeholder consultations and align public and private sector views into a policy document.

Provide clear land tenure security for promoting investments and land market	▪ Introduce legal/regulatory reforms to allow for medium term land concessions ▪ Improve the land cadaster to allow for a land market to function	▪ Support to the development of a land cadaster ▪ Undertake an agriculture census
Support the promotion of agriculture products in external markets	▪ Direct APCI towards promotion of agriculture products and increase market access	▪ Technical assistance support to APCI to develop its capacity to support sector promotion efforts
Introduce private sector participation in decision making on agriculture innovation and SPS priorities	▪ Introduce policies for CIAT and CATAP to make R&D decisions and prioritize SPS issues jointly with private sector	▪ Advisory services on agriculture innovation systems, disruptive technologies and animal and plant health priority setting

Table 9 - Public Investment Recommendations

Areas of Public Support	Description of Public Sector Investment
Management of agriculture climate risks	CSA: Public investment in research and adoption of climate smart agriculture technologies for farmers and agribusiness to increase resilience.
	Irrigation: A thorough-going analysis of irrigation needs was completed in 2018 financed by the African Development Bank. A major lesson of irrigation schemes worldwide shows the importance of organizing irrigation districts and systems to collect private user commitments and fees to maintain works. Technologies deployed to optimize utilization of water, such as drip irrigation, can lower costs and increase on-farm yields even in areas without irrigation, thus the dissemination of water management know-how and training to farmers more broadly would enhance competitiveness, independent of whether specific areas will implement irrigation infrastructure.
Agriculture Information Systems	AIS: Investing in agriculture statistics in STP will be crucial for leveraging private sector investments. Information on prices, yields, land use, agrometeorology, farmer typology, etc. will drastically improve sector knowledge for investment decisions.
Agriculture R&D	Public-Public and Public-Private: Experience from agricultural research programs around the globe, including those in both developing and industrialized countries, shows that public-public and public-private partnerships offers a cost-effective way to raise the level of generation and transfer of agricultural technology to producers. This includes public-public partnerships with research institutes around the world, notably those that are part of the top research centers forming the Consultative Group on International Agricultural Technology (CGIAR), including the International Institute for Tropical Agricultural (IITA) in Ibadan, Nigeria or the Brazilian national research giant Embrapa. Public-private partnerships within country and outside, such as with WCF for cacao, leverage resources and know-how within supply chains, bringing public resources to play for maximum impact of scarce public budgetary and human resources. CIAT, along with representatives of the respective chains, should take the lead to prioritize areas for promising public-public and public-private collaborations, including attention to value-added processing technologies. A crucial area where CIAT needs external assistance to reinforce its own capacity to prioritize and to evaluate its work lies in the field of agricultural economics
Agrologistics	Soft investments: While economically unwarranted to contemplate significant investments in transport infrastructure beyond those currently contemplated in roads, a relative void exists in the identification of improvements in agrologistics that could prove cost-effective. Filling this void includes identifying measures to enhance public management of existing export transportation networks, both maritime and air freight, taking into account post-harvest handling considerations particular to various agricultural supply chains (i.e. obtaining certification of airline cargo safety screening at STP airport)

Agrifinance	Agrifinance innovations: Address the market failure in current financing to farmer cooperatives and AgriSMEs by introducing financial risk management instruments that can help overcome the lack of collateral (land title) and the understanding of financial institutions of agribusiness plans. Such instruments can include agriculture insurance, PCGs, price hedging (for cacao), and matching grants.
	Warehouse receipts: Currently producers seasonally hold valuable product inventory, yet they have no means to use those assets as collateral to access to credit. The introduction of a system of warehouse receipts or proof of product ownership (known in Portuguese as "*cedula do produtor rural*") would enable producers to manage their product inventory as collateral, greatly enhancing access to liquid resources.
	Trade finance: Exporting firms, foreign buyers as well as input suppliers, regularly extend 90-day or 120-day credit to agricultural producers in countries around the world. This assists producers to manage the typically long periods without revenue in their production cycle yet exposes the firms to limited risk and contributes to producer loyalty. The limited practice of trade finance in STP could expand through greater education and promotion of financial innovation
	Equity investment: In the absence of access to credit, various VCF options exist for producers and processors to utilize equity as a means to finance increasingly integrated value chain. Innovative "new generation" cooperative structures, joint ventures, and other investor participation arrangements offer alternatives to be explored. The public authorities in collaboration with existing cooperatives and innovators in this area of VCF have a common interest in becoming familiar with institutional alternatives for equity finance.

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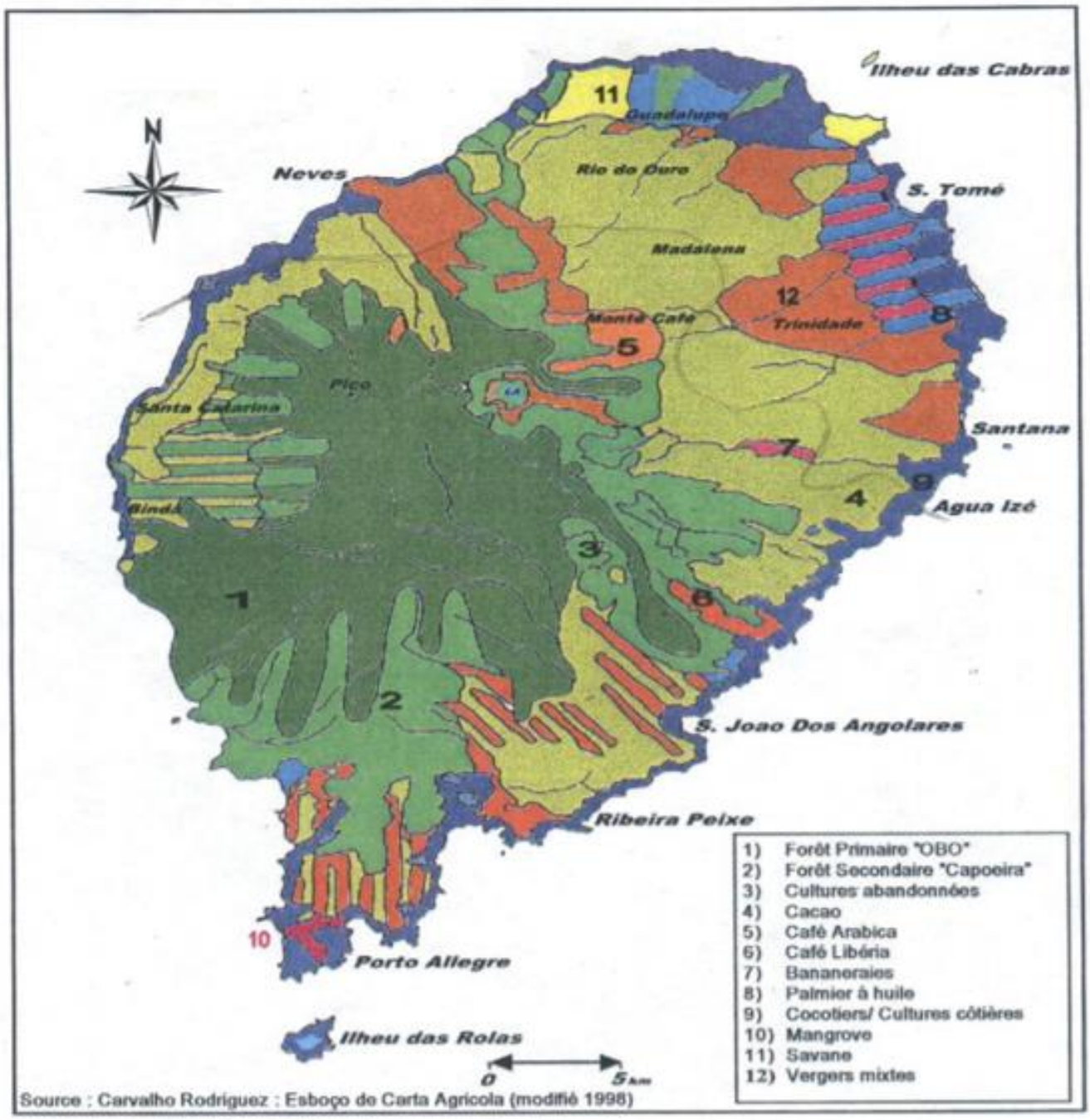
Annex 1. Map of the Forestry and Agrarian Ecosystems



Annex 2. Main food movements from production areas to consumption markets.

Source: Espirito Santo and Pacheco de Carvalho, 2012

Annex 3. Crop yield losses, 1986 and 2016.

Year / Crops	Cassava	Cinnamon (canella)	Cocoa, beans	Coconuts	Coffee, green	Maize	Oil palm fruit	Taro (cocoyam)	Veg., fresh	Yams
1986	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1987	11.63%	0.06%	0.00%	7.98%	11.18%	0.00%	0.00%	2.99%	0.00%	10.88%
1988	2.05%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	4.68%	0.00%	6.32%
1989	19.17%	0.06%	12.43%	0.00%	9.75%	0.00%	0.00%	0.00%	0.00%	0.88%
1990	16.46%	0.00%	28.85%	7.36%	0.00%	0.00%	0.00%	0.00%	0.03%	10.01%
1991	13.56%	0.67%	20.42%	25.31%	0.00%	0.00%	0.00%	10.44%	3.09%	0.00%
1992	7.80%	1.04%	0.00%	15.55%	0.00%	0.00%	0.00%	0.10%	4.45%	0.00%
1993	7.80%	1.23%	0.00%	5.04%	0.00%	0.00%	3.54%	1.72%	0.00%	0.00%
1994	7.80%	1.17%	0.00%	0.00%	0.00%	0.00%	6.56%	0.00%	0.00%	3.27%
1995	8.34%	1.16%	0.00%	0.00%	7.14%	0.25%	5.43%	0.00%	0.00%	4.39%
1996	7.62%	1.16%	0.00%	0.00%	0.00%	0.00%	0.79%	0.00%	0.00%	8.98%
1997	8.53%	1.15%	0.00%	0.00%	0.00%	1.13%	0.00%	0.00%	0.00%	1.77%
1998	18.43%	1.16%	0.00%	0.00%	0.00%	13.54%	3.25%	0.00%	0.00%	0.00%
1999	11.99%	1.17%	0.81%	0.00%	0.00%	1.67%	0.12%	1.77%	0.00%	0.00%
2000	10.32%	1.17%	25.12%	0.00%	11.20%	0.00%	0.00%	0.00%	0.00%	0.00%
2001	0.70%	1.18%	11.85%	0.00%	0.00%	0.00%	0.00%	0.69%	0.00%	3.36%
2002	4.42%	1.18%	5.60%	0.00%	0.00%	2.92%	0.00%	0.00%	0.00%	2.58%
2003	3.87%	1.19%	5.77%	0.00%	0.00%	1.92%	1.34%	4.33%	0.00%	3.19%
2004	9.10%	1.37%	16.67%	0.00%	0.00%	0.00%	0.88%	6.44%	0.00%	3.07%
2005	6.22%	1.50%	0.29%	0.00%	0.00%	0.00%	0.97%	5.53%	0.00%	1.48%
2006	24.37%	0.20%	0.00%	0.00%	0.00%	0.00%	3.17%	20.90%	0.00%	3.42%
2007	31.22%	1.24%	0.00%	0.00%	6.49%	0.00%	2.31%	28.88%	0.00%	3.31%
2008	47.93%	0.86%	0.00%	0.00%	12.49%	7.72%	4.38%	25.36%	0.00%	3.33%
2009	28.93%	1.64%	0.00%	0.00%	13.52%	33.34%	0.00%	23.90%	0.00%	2.94%
2010	21.41%	0.03%	6.11%	0.00%	12.04%	27.72%	0.00%	20.15%	0.00%	0.00%
2011	0.00%	3.40%	27.21%	0.00%	92.00%	0.00%	0.00%	0.00%	0.00%	1.38%
2012	7.60%	6.78%	2.91%	0.00%	0.00%	0.00%	0.64%	0.00%	0.00%	0.00%
2013	14.56%	6.65%	0.00%	0.00%	0.00%	0.00%	1.60%	2.59%	3.01%	21.75%

2014	21.27%	0.00%	0.00%	0.00%	0.00%	0.30%	1.79%	11.45%	0.55%	4.95%
2015	21.88%	0.00%	0.00%	11.95%	0.00%	0.36%	0.64%	11.45%	0.00%	1.14%
2016	23.04%	0.00%	0.00%	8.13%	0.00%	0.36%	0.29%	11.75%	0.00%	0.00%

Annex 4. List of climate smart agriculture (CSA) technology options for STP

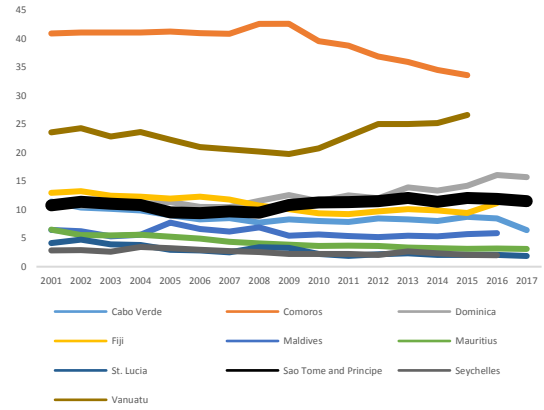
CSA Technology	CSA triple win contribution (Productivity, Adaptation and Mitigation)
1. Technology to improve water use efficiency	
▪ Rain-water harvesting infrastructure	- Reduces soil erosion and collect water for crop irrigation and animal watering.
▪ Improving water irrigation efficiency (i.e., sprinkler irrigation or drip irrigation)	- Reduces water demand in crop irrigation in areas with high agricultural share of freshwater use while maintaining full crop production.
▪ Laser land leveling	- Improves irrigation efficiency and crop yields. - Reduces the use of agrochemicals (i.e., herbicides); thus, improving energy use efficiency.
▪ Mulching	- Protects crops from extreme temperatures, thus conserves soil moisture. - Improves soil fertility - Reduces the use of agrochemicals (i.e., herbicides); thus, improving energy use efficiency. - Improves food safety.
2. Technology to improve energy use efficiency	
▪ Minimum / zero tillage	- Reduces amount of fuel in land preparation - Improve soil fertility through the incorporation of nutrients, and through the reduction of soil erosion.
▪ Biogas production	- Reduces greenhouse emissions - Reduces the use of fossil fuels (i.e., oil and coal). - Reduces soil and water pollution. - Produces organic fertilizer; thus, reducing the demand of agrochemicals.
3. Technology to improve nutrient use efficiency	
▪ Fallow and green manuring	- Improves weed control efficiency. - Reduces the use of agrochemicals (i.e., herbicides) - Re-establishes soil biota and breaks crop pest and disease cycles.
▪ Precision agriculture (set of technologies)	- Increases the efficiency of input materials. - Contributes to waste reduction. - Reduces the use of fertilizers, agrochemicals, and irrigation water.
▪ Legumes intercropping systems	- Increases crop productivity because of enhanced soil fertility - Reduces the use of nitrogen-based synthetic fertilizers - Reduces the use of external inputs (i.e. agrochemicals)

	- agrochemicals (i.e., herbicides).
▪ Production and use of compost	- Lowers the incidence of plant root and leaf diseases - Improves soil physical properties - Reduces pollution (i.e., in ground water) because it decreases the solubility of nutrients.
▪ Biofertilizers	- Increases soil nutrients and increases the nitrogen and phosphorus available to plants. - Reduces dependence on external inputs (i.e., chemical fertilizers)
4. Carbon-smart technology	
▪ Agrosilvopastoral systems and Agroforestry systems	- Promotes carbon sequestration. - Improves land use management. - Increases product / income diversification. - Strengthens human and animal food security. - Incorporates measures of adaptation and mitigation of climate change into the farm. - Improves water infiltration and soil fertility.
5. Climatic services and knowledge dissemination	
▪ Agro-climat services and advisory	- Reduces losses due to the occurrence of extreme weather events - Inform farmer decision-making (i.e. best planting dates and best crops to be grown given weather variability and climate change uncertainty)

Source: adapted from Khatri-Chhetri et al, 2016

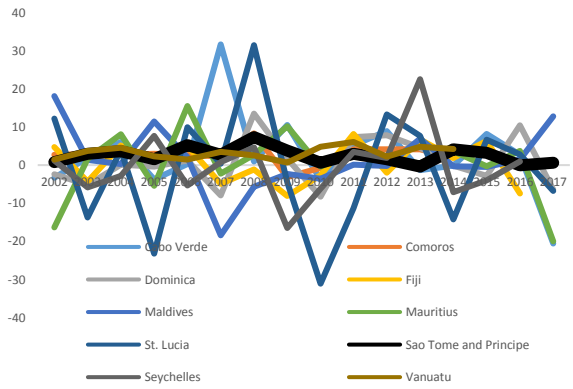
CHARTS

Figure 4 - Agriculture, forestry, and fishing, value added (percent of GDP)



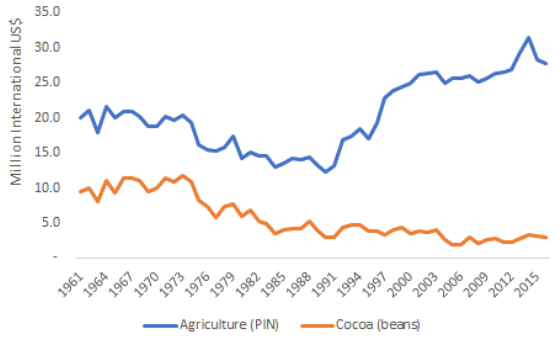
Source: WDI 2018

Figure 5 - Agriculture, forestry, and fishing, value added (annual percent growth)



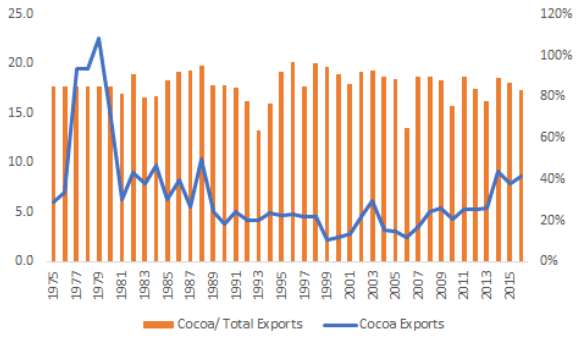
Source: WDI 2018

Figure 6 - Gross Production Value (constant US$): 1961-2016



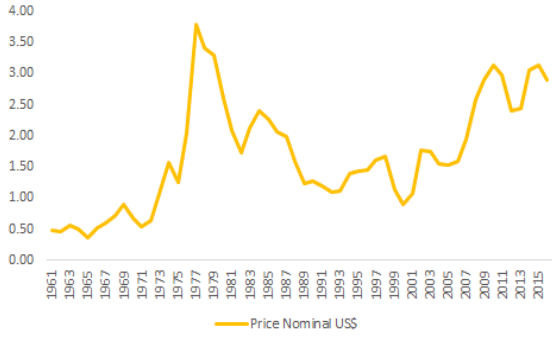
Source: FAO

Figure 7 - Cacao Exports (Million US$) and share in total: 1975-2016



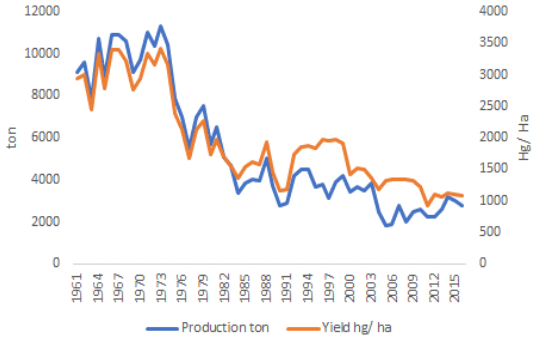
Source: BCSTP

Figure 8 - Cacao Prices (US$/ Kg): 1961-2016



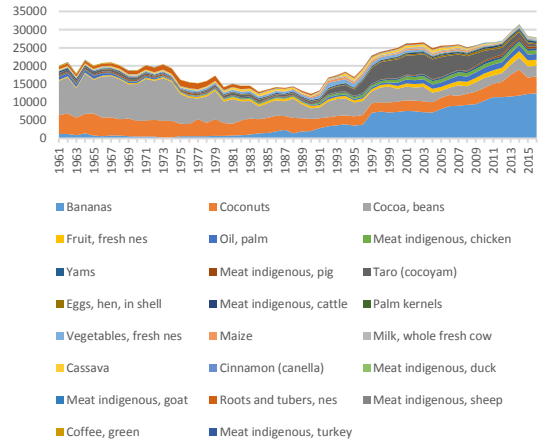
Source: International Cacao Organization; World Bank

Figure 9 - Cacao Production (ton) and yield (Hg/ Ha): 1975-2016



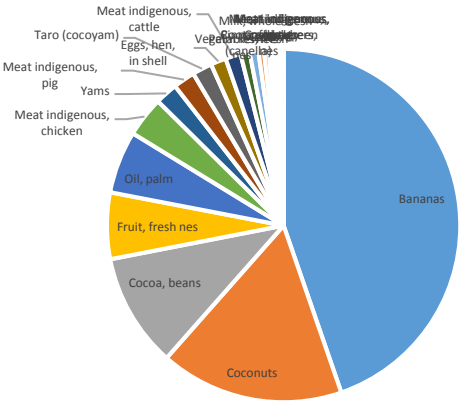
Source: FAO

Figure 10 - STP - Gross Production Value (constant 2004-2006, 1000 US$): 1961 -2016



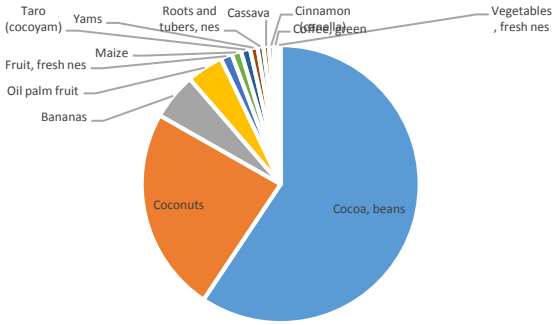
Source: FAOSTAT

Figure 11 - STP – Agriculture GDP Composition: 2016



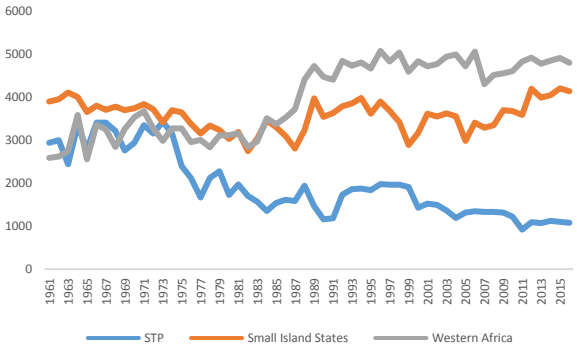
Source: FAOSTAT

Figure 12 - STP - Harvested Area 2016



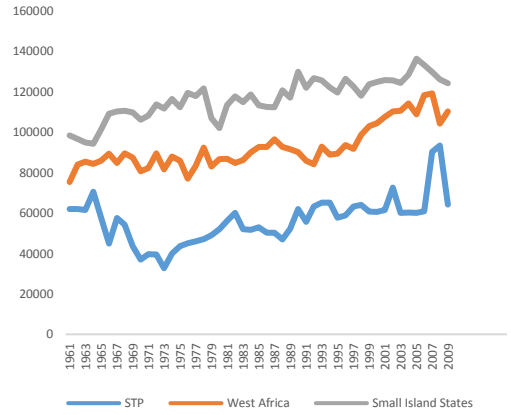
Source: FAOSTAT

Figure 13 - Cacao, beans - Yield kg/ha



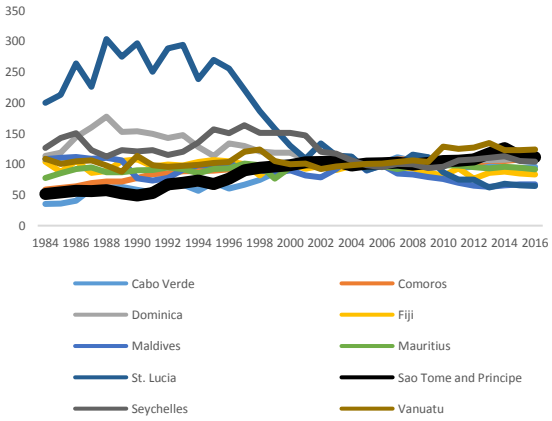
Source: FAOSTAT

Figure 14 - Banana yields (kg/ha): 1961 - 2009



Source: FAOSTAT

Figure 15 - Food production index (2004-2006 = 100): 1961- 2016



Source: FAOSTAT

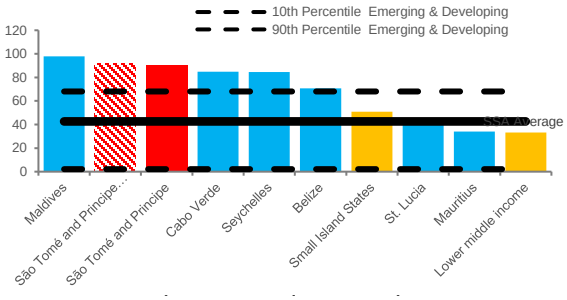
Figure 16 – Household consumption frequency

Household percentage (families %) with consumption frequency per week and per family above two times per week

	1992	2002	2008
Bread(units)	99.9	98	97
Rice	99.2	97	94
Imp Oil	72.2	86	97
Fish	99.1	98	98
Banana	84.4	94	86
Matabla*	49.6	43	24
Milk	67.8	56	14
Beans	68.6	93	75
Fruta Pão**	52.2	50	50
Eggs	60.9	54	31
Palm Oil	85	89	34
Meat	27.8	72	18
Fuba (corn powder)	87.9	25	13
Cassava	12.1	37	12
Sugar	99.1		98

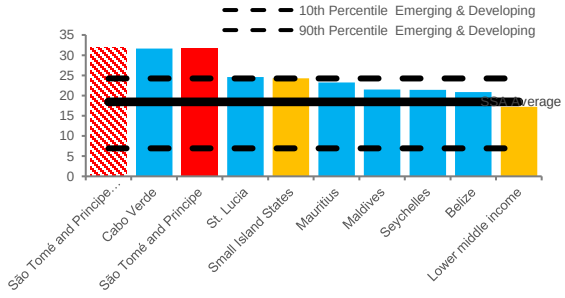
Source: Espirito Santo and Pacheco de Carvalho, 2012.

Figure 17 - Food Exports as percent of Total Merchandise Exports: 2015-2017



Source: Find My Friends using the World Development Indicators

Figure 18 -Food Imports as percent of Total Merchandise Imports: 2015-2017



Source: World Development Indicators

Figure 19 - CEPIBA Projection of Pepper Exports