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WOMEN ENTREPRENEURS
FINANCE INITIATIVE

BOOSTING OPPORTUNITIES FOR WOMEN IN FRUIT AND VEGETABLE VALUE CHAINS IN CÔTE D'IVOIRE

WORLD BANK GROUP

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About We-Fi

Founded in 2017, the Women Entrepreneurs Finance Initiative (We-Fi) is a multilateral partnership supporting women entrepreneurs in developing countries with access to finance, markets, technology, mentoring, and other services, while working with governments and the private sector to improve the laws and policies inhibiting women's businesses in developing countries. It has allocated $353 Million since 2018, which will support over 200,000 WSMEs in 60+ countries and will mobilize $3.55 billion in additional private and public sector funds.

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Acronyms

1PL	First-Party Logistics
2PL	Second-Party Logistics
3PL	Third-Party Logistics
4PL	Fourth-Party Logistics
ANADER	Agence Nationale d'Appui au Développement Rural
CAGR	Compounded Annual Growth Rate
CIF	Cost, Insurance, and Freight
CRNA	*Centre National de Recherches Agronomiques*
F&V	Fruit & Vegetable
FAO	Food and Agriculture Organization of the United Nations
FCI	Finance, Competitiveness and Innovation
FIRCA	*Fonds interprofessional pour la recherché et le conseil Agricole*
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GoCdI	Government of Côte d'Ivoire
HH	Herfindahl–Hirschman
HPP	High Pressure Processing
HS	Harmonized Commodity Description and Coding Systems
ILO	International Labour Organization
IMF	International Monetary Fund
LPI	Logistics Performance Index
LTR	Land Tenure Regularization
MFI	Microfinance Institution
ONDR	*Office National de Développement de la Riziculture*
RCA	Revealed Comparative Advantage
SPS	Sanitary and Phytosanitary
TCL	Temperature-Controlled Logistics
UNDP	United Nations Development Program
WAEMU	West African Economic and Monetary Union
WITS	World Integrated Trade Solution

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Foreword

This policy note is a rapid assessment of women in the horticulture industry in Côte d'Ivoire. Horticulture is defined in this report a**s** fruits and vegetables, excluding roots and tubers, nuts, spices and ornamental horticulture. The report was prepared by the Finance, Competitiveness and Innovation (FCI) Global Practice's regional West Africa and global Markets & Technology teams, with inputs from the Africa Gender Innovation Lab. The findings presented—which are based on literature review and World Bank field missions undertaken between November 2018 and September 2019—are expected to inform the policies and investments of the Government of Côte d'Ivoire (GoCdI) and provide inputs to Programs (including World Bank operations) aiming to boost women in fruit and vegetable value chains.

The paper uses a methodology that allows for the identification of business models and strategies that position women farmers and entrepreneurs to be competitive within a global industry. To assess attractiveness of such business models from the perspective of countries and the private sector, this document employs several frameworks developed by Harvard Business School Professor, Michael Porter, including the *Five Forces* that shape competitive strategy, the *Porter Diamond*, and Porter's *Generic Strategies*. While these frameworks are not explicitly detailed in this document, they have been used in the composition of global work conducted by FCI on the horticulture and food manufacturing sectors, which have informed this paper (Lapres 2018b; Lapres and Bacic 2017).

Beyond an assessment of the global industry, this document employs an integrated framework that applies it to an analysis of a given country's industry (Duch 2004). As such, these frameworks are being adapted from global use for a benchmarking of Côte d'Ivoire. The approach largely uses qualitative assessments backed up with statistics, where available. Importantly, the analytical approach allows policy makers to move beyond trade data (and a dependence on product codes in particular) toward policy and investment recommendations that support the development of 'strategic segments' that increase the opportunities for women to expand into higher value-added activities.

Considering the attractiveness of various segments that exist within the horticulture sector, this document identifies a set of options and actions that could help position Côte d'Ivoire's female farmers and entrepreneurs more competitively. While this report has set forward some preliminary strategic options, it will need to be followed up by a range of feasibility studies, which assess the viability and sequencing of investments given that many of the targets could be viewed as long-term options. The document begins to map a set of short-term and long-term strategic policy and investment proposals that will need to be fleshed out more thoroughly over the course of a longer-term initiative.

Executive Summary

Côte d'Ivoire's growth has been impressive over the past decade, although the outlook has been weakened by COVID19. Between 2012 and 2019, real gross domestic product (GDP) growth averaged 8.2 percent per year. This growth contributed to significant poverty reduction from 44.4 percent of the population in 2015 to 39.4 percent in 2018, particularly in urban areas. With the COVID-19 pandemic, economic growth is projected to slow to 1.8 percent in 2020 and to recover its growth trajectory in 2021, though at a slower pace due to the global recession.[1] Based on recent survey data, poverty increased from 39.4 percent pre-COVID-19 to 43 percent over the summer of 2020, but started to recede to 41.5 percent in October 2020, reversing recent gains.

Human development outcomes have been slower to improve, including gender-based outcomes.[2] Côte d'Ivoire falls behind international benchmarks and regional comparator countries, with reference to gender-based outcomes. Several rankings show that Côte d'Ivoire has fared poorly in its economic participation and opportunities for women. For example, Côte d'Ivoire ranks 170 out of 189 countries in the United Nations Development Program (UNDP) Gender Inequality Index, ranking below neighboring countries such as Togo (165), Senegal (164), and Nigeria (157). Moreover, the Country Policy and Institutional Assessment (CPIA) index for gender equality in Côte d'Ivoire further reflects the weak position of women in the economy. Currently, the CPIA gender equality ranking is only rated a 3.0 out of 6.0, which is below other regional comparators such as Ghana (4.0) and Senegal (3.5) and the Sub-Saharan region as a whole (3.2).

Policies that strengthen and aim to close gender gaps within the agricultural sector could serve to improve some of these gender biases; however, it is important that women-focused segments within the agricultural sector, such as horticulture, are prioritized. More than 40 percent of women are employed in the agricultural sector, making the sector relevant for women. However, several fieldwork assessments have noted structural differences between female and male employment in the sector. For instance, women typically engage in subsistence agricultural activities (often in fruit and vegetable crops), while men mostly engage in farming on commercial plantations (such as for cocoa, coffee, or sugar) (Mitsubishi UFJ Research and Consulting Co., Ltd. 2013). Additionally, anecdotal reports suggest, and field visits confirm, that women are also more prevalent in some crop categories, such as cassava, where they constitute 90 percent of the sector.

There is potential for horticulture as evidenced by the revealed comparative advantage (RCA). At 4.26, the RCA for primary horticulture production exceeds that of animal products at 0.05, minerals at 0.52, textiles and clothing at 0.69, metals at 0.05 and machinery and electronics at 0.01. Thus, knowing that Côte d'Ivoire already has a comparative advantage, an alignment of government policies to achieve a competitive advantage could help achieve improved growth.

Within the horticulture industry, several strategic segments exist with varying determinants of success. In contrast to the conventional approach to segmentation which divides an industry only by traditional product category (for example, pineapples, nuts, and cassava), the strategic segmentation explored in this paper builds on frameworks provided by Michael Porter, such as the Five Forces, Diamond, and Generic Strategies. It constructs a segmentation of the horticulture industry by differentiating between two main segments, stockable horticultural products and perishable horticultural products. The perishability of the product is a function of two critical stages of the value chain: its perishability at harvest and its perishability at processing. Products can have either relatively high ('fresh' products) or relatively low levels of perishability at each stage.

1 Macroeconomic figures for 2020-2023 reflect the World Bank's estimates and projections.
2 Banque mondiale (2018). *"Côte d'Ivoire Economic Update: Understanding the State of the Ivorian Economy in Five Charts and Five Minutes"*.

Competing in the stockable/low-perishable segment requires scale while competing in the perishable segment requires well-developed logistics management systems. Products that have low perishability can easily become commoditized[3] as without time pressure for delivery on such products, they can be traded over long distances. The lack of time pressure diminishes natural barriers to trade and enables new entrants to erode any margins that temporarily exist within the sector. These circumstances ultimately create low returns for those businesses engaged in this segment. As such, the low margins force firms operating in this segment to compete on cost, which drives them into a volume-based business. In the long run, only firms that scale up their operations will survive in the competitive global market. In contrast, there is often product scarcity in the perishable segment because of the natural tendency of such produce to spoil, while coordination failures in the value chain further result in inconsistent supply. However, given the time sensitivities, perishable products require frequent just-in-time delivery to consumer outlets. This means that only the producers and processors that can deliver perishable products to the market within the time frame of perishability can participate in the market.

To remain competitive in the stockable segment in the future, women in Côte d'Ivoire will need to increase scale of production, improve quality of inputs, and embrace mechanization of production processes. The shift to mechanized agriculture is changing the factor of production mix required for success in this market segment. Specifically, there is a movement toward larger-scale, technology-based agricultural processes. As other regions continue to adapt their production methods to fit the changing dynamics, there will be increasing competition for farmers in Côte d'Ivoire. To achieve a competitive position in this market, farmers must expand their scale of production while also increasing their use of both capital and knowledge. Given the current levels of mechanization, the feasibility of engagement in this segment is limited.

In addition, opportunities exist for Ivorian women in the perishable product segment; however, current gaps in logistics service availability hinder women's ability—even more than men's—to operate optimally in this segment. The growing middle class, increased tourism, and the rise in formal markets should result in increased demand for fresh and high-quality products. However, challenges exist to the efficient operation of this segment. For example, although organized third-party logistics (3PL) service providers exist in Côte d'Ivoire (both multinational and domestic), majority of temperature-controlled logistics (TCL) is done in-house by end users. This means that small-scale farmers are often left to work with the unorganized, informal players who do not have access to these TCL solutions. Instead, products are mostly transported via unrefrigerated trucks or containers to San Pedro and Abidjan which raises waste levels and limits product value.

The challenges outlined will be eliminated through a combination of private sector investments, regulatory reforms, and public spending as outlined in the table E.1.

Table E.1. List of Constraints, Actions and Investments Needed to Improve Côte d'Ivoire's Horticulture Sector

Constraints	Solutions	Timeline	Target Segment
Private sector intervention			
Poor support services: Consumer and market research, aggregation and packaging, brokerage	Development of cooperative capacity for service provision, with specific focus on women-led cooperatives	Short to medium term	Perishable (High)
Poor access to water, resulting in dependence on rain-fed agriculture which leaves farmers vulnerable to natural disasters and reduces yield	Provision of smart irrigation equipment and services	Long term	Stockable Perishable (High)

3 Typically, products in this category can include a range of dry goods such as cereals; canned and bottled goods (for example, sunflower oil); dehydrated foods (raisins); and certain types of deep frozen foods (frozen berries).

Constraints	Solutions	Timeline	Target Segment
Poor access to equipment needed to mechanize primary production activities.	Promotion of specialized financial products, such as long-term financing, and policies aimed at closing the gender financial gap such as the use of movable collateral registries.	Long term	Stockable
Poor accessibility and high cost of transportation services	Promotion of private sector investment in TCL and improved efficiency of existing logistics platforms	Medium term	Perishable
Regulatory Reforms			
Poor support services: Consumer and market research, aggregation and packaging, brokerage	Incentives to facilitate the setup of service provision companies	Medium term	Perishable
Fragmented land ownership and poor access to land for women farmers	Fostering women land ownership through improved legal and administrative frameworks	Long term	Stockable (High) Perishable
Widening financial gender gap and low financial inclusion rates	Promotion of long-term financing and policies aimed at closing the gender financial gap such as the use of movable collateral registries and increased penetration of mobile money solutions	Short to medium term	Stockable Perishable(Long-term financing)
Investments in public, common, and club goods			
Poor quality compliance rates	Investments in improved national quality infrastructure	Medium term	Stockable Perishable
Insufficient farmer capacity	Investments in training and skills of farmers through improved extension services. Extension services should be gender sensitive, taking into consideration the childcare requirements and customary practices. Engaging men in agricultural households in training sessions leads to joint decision-making over allocation of resources on the farm.	Medium term	Stockable Perishable
Lower productivity of **women farmers**	Tailor extension services to meet women farmers' needs; expand women's land rights; increase women's access to agricultural labor, facilitating women's access to markets, and encouraging women to "cross-over" to more profitable high-value export crop cultivation. Great access to non-labor inputs (including fertilizers and pesticides).	Long term	Stockable Perishable

Constraints	Solutions	Timeline	Target Segment
Poor access to water, resulting in dependence on rain-fed agriculture which leaves farmers vulnerable to natural disasters and reduces yield.	Investment in irrigation especially for dry seasons	Long term	Stockable Perishable (High)
Unequal access to inputs for women (e.g. fertilizers, pesticides and seedlings)	Government programs that provide women with financing to acquire these inputs and educate them on the need and process for applying inputs. Agricultural extension services that are targeted and designed to meet the needs of women farmers could potentially ease women farmers' access to inputs. Increase number and deployment of female extension agents Digital platforms for disseminating agricultural extension information—about input prices and suppliers, for instance—could help promote input use.	Medium term	Stockable Perishable
Poor availability of improved seed varieties	Investments in research and development. Improvement in the quality and availability of fertilizers in local markets.	Medium to long term	Both

1. Country-Industry Profile

1.1. An Overview of Côte d'Ivoire

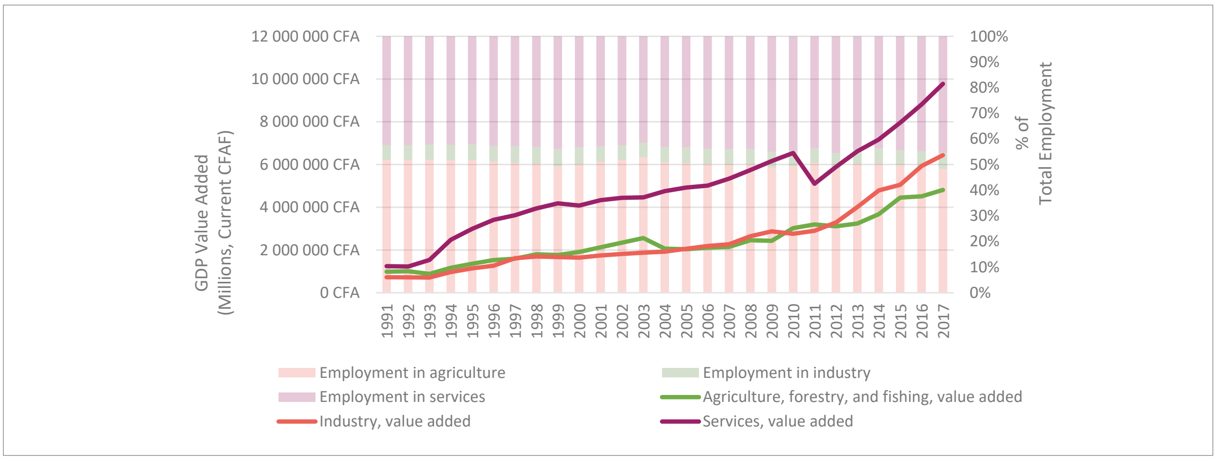
1.1.1. Country Economic Position

Côte d'Ivoire's growth has been impressive over the past decade, although the outlook has been weakened by COVID19. Between 2012 and 2019, real gross domestic product (GDP) growth averaged 8.2 percent per year (5.7 percent in per capita terms), driven by an expansion of services and industry on the supply side and private consumption and public investments on the demand side. Growth has been concentrated in capital-intensive sectors, namely construction (including private housing and public infrastructure projects), transportation, and telecommunications. This growth contributed to significant poverty reduction from 44.4 percent of the population in 2015 to 39.4 percent in 2018, particularly in urban areas. With the COVID-19 pandemic, economic growth is projected to slow to 1.8 percent in 2020 and to recover its growth trajectory in 2021, though at a slower pace due to the global recession.[4] Based on recent survey data, poverty increased from 39.4 percent pre-COVID-19 to 43 percent over the summer of 2020, but started to recede to 41.5 percent in October 2020, reversing recent gains. However, human development outcomes have been slower to improve.[5] With the COVID19 pandemic, economic growth is projected to slow to 1.8 percent in 2020 and to recover its growth trajectory in 2021, though at a slower pace due to global recession.

The agriculture sector contributes significantly to employment and the share of exports, but suffers from low productivity, low value added and a lack of diversification. While agriculture employs 50.4 percent of the population and accounts for 22 percent of GDP (thus the largest source of employment and foreign exchange), the sector is dominated by smallholders and informal employment. The cocoa sector represented approximately 14% of GDP in 2018. There is a little over 1 million small cocoa producers and cocoa constitutes the principal income source for 5-6 million people (a fifth of the country's population). Despite the key role of the agriculture sector in the Ivorian economy, its average contribution to growth was relatively low at 1.9 percentage points of GDP growth between 2012 and 2019 (average annual GDP growth was 8.6 percent during this period). This is significantly below services, which was the main driver of growth during the 2012 – 2019 period. The continued lack of progress in improving agricultural productivity, value addition and diversification have limited the sector's contribution to overall economic growth while slowing down the pace of structural transformation. Services account for around 46 percent of value added (VA), growing at 7.2 percent in 2019; industry (contributing 24 percent to VA) grew even faster at 10 percent. The manufacturing sector still plays a limited role in Côte d'Ivoire's economy, currently accounting for 5.9% of the country's real GDP (about 1,100 billion FCFA) and less than 5% of employment and has recorded annual growth of 8% between 2011 and 2017, albeit slowing to 5% over the past five years.

4 Macroeconomic figures for 2020-2023 reflect the World Bank's estimates and projections.
5 Banque mondiale (2018). *"Côte d'Ivoire Economic Update: Understanding the State of the Ivorian Economy in Five Charts and Five Minutes".*

Value Added by Sector, Current CFAF



Source: World DataBank and International Labour Organization (ILO) modeled estimates.

1.1.2. Gender Profile

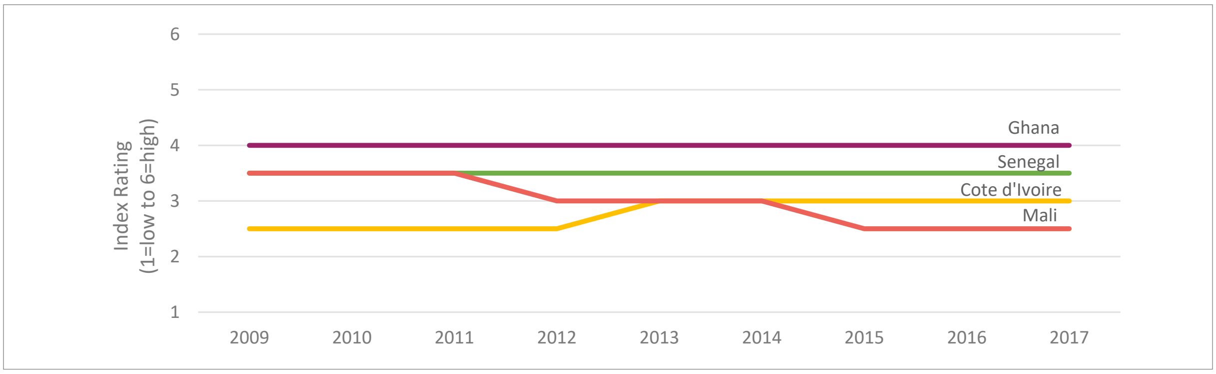
Regarding gender-based outcomes, Côte d'Ivoire falls behind international benchmarks and regional comparator countries, which have demonstrated better performance for women in key indicators across the domains of human capital, economic empowerment, and voice and agency. While women in Côte d'Ivoire fare worse than men on outcomes that affect both genders—including educational attainment, health, unemployment, productivity, and earnings—women also face challenges specific to their gender, including maternal mortality and teen pregnancy. For example, Côte d'Ivoire has made important progress in reducing maternal mortality, which has fallen faster than the Sub-Saharan African average in recent years: Between 2012 and 2017, estimated maternal mortality decreased by 12 percent in Côte d'Ivoire compared to 10 percent in Sub-Saharan Africa. Still, the maternal mortality ratio in Côte d'Ivoire remains higher than the regional average at 617 per 100,000 live births relative to 534 per 100,000 live births. Meanwhile, the adolescent fertility rate declined by 5.4 percent over the same period in Côte d'Ivoire, falling more slowly than the rate for Sub-Saharan Africa (8.1 percent) and West African Economic and Monetary Union (WAEMU) countries (7.1 percent). Nearly one-third of Ivorian girls report becoming pregnant by the age of 19, which often impacts their educational and professional aspirations and life trajectories.

While both men and women face constraints to economic empowerment in Côte d'Ivoire, several rankings show that women in Côte d'Ivoire face even greater challenges to participating in the economy and accessing opportunities. For example, Côte d'Ivoire ranks 170 out of 189 countries in the United Nations Development Program (UNDP) Gender Inequality Index, ranking below neighboring countries such as Togo (165), Senegal (164), and Nigeria (157) across the key dimensions of human development, including reproductive health, empowerment, and economic status.[6] Moreover, the Country Policy and Institutional Assessment (CPIA) index for gender equality in Côte d'Ivoire further reflects the weak position of women in the economy. Currently the CPIA gender equality rating is only a 3.0 out of 6.0, which is below other regional comparators such as Ghana (4.0) and Senegal (3.5) and the Sub-Saharan region as a whole (3.2).[7] This index assesses the extent to which the country has installed institutions and programs to enforce laws and policies that promote equal access for men and women in education, health, the economy, and protection under law.

6 The UNDP Gender Inequality Index measures gender gaps in human development across 162 countries globally. It focuses on challenges and disparities between men and women in three key dimensions of human development: (i) reproductive health, measured by maternal mortality ratio and adolescent fertility rate; (ii) empowerment, measured by women's representation in parliament and the proportion of women and men 25 years and older with some secondary education; and (iii) economic status, measured by labor force participation rate of individuals aged 15 years and older.

7 A country gender equality rating of 3.0 out of 6.0 suggests that significant gender gaps and challenges exist in terms of human capital development, access to productive and economic resources, and protection under the law, and that although policies and laws for gender equality in these areas have been enacted, they are weakly enforced. A rating of 4.0 out of 6.0 indicates that significant gender gaps may exist alongside policies and laws to address gender equality, however, specific actions or mechanisms to enforce these laws, such as complementary programs, institutions, and/or agencies are supporting the policies and laws to make progress towards gender equality.

Figure 4: CPIA Gender Equality Ratings



Source: World DataBank.

The World Bank (2017) report *Et si l'Emergence était une Femme* estimates that increasing women's engagement to achieve parity with men in labor force participation and earnings could contribute as much as US$6 billion to the national economy in Côte d'Ivoire. However, there are several challenges to women's engagement in the productive sectors, including time constraints due to high levels of unpaid domestic and care work, limited access to education, and limited access to the required inputs for production. For example, women spend 3 to 4 hours more than men on domestic tasks such as childcare and preparing meals, which means they typically have less time to spend in the labor market than men do. In addition, girls and women attain lower levels of formal education than boys and men on average, which can impact their professional opportunities. Though the number of out-of-school children has decreased in recent years, with rates falling from 23.2 percent in 2015 to about 6.1 percent in 2018, there are still disparities across gender with only 2.2 percent of boys out of school compared to 10.1 percent for girls. Girls still attend fewer years of school than boys on average—7.8 years, compared to 9.8 years for boys—owing in large part to the cost of schooling and social norms around girls' greater domestic responsibilities, early marriage and childbearing among girls and women, and gender-based violence in schools (Christiaensen & Premand, 2017).

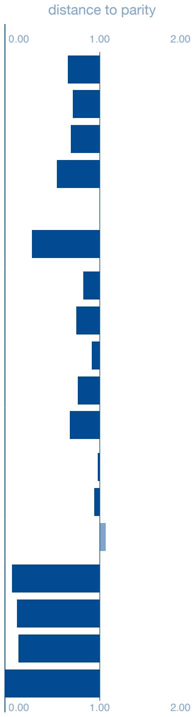
Beyond the education gap, women find it more difficult to access well-paying, salaried jobs. Even with the same level of education, women are two times less likely than men to be working in paid employment, and even when in paid employment, women earn 30 percent less than men. Although much of the difference in men and women's wages can be explained by individual characteristics such as age and level of education, other potential explanations for the gap include both vertical and horizontal occupational segregation—with women tending to work in less lucrative or productive female-concentrated industries or at lower levels within firms and organizations—and discrimination (Christiaensen & Premand, 2017; World Bank, 2017c). Women are heavily employed in informal instead of formal economic activities. While the national statistics for informal employment (as percentage of nonagricultural employment) shows that 87.7 percent of the country works in the informal sector, the rate is noticeably higher for women (93.8 percent) than for men (82.4 percent).[8] The differing levels of participation in formal employment create some inherent inequalities: Notably, women are a third more likely than men to be engaged in vulnerable employment—85 percent for women, compared to 64 percent for men—which is often characterized by insufficient earnings, low productivity, and challenging working conditions.[9]

8 Statistics also show that women in Côte d'Ivoire have significantly less participation in the industrial sector, which typically tends to be a more formalized part of the economy.
9 Vulnerable employment refers to the sum of employment groups of own-account workers and contributing family workers, according to the International Labor Organization.

Figure 5: Gender Score Card, 2021

COUNTRY SCORE CARD

	rank	score	avg	female	male	f/m
Economic participation and opportunity	**90**	**0.664**	**0.583**			
Labour force participation rate, %	106	0.717	0.655	45.5	63.5	0.72
Wage equality for similar work, 1-7 (best)	57	0.697	0.628	–	–	4.88
Estimated earned income, int'l $ 1,000	106	0.550	0.494	3.4	6.1	0.55
Legislators, senior officials and managers, %	1	1.000	0.349	56.9	43.1	1.32
Professional and technical workers, %	147	0.286	0.755	22.2	77.8	0.29
Educational attainment	**143**	**0.828**	**0.950**			
Literacy rate, %	134	0.755	0.897	40.5	53.7	0.75
Enrolment in primary education, %	137	0.921	0.755	86.6	94.0	0.92
Enrolment in secondary education, %	145	0.773	0.950	35.1	45.3	0.77
Enrolment in tertiary education, %	131	0.690	0.927	7.6	11.1	0.69
Health and survival	**36**	**0.979**	**0.957**			
Sex ratio at birth, %	1	0.944	0.925	–	–	0.97
Healthy life expectancy, years	45	1.058	1.029	56.5	53.4	1.06
Political empowerment	**139**	**0.076**	**0.218**			
Women in parliament , %	136	0.129	0.312	11.4	88.6	0.13
Women in ministerial positions, %	115	0.147	0.235	12.8	87.2	0.15
Years with female/male head of state (last 50)	76	0.000	0.144	0.0	50.0	0.00



Source: Global Gender Gap Report, World Economic Forum

Agriculture remains an essential economic activity for many women, employing about 40 percent of the female workforce. However, the percentage of women employed in agriculture has declined over the past several decades, as can be seen from figure 6. Discrimination of women in this sector is especially visible, as several fieldwork assessments have noted structural differences between female and male employment in the agricultural sector (Fair Labor Association 2014; CARE International 2014). For instance, women typically engage in subsistence agricultural activities (often in fruit and vegetable crops), while men mostly farm export crops on commercial plantations (such as for cocoa, coffee, or sugar) (Mitsubishi UFJ Research and Consulting Co., Ltd. 2013). Specifically, only 8 percent of households producing export crops have a woman as the head of the household. In addition, fieldwork suggests that women are also more prevalent in some crop categories, such as cassava, where they constitute 90 percent of the sector. Women's greater involvement in cultivating food crops relative to cash crops may be linked not only to risk preferences, and gender norms around which crops are appropriate for women to farm, but also constraints to accessing the inputs needed to cultivate export crops at a profitable scale.

Figure 6: Female Employment by Sector in Côte d'Ivoire

Source: Modeled ILO estimates.

Several gender-based inequities in access to resources—including land and agricultural inputs—particularly affect women farmers in Côte d'Ivoire. For example, while the 1998 Rural Land Law challenges customary land ownership practices by granting women equal inheritance rights, customary systems still predominate, often making it difficult for women to acquire land.[10] Specifically, a recent World Bank survey showed that only 8 percent of women hold a land title or title sales attestation against 22 percent for men, with the difference diminishing when customary law is considered. Women are also more likely than men to report being concerned about evictions from their property following divorce (by 21 percentage points) and widowhood (by 35 percentage points). Meanwhile, women farmers tend to use fewer agricultural inputs than men farmers: In 2016, women used 1.9 and 1.7 times less fertilizer and insecticide than men, respectively. However, in recent years, as the government has prioritized women farmers' inclusion in agricultural programs, women have increased their use of agricultural inputs (World Bank Group, 2020). The increased adoption of fertilizer and pesticides by female-headed households has played an important role in narrowing the gap in agricultural productivity between male- and female-headed households, which has decreased by 14 percent over the past decade. Finally, many women have difficulty accessing logistic services, which would allow them to commercialize their products (Mitsubishi UFJ Research and Consulting Co., Ltd. 2013). As such, there are effectively many barriers to rural women's participation in economic life.

These gendered differences in crop choice and gaps in access to land and inputs result in women-led farms being less productive. Specifically, the difference between male and female agricultural productivity was about 40 percent for food crops and 17 percent for export crops in 2008; however, these gaps narrowed to 19 percent for food crops and no significant gap for export crops in 2016. Still over the same period, female-headed households largely did not shift into commercial agriculture and experienced greater reductions in land area compared with their male counterparts. The variation in productivity by crop type further suggests that the lower adoption of export crops among women is a crucial driver of the lower levels of agricultural productivity in Côte d'Ivoire. Therefore, supporting women to transition into export crop production could be an important channel for boosting productivity and addressing inequality in agriculture. Moreover, given the limited engagement of women in traditional export crop cultivation, it is important to also boost the productivity of the food crops, which women already typically farm.[11] Policy options to increase women's productivity and achieve gender equality in agriculture include tailoring extension services to meet women farmers' needs, expanding women's land rights, increasing women's access to agricultural labor, facilitating women's access to markets, and encouraging women to "cross-over" to more profitable high-value export crop cultivation.

1.1.3. Government Priorities and Programs

The Government's 2016–2020 National Development Plan prioritized the acceleration of structural transformation of the economy through industrialization. Agri-foods was identified as the core primary industrialization activity. Specifically, the government focused on increasing the processing rates of cocoa (30 to 50 percent), coffee (5 to 50 percent), cotton fiber (5 to 50 percent), cashew nuts (5 percent to 50 percent), and rubber (5 percent to 50 percent). Its stated aim was to accomplish this through removing barriers, facilitating access to finance, marketing campaigns, transforming agricultural production, building technological capacity, creating tax incentives, developing export premiums, and directly supporting companies.

The 2021-2025 National Development Plan (NDP) continues to prioritize structural transformation of the economy through cluster development and industrialization. The NDP outlines the strategies of an industrialization policy that includes: strengthening the industrial base of the country, development of industrial infrastructure (such as Integrated Industrial Zones), creation of national champions in industrial clusters, and the creation of nine agro-poles and the continued growth in the rate of local transformation of cocoa (from 28 to 50 percent) and cashew nuts (from 11 to 50 percent) by 2025. Agroindustry is one of the seven industrial clusters targeted.

10 Under both patrilineal and matrilineal customary land tenure systems, women are limited in their ownership of property and have less secure land rights than men (Donald et al., 2020; Koné, 2006; McCallin & Montemurro, 2009). While in patrilineal communities, land is passed from father to son, in matrilineal communities, including the Baoulé and Agni groups in the Southeast and center of the country, land is passed from maternal uncles to their nephews.

11 It is worth noting that gendered norms around which crops are dominated by male v. female production can change; for example, evidence from Mali on shea butter production illustrates how once an "unprofitable" crop or activity becomes profitable, men tend to take over from women (Government of Mali's Gender Policy, 2009).

Some key programs that resulted from past policy reforms of the government include the use of marketing mechanisms. The marketing mechanisms that have been used by the government include forward contracts and forward sales of export licenses. Through this program, farmers receive at least 60 percent of the anticipated forward sales of cost, insurance, and freight (CIF) export price. This mechanism finances 80 percent of crop production. Only 20 percent of production is typically sold on spot markets (Republic of Côte d'Ivoire 2018). Such economic governance may entail competition policy issues, which allow the elite to capture rents. The government established the Coffee-Cocoa Board (Conseil du Café Cacao – CCC) in January 2012 and tasked it with the management, regulation, development, and stabilization of prices. In 2020, Côte d'Ivoire and Ghana established a joint mechanism for collective action ("Initiative Cacao Côte d'Ivoire-Ghana (ICCIG)") with the aim of influencing international cocoa prices (in a way not too dissimilar to how Organization of the Petroleum Exporting Countries manages oil prices) since nearly 60 percent of world cocoa bean exports originate in these countries. This partnership resulted in the decision by both governments to place a fixed price premium of US$400 per ton over the benchmark cocoa future prices, for every contract sold for the 2020/2021 campaign (Terazono 2019). However, analysts predict that this could result in an oversupply of cocoa which could be wasted due to the limited storage capabilities. In addition, with increasing competition from other countries, it is uncertain if this cartel's influence on price will be long lasting.

Several market-distorting government programs are also intended to protect farmers from price volatility, a variable which has plagued the sector over the past several decades. Price guarantee mechanisms[12] are quite popular with farmers but are often distortionary to the market and add inefficient expenditures to the government budget. In effect, the price guarantee is supposed to be a social safety net for farmers, but social protection programs for people are often more effective at mitigating the poverty impacts resulting from swings in commodity prices. Moreover, the government policy for such price guarantees is largely focused on the support of cash crops. However, since women are underrepresented in the production and employment systems of such industrial plantations—for example, cocoa plantations employ only 5 percent female laborers (Cocoa Horizons 2017)—they are often excluded from government benefits accruing to these sectors. As such, these flagship programs have been excluding Côte d'Ivoire's women. Programs that support the subsectors in which women work have been less substantive. The focus of the government on mitigating price fluctuations, perhaps, underlies the need to take a more strategic look at the horticultural sector and understand the opportunities and risks that are inherent within it.

With the COVID19 pandemic, economic growth is projected to slow to 1.8 percent in 2020 and to recover its growth trajectory in 2021, though at a slower pace due to global recession. The global crisis is expected to cause a recession in most industrialized countries with GDP contracting substantially in many. Economic growth in Sub-Saharan Africa is projected to decline from 2.4 percent in 2019 to -2.1 to -5.1 percent in 2020, the first recession in the region in 25 years[13]. In light of this, Côte d'Ivoire's exports and imports are affected by slowing global demand and disruptions in global value chains. Despite these negative demand shocks, in 2021 it is expected that Côte d'Ivoire would return to its original path of strong growth and fiscal consolidation, although downside risks remain.

Private sector-led growth, already an imperative pre-COVID19, will be essential post-COVID19, for short-term recovery and longer-term economic transformation. In 2018, tax revenue to GDP stagnated at 16.2%, below the WAEMU objective of 20% and public debt was 53.2% of GDP. Fiscal revenues were not adequate enough to finance the government's program – especially in social services and infrastructure - despite several reforms to increase tax collection, such as the new e-payment platform. Though private investment experienced an uptick in 2018, it remains below the regional average, averaging 12% of GDP from 2015-2018, compared to the Sub-Saharan Africa (SSA) average of 15.8%. Foreign Direct Investment (FDI) also remains below the SSA average, at 1.6% of GDP, with more than 80% in the telecommunications sector. The Country Private Sector Diagnostic (CPSD) for Côte d'Ivoire proposes priority interventions to overcome constraints and seize opportunities for the private sector to lead economic transformation.

In response to COVID-19, the Government of Côte d'Ivoire set up four emergency funds to support the private sector, informal workers and businesses. These include: the Large Enterprise Support Fund (*Fonds d'Appui aux Grandes Entreprises, FSGE);* the SME Support Fund (*Fonds d'Appui aux PMEs*, FSPME); the Support and Solidarity Fund (*Fonds de Soutien et de Solidarité*, FSS) and the Informal Sector Actor Support Fund (*Fonds d'Appui aux Acteurs du Secteur Informel*, FASI). The FSGE provides loans to large firms who suffered

12 The Stabilization Fund (CFAF 70 billion) and the Technical Reserve Fund (CFAF 170 billion) are each used to support producer prices (Republic of Côte d'Ivoire 2018).

13 Africa's Pulse, No. 21, Spring 2020: An Analysis of Issues Shaping Africa's Economic Future.

losses directly related to COVID19 in order to protect assets and jobs; the FSPME provides loans and bank guarantees for SMEs suffering losses directly related to COVID19 to protect assets and jobs; The FSS provides emergency cash transfers to those most affected by COVID-19, including informal workers; and the FASI provides grants and loans to informal businesses affected by the economic effects induced by the pandemic. It further lays out a recovery strategy, including support for informal businesses to become more productive. While none of these funds are specifically targeted towards women, given that informal employment is far more common among women (91.7 percent) than men (82.9 percent), it is more likely that the informal sector fund will support more women.

1.2. Scope of Study and Industry Definition

1.2.1. Analytical Frameworks

The aim of this report is to identify economic development opportunities that will empower women in the horticulture (fruit and vegetable) value chains in Côte d'Ivoire. As such, this study uses a two-pronged approach that will first aim to understand the economic development opportunities available (given the country's factor endowments) and then will try to find a way to maximize gender-relevant development outcomes. Importantly, exploring the constraints that women farmers face in increasing their productivity will be an important entry point to understanding how they can overcome these obstacles and tap their potential. Therefore, this study will focus on identifying the determinants of agricultural competitiveness, assessing where Côte d'Ivoire lacks capabilities, and identifying opportunities where women would be able to capture greater benefits.

As such, it will use a value chain approach to understand *where and how value is created* within the market to know which value chain activities are worth competing for. Moreover, this analytical methodology will go beyond quantifying 'how much value' or profit is created by participating in a value chain and instead focus on *how* value is created *and by/for whom*—potent information for policy makers seeking to promote shared value and prosperity for women.

In terms of gender-based development outcomes, this study draws on literature which details the pathways to female empowerment in an economic setting. Specifically, to bring a gender-based lens to the value chain agenda, policy makers must find avenues by which industry can enable the appropriation of profits by women. Awareness of such avenues can then allow policy and public investment benefits to be geared through them. As such, this study draws on literature and will appropriately try to find opportunities which maximize (a) female access to and control over capital assets, (b) female access to and control over inputs and benefits, and (c) female participation in employment (particularly formal employment) in the sector (FAO 2016).

This study will aim to identify industries, segments, and activities, which could be more suited to achieving the outcomes for the desired female beneficiaries. The study will then aim to recommend ways to access these market opportunities and a means to finance women's participation in them. Such an analytical approach to reducing gender-based disparities can more effectively reduce women's poverty and increase human development outcomes.

1.2.2. Scope of Study

The study focuses on the horticulture sector – in particular the fruits and vegetables subsectors - given the proportion of female beneficiaries employed in such primary activities. Horticulture is the branch of agriculture that deals with the art, science, technology and business of growing garden crops, generally fruits and vegetables (food crops) as well as ornamental plants. From a commercial development point of view the key segments of horticulture are fruits, vegetables and spices, though medicinal and aromatic plants that find use in cosmetics, perfumes and traditional medicine are another strong commercial segment albeit relatively smaller compared to fruits and vegetables. The report will focus on the fruit and vegetable subsectors given Côte d'Ivoire has some factor endowments suited to it, as will be presented in following sections. For this, the use of trade data will be beneficial to understand where Côte d'Ivoire already has some existing comparative advantage.

There is potential for horticulture as evidenced by the revealed comparative advantage (RCA). At 4.26, the RCA for primary horticulture production exceeds that of animal products at 0.05, minerals at 0.52, textiles and clothing at 0.69, metals at 0.05 and machinery and electronics at 0.01.[14] Values above 1 indicate that Côte d'Ivoire's factor endowments are still more suited to horticulture production relative to other parts of the economy. Additionally, another area with high RCA is food products—defined as *preparations of vegetables, fruit, and nuts*—with an RCA of 17.7. However, these figures only show a comparative advantage and do not necessarily translate to competitive advantage, nor does it reveal when there is a market failure or market distortion. However, knowing that Côte d'Ivoire already has a comparative advantage, an alignment of government policies to achieve a competitive advantage could help achieve improved growth.

Given that some factor endowments in Côte d'Ivoire have given favorable advantages to the horticulture sector, this paper will specifically focus on the fruits and vegetables subsector as a whole. Fruits and vegetables can be classified in a number of different genera, which can be useful in understanding the sector. Table 1 provides the taxonomies for fruits and vegetables used in scientific literature.[15] The study will exclude edible products used for therapeutic purposes (e.g. medicinal herbs) and grains. These classifications can provide an aggregate level for analysis in the next sections.

Table 1: Categories of Horticultural Items: Fruits and Vegetables

Classification	Description	Examples
Fruits		
Fleshy fruits		
Drupe (stone fruit)	Fleshy outer part surrounding a pit	Plums, peaches, olives
Pomes	Fleshy receptacle with a core containing seeds	Apples, pears
Berries	Fleshy and pulpy fruits without a stone	Tomatoes, cocoa, coffee
Hesperidia (citrus)	Fruit with sectioned pulp inside a separable rind	Oranges, lemon, citrus
Pepos	Fruit covered by a rind that is hard and thick	Cantaloupe, watermelon, squash
Dry fruits		
Legumes (Pulses)[a]	Fruit that develops from a simple carpel or 'pod'	Peas, beans, peanuts
Nuts	Fruit comprising an inedible hard shell and a seed	Hazelnuts, almonds
Other dry fruits	Other dry fruits including, capsules,[a] achenes, and schizocarps	Mustard, dill, sunflower seeds
Caryopses (Grain)	One-seeded fruit where the ovary wall is united with the seed coat	Wheat, corn, rice, oats
Vegetables and fungi		
Leaves	Plant leaves eaten and often accompanied by tender petioles and shoots	Brussel sprouts, kale, cabbage
Stem/Stalk	Vegetables comprising primarily of above-ground stems	Asparagus, rhubarb, celery
Root vegetables	Parts of a plant that anchor the plant and absorb nutrients	Beet, shallots, ginger
Tubers	Thickened underground part of a stem that stores starch for energy	Potato, yam
Bulb	Underground fleshy part that produces a leafy shoot above ground	Garlic, onion, shallot
Fungi	Encompasses a range of mushrooms, yeasts, and so on	Champignons, portobello

Source: Various including (IARC n.d.) (University of Wisconsin, Madison n.d.)

14 https://wits.worldbank.org/CountryProfile/en/Country/CIV/StartYear/1988/EndYear/2017/TradeFlow/Export/Indicator/RCA/Partner/WLD/Product/16-24_FoodProd

15 Fruits can be further classified as either (a) fleshy where the wall becomes soft as it matures or (b) dry where the coat becomes hard. Dry fruits can be further split between dehiscent fruits* (which open at maturity) and indehiscent fruits (which do not).

Beyond the definition of crop categories, the study will consider an overview of the entire supply chain. While traditional notions of the horticulture industry are quite localized around domestic production of these crops, in actuality the sector has become a complex value chain involving a number of related and supporting activities. As such, the supply chain connects both *production* activities and the set of *services* that support marketing along the value chain. Specifically, such services create value through a range of functions such as financing, packaging, storage, certification, and distribution among a range of others. In this way, the productivity of the sector is reliant on the capacity of various service-based firms to market products in a commercial context.

The paper aims to present some options in support of women in the fruits and vegetable subsectors of the horticulture industry. The following sections of the paper will start with a review of the global industry and a strategic segmentation of the industry that sets out various strategic options, as well as a review of the global horticulture industry (Section 2), offer an assessment of the current horticulture industry in Côte d'Ivoire including the *Vallée du Bandama District* (Section 3), and detail the opportunities for boosting women in the horticulture sector and the policy measures and gaps in the value chain that would need to be reinforced to realize such opportunities (Section 4).

2. The Horticulture Sector Segments[16]

2.1. Segmenting the Industry

In this section of the document, a 'strategic segmentation' is applied to the horticulture industry to identify the determinants of competitiveness. It contrasts with a conventional approach to segmentation, which divides an industry only by traditional product category (for example, pineapples, nuts, and cassava). In doing so, the segmentation matrix aims to identify the attractiveness of various segments and broad requirements for entry, survival, and growth. Specifically, the attractiveness of each segment is determined by global conditions (such as the evolution of substitutes, rivals, suppliers, buyers, and minimum efficient size of production). A strategic segmentation can then lead to value chain benchmarking, which identifies what currently exists and what areas require investment in a given value chain (see sections 4.2.1 and 4.2.2).

2.1.1. Consumer Markets

Table 2 provides a strategic segmentation for the horticulture sector to define differences that exist within the industry. As a first step, it is useful to understand consumer markets since it is this that actually drives demand. While the industry has traditionally been dominated by a production focus, emerging consumer-focused strategies are necessary to capture value in an increasingly competitive market. The horizontal axis therefore identifies two markets—subsistence and commercial—to approximate the different types of end users that exist. Having this established, the vertical axis of this segmentation then summarizes the types of products that can be brought to market. This is displayed using a binary classification according to the perishability of the product. Products can have either relatively high or relatively low levels of perishability. These axes are detailed in the following paragraphs.

Table 2: Strategic Segmentation for the Horticulture Sector

		Consumer Markets			
		Calorie-Driven Consumers	Nutrition-Driven Consumers	Convenience-Driven Consumers	Taste-Driven Consumers
Product Perishability	Low (Stockable)	A1	A2	A3	A4
	High (Perishable)	B1	B2	B3	B4

In scanning the consumer market, four macro-typologies of users have been identified: consumers driven by calories, nutrition, convenience, and taste. *Calorie-driven* consumers of horticultural products are a segment of users who typically consume food to meet their basic food needs, such as plantain or yams. However, global trends have also spurred the development of a set of new consumer segments: *nutrition-driven consumers*[17] are those who purchase horticultural products to meet some higher-level dietary objectives that suit the need to live a healthy lifestyle (for example, consumption of superfoods that lower cholesterol such as goji and acai berries) (Kwiatkowski and Schäfer 2017; Lee 2011). *Convenience-driven consumers* are those who are driven by the need for ease of consumption and thus they demand ready-to-eat foods such

16 This section is adapted from Lapres 2018b.

17 In response to rapidly growing demands for healthier and more nutritious foods, grocery retailers around the world have sought to source produce that fits in with consumers' perceptions of health. Consumers' consumption is driven by new dietary principles, such as low calories, portion controlled, gluten free, protein/nutrient rich, vegan/vegetarian, low sugar, and high fiber.

as freshly cut and packaged fruits and vegetables (Lapres and Bacic 2017). *Taste-driven consumers* are a set of consumers who are driven by the desire to obtain some special experience in the consumption of their food, such as truffles or spices that provide aroma.

Although it is difficult to value demand of such consumer segments, there is some evidence that the value of demand for new consumer segments (nutrition, convenience, and taste) has been growing faster than demand for basic calorie-seeking consumers. For example, basic (global) horticultural markets grew at only 2.49 percent per year in 2016 (World Bank, A Strategic Segmentation of the Horticulture Sector: Fruits and Vegetables, 2018). However, demand for convenience products in the United Kingdom was growing at 6.1 percent per year in 2012 and had a market value of over EUR 12.5 billion. Moreover, demand for nutritious superfoods is expected to grow at 15.7 percent (TechNavio 2018), while specialty taste-driven products were estimated to be growing at 6.1 percent (CBI, s.d.).

In Côte d'Ivoire, consumer demand is mostly concentrated in the calorie-driven segments – making consumers sensitive to price - and this segment will be the focus of the rest of the report.

2.1.2. Product Perishability

The vertical axis of the strategic segmentation denotes the perishability of the product on offer. The perishability of the product is a function of two critical stages of the value chain: its *perishability at harvest* and its *perishability at processing*. Products can have either relatively high ('fresh' products) or relatively low levels of perishability at each stage, the characteristics of which are defined as follows.

Dimensions for Perishability at Harvest and at Processing

The perishability of horticultural items is a function of the crops' rate of respiration, which is in turn affected by variations in the temperature, atmosphere, and moisture. Different types of crops (and indeed even different varieties of the same crop) have very different rates of respiration (see simplified framework for respiration in Annex 1). Products with relatively low perishability at harvest are items such as tubers, while okra has a relatively high perishability at harvest. Understanding the dimension of such rates of respiration has implications for how the value chain is structured, with more highly perishable crops requiring a more resource- and coordination-intensive cold chain.

Similarly, the perishability of horticultural items once 'processed' is a function of the type of processing method used (see Annex 1). Horticultural products can be processed in several different ways, including some rudimentary and some more sophisticated methods, which are marked by increasing capital and knowledge intensity. Moreover, some methods of processing can lead to an extended shelf life of a horticultural product (for example, canning, drying, or pasteurization), whereas other methods of processing (for example, cutting and dicing) can lead to an accelerated rate of respiration and therefore an accelerated rate of perishability.

Taken together, the perishability at harvesting and perishability at processing have consequences for the value that can potentially be created by industries. In this way, the strategic segments created by the interaction of these axes can be useful in identifying relatively attractive and unattractive business models. Quite typically, there is often the perception that agro-processing which decreases the rate of respiration leads to higher value. However, often such conventional wisdom no longer holds true in today's markets as will be demonstrated in the following paragraphs. Instead, industries where more value can be appropriated (after accounting for costs) tend to be more attractive from the perspective of countries and the private sector.

2.1.3. Benefits of Perishability: The Global Horticulture Market

Great advancements in crop productivity around the world have led to improvements in the availability of supply which has subsequently resulted in increased competition and lowering of prices. The increased availability of fruits and vegetables has in fact made them more accessible to world markets.[18] In 2016, global trade in horticultural produce (narrowly defined[19]) neared US$209 billion. This enormous growth rose along with the liberalization of trade regimes and the reduction of nontariff barriers. The natural outgrowth of this increase in supply is a corollary increase in competition and lowering of prices, which now intensively characterizes the global market.[20]

The COVID19 pandemic was a shock to trade flows including global trade in horticultural produce. Early in the pandemic, infections and quarantine measures prevented the regular flow of horticultural goods and the operation of associated services (Bulgari et al, 2021). Horticultural value chains were disrupted by labor constraints, especially for those products dependent on seasonal and migrant workers as well by a reduction in air cargo capacity (though air cargo has rebounded compared to the beginning of the pandemic) (Seabury Cargo, 2021). The production of staple crops is more mechanized in the developed world and as such been less affected by the pandemic than more labor-intensive crops, such as fruits and vegetables.

Over the past years, the sale of products from stockable segments has become a less attractive business model. Products that have low perishability—both primary products of agricultural production and processed products of fruits and vegetables—can easily become commoditized.[21] Without time pressure for delivery on such products, they can be traded over long distances. This creates a market wherein competition exists between the entire world of producers (or at least among large regions).[22] The lack of time pressure diminishes natural barriers to trade and enables new entrants to erode any margins that temporarily exist within the sector. These circumstances ultimately create low returns for those businesses engaged in this segment. As such, the low margins force firms operating in this segment to compete on cost, which drives them into a volume-based business. In the long run, only firms that scale up their operations—through investments in assets and branding expenditures that increase revenues—will survive in the competitive global market.

Given the emerging need for scale, multinational corporations have thus stepped into the role of 'lead firms' in this segment. These companies occupy the function of wholesale traders or agro-processors of stockable goods on the global market.[23] Lead firms have revenues and assets in billions of dollars. However, attractiveness of their businesses may be estimated by the profit margin, which—expressed as a percentage—is a better indicator to assess sustainable competitiveness. In unattractive segments characterized by intense competition (such as in stockable commodities), profits tend toward zero over time.

Despite the size of these companies, they are not able to make considerable profit margins, however these 'lead firms' do wield a considerable amount of power over their suppliers. While there is a smaller profit margin, due to their size and market power, these 'lead firms' can dictate their terms to the industry. However, as large corporations, they also typically prefer established relationships with suppliers that have similarly large economies of scale. The sourcing operations of these companies thus tend to be focused on contracts with established corporate firms that are able to supply substantial quantities of products that meet some consistent quality standard.[24]

In contrast, products that have a higher rate of respiration—perishable or 'fresh' products—typically have more appropriate value than products that have a lower rate of respiration. This value results from the scarcity of perishable products on the market. Given the natural tendency of such produce to spoil and given coordination failures in the value chain, the market often lacks sufficient supply on a consistent basis. Given the time sensitivities, perishable products require frequent just-in-time delivery to consumer outlets. This means that only the producers and processors that can deliver perishable products to the market

18 The growth in supply should not be reflective of growth in demand, but rather on industry's ability to respond to that demand.
19 The narrow definition of horticulture used here includes vegetables, nuts, fruits and berries, hops, live plants, bulbs, roots, and cut flowers.

20 However, the growth in supply should not be reflective of growth in demand, but rather on industry's ability to respond to that demand.
21 Typically, products in this category can include a range of dry goods such as cereals; canned and bottled goods (for example, sunflower oil); dehydrated foods (raisins); and certain types of deep-frozen foods (frozen berries).
22 Firms in this segment will increasingly be forced to compete in an overly crowded market where long-term success is unlikely.
23 The table differentiates between wholesale traders of low perishability products and agro-processors of low perishability products; however, both types of firms can fit within the same strategic segment.
24 While at times these companies source from spot markets to top up supplies, in general procurement is maintained through established relationships.

within the time frame of perishability can participate in the market. This reduces the amount of competition in the individual product market, which diminishes the pressure to compete on price and creates appropriate margins for producers and processors that are able to supply.

The effect of this less-intensive market competition can be observed in price data. Using consumer price data from the United States we see that the more expensive produce are those which have either Extremely High, Very High, or High respiration rates (see Figure A1.1). Those products with Moderate or Low respiration rates tend to be more prevalent on the list of the 10 least expensive fruits and vegetables. As such, highly perishable produce such as asparagus, spinach, and okra tend to be quite expensive. Similarly, figure A1.2 depicts the price of individual raspberry products, where prices between fresh and frozen-processed berries are noticeably different.

Perishable products not only have a higher price, but they also allow the retention of profit in producer's accounts, even in lieu of the typical power of the lead firms. Lead firms in perishable segments tend to make margins of between 4 and 10 percent. However, farms that can produce and properly handle perishable products still have the negotiating power to keep some margin themselves given that the switching costs of buyers are quite high. Farms engaged in production of perishable products can often make upwards of 8 percent margins given that competition is naturally less intense and more highly localized within producing regions (Lapres 2018b).

3. Assessment of Côte d'Ivoire's Horticulture Industry

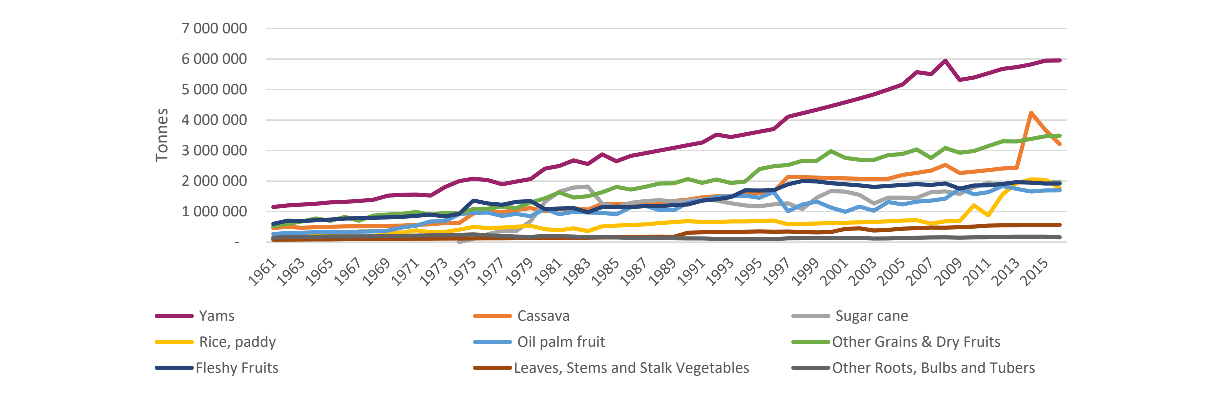
3.1. Côte d'Ivoire's Production is Slowly Diversifying

The prevalence of informality in the agriculture and food manufacturing sectors is especially notable given that most farms are subsistence driven or they engage in localized trade. Very few farms tend to have operations that would resemble a commercial operation (with a few notable exceptions). Moreover, given the inefficiency and limited capacity of farms to commercialize their products, there are often a number of market intermediaries—that is, wholesalers, each of which takes a cut—that extend the value chain and hinder efforts at providing traceability of products. As such, it is more viable to describe primary production outputs than it is to describe firms engaged in them.

3.1.1. Primary Production

Over the past three decades, impressive growth in yam and cassava production has contributed to Côte d'Ivoire's food security (figure 7). As of 2016, primary production was somewhat concentrated in roots and tubers, such as yams and cassava[25], which together comprise nearly half of production and mainly supply subsistence markets (figure 8).[26] Other commoditized commercial products, such as rice, maize,[27] oil palm, and sugarcane constitute another third of the country's production. Harvesting and rudimentary processing of both rice and maize are labor-intensive activities that are traditionally undertaken by women.[28] The concentration in such crops is to be expected given that Côte d'Ivoire is still transitioning to an industrialized society and many crops are grown for subsistence, calorie-driven consumption. However, there has been considerable progress toward diversification of production, which can be seen in the more rapid rise of production in grains and fruits.

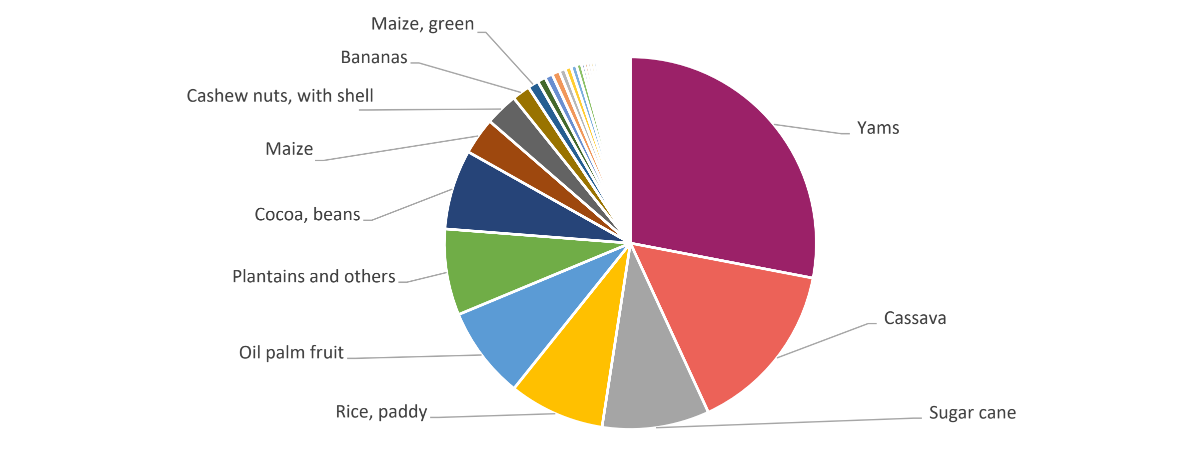
Figure 7: Production Increases in Côte d'Ivoire's Horticulture Sector



Source: Author's calculation based on FAOSTAT.

25 Cassava production neared 3.5 million tons in 2016, with a regional production split between the Abidjan region (34 percent), the Bouake region (18 percent), the San Pedro region (11 percent), and the Aboisso region (9 percent) (Yao 2017).
26 Production figures are taken from FAO; however, some of the data may be incomplete given inadequate reporting. Annex 3 further details the other fruits and vegetables that are known to be grown in Côte d'Ivoire in some quantity.
27 Maize is the larger part of the consumption diet in the north than in the south of the country (Yao 2017).
28 Rice harvests typically use a labor force consisting of approximately 60 percent women. Moreover, a 2001 study by the Ministry of Agriculture reveals that women are more likely to be employed in the traditional methods of shelling rice, whereas men are more likely to be employed in the semi-industrial and industrial activities surrounding rice processing. However, there is only one industrial rice mill still in operation (out of 11 that existed in the 1970s) (Yao 2017).

Figure 8: Proportion of Côte d'Ivoire's Horticultural Production by Crop (2016)



Source: Author's calculation based on FAOSTAT.

Côte d'Ivoire has also developed markets for other horticultural items that are traded on international markets. Particularly, Côte d'Ivoire has commercial markets for coffee, cocoa, cashews, palm oil, and to a lesser extent bananas and pineapples. While these crops make up a smaller proportion of total production, their commercial value is often much greater. However, a key preoccupation for Côte d'Ivoire is how to capture more value within the global cocoa value chain (which currently amounts to 13%). Large multinationals wield high power over smaller supplying farmers. The average cocoa farm size is 4 ha, but with the cocoa farmer's annual income of only US$3,000, nearly 60 percent of cocoa farmers in Côte d'Ivoire are living below the poverty line (Cocoa Horizons 2017). As a result, the 6 million people employed in the cocoa industry have limited benefits from participation in this industry, albeit they are often better off than subsistence production in staple products.

A range of other horticultural items—including papayas, mangoes, and chilies—have contributed to aggregate production in much smaller quantities but have been growing quite rapidly.[29] The majority of fruit and vegetable production comes from the east, center east, and center of the country[30]. These fruits and vegetables are also contributing to an increasingly commercialized domestic market. This diversification has been driven by growth in the country more broadly, which has precipitated increased demand for high-value horticultural items. The production volumes and growth of all recorded crops are listed in annex 3.

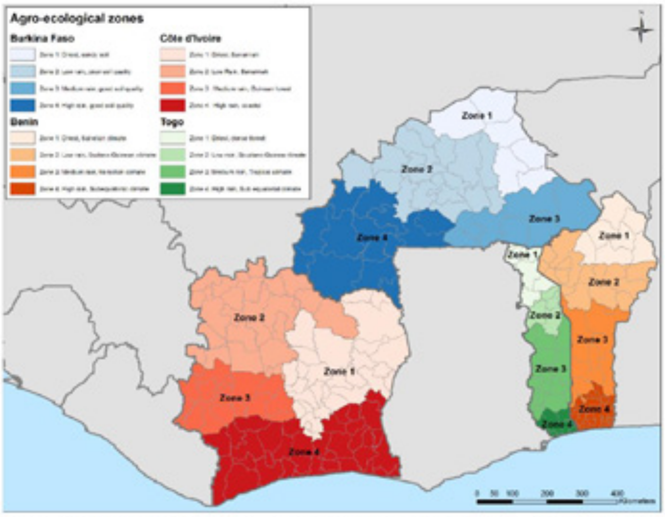
3.1.2. Natural Factor Endowments

To assess the full range of potential products that can be cultivated, it is important to look at the natural factor endowments, which support productivity of the sector. Côte d'Ivoire as a country has 2.9 million ha of arable land (65 percent of the total landmass) with an average plot size of just 0.12 ha. The country's climate supports at least four different agro-ecological zones as defined by the Food and Agriculture Organization of the United Nations (FAO) (see figure 12). Table 6 details the range of these zones, the administrative units which they span, a description of the natural factor endowments of those zones, and some main crops that are typically produced there (FAO 2010).

29 The vegetables produced in Côte d'Ivoire are of two types: (a) the African type: okra, eggplant N'drowa, local tomato, pepper, shallot, cowpea, pistachio and (b) the European type: purple eggplant, onion, cucumber, carrot, cabbage, beans, turnip, pepper, tomato (Yao 2017).

30 Concentrated production of vegetables often occurs close to urban centers in Sinématiali (estimated 1,200 ha of vegetable production), Férké (300 ha), Touba (261 ha), N'Dakro (1,212 ha), Kankoubi (1,000 ha), Marabadiasso (990 ha), Niambrum (60 ha), Koriakro (60 ha), and Zatta (20 ha) (Yao 2017).

Figure 9: Map of Côte d'Ivoire Showing the Agro-ecological Zones



Sources: AGRHYMET, 2016; Dixon and Holt, 2010; FAO, 2001, 2009a, 2009b; Ministère de l'Environnement et des Ressources Forestières, 2003, 2014; Vissoh et al., 2004.

Source: Dizon 2016; Kone 2017.

While table 6 lists some typical crops that are known to be produced, given Côte d'Ivoire's forested-tropical south and its drier savannah in the north, this list is far from exhaustive. The country's wet season occurs approximately from March to November. Rainfall is also more abundant on the coast than it is in the northern inland areas. This can limit the range of crops produced by farmers in the north, which often lack irrigation. However, even some producers in the south can face water constraints during the dry season that occurs approximately from December to February.

Table 6: Agro-ecological Zones and Descriptions in Côte d'Ivoire

Agro-ecological Region	Administrative Areas	Description	Agricultural Practices: Main Crops
Guinea Zone (South and west of the country)	Lagunes, South Comoé, Lower Sassandra, Upper Sassandra, South Bandama and Mountain Regions	**Vegetation**: Dense forest. **Four seasons**: A long dry season (December to March), a long rainy season (March to mid-July), a small dry season (July to August), and a short rainy season (September to November). Average annual rainfall is about 1,800 mm. **Altitude**: 50 to 100 m in the south, mountainous in the west with some summits culminating to more than 1,000 m.	*Food crops are generally associated together or with perennial crops in the first years. Cropping system is cassava based and/or upland rice in the west.* **Oil crops**: Oil palm, coconut. **Cereals**: Maize. **Roots and tubers**: Yam, cassava. **Vegetables and legume crops**: All types. **Other crops**: Banana, plantain, cocoa, coffee; rubber, banana, pineapple.
Sudan Zone (North and west of the country)	Sanannah, Denguélé, and North of Worodougou Regions	**Vegetation**: Grassy savannah. **Two Seasons**: It is the zone with the least rainfall, with essentially two seasons: short rainy season (abundant rains) and a long dry season that can last 5 to 7 months. **Altitude**: 400 m.	*Food crops are generally associated together or with perennial crops in the first years. Cropping system is cotton/ maize based. Good knowledge of the use of animal traction, pesticides, and fertilizers.* **Cereals**: Maize, millet, sorghum. **Roots and tubers**: Yam. **Vegetables and legume crops**: All types. **Other crops**: Cashew nut, cotton, mango.

Sudano-Guinean 1 Zone (Center and south of the country)	Fromager, Marahoué, Agnéby; Mid-Comoé, South of N'Zi Comoé, Mid-Cavally and Bafing Regions	**Vegetation**: Clear forest. **Four seasons**: A long dry season (November to February), a long rainy season (March to mid-July), a short dry season (July to August), and a short rainy season (September to October). **Altitude**: 50 to 400 m.	*Food crops are generally associated together or with perennial crops in the first years. Cropping system is essentially upland rice and cassava or yam in the east.* **Oil crops**: Oil palm, coconut. **Cereals**: Maize. **Root and tubers:** Yam, cassava. **Vegetables and legume crops**: All types. **Other crops**: Banana, plantain, cocoa, coffee, rubber.
Sudano-Guinean 2 Zone (Center and east of the country)	Bandaman Valley, Lakes, North of N'Zi Comoé, Zanzan, and South of Worogougou Regions	**Vegetation**: Humid savannah. **Four seasons**: A long dry season (November to February), a long rainy season (March to mid-July), a short dry season (July to August), and a short rainy season (September to October). **Altitude**: 50 to 400 m.	*Food crops are generally associated together or with perennial crops in the first years. Cropping system is yam based.* **Cereals**: Maize, millet, sorghum. **Roots and tubers**: Yam, cassava. **Vegetables and legume crops**: All types. **Other crops**: Banana, plantain, cocoa, cashew nut, cotton.

Source: FAO 2010.

Box 1: Economic Geography: The Clustering of Production and Firms

Agglomeration and connectivity are two factors that heavily influence the competitiveness of an economy and of agricultural industries. As such, it is often useful to understand how existing agglomerations and connectivity infrastructure can be targeted to ensure that development programs have more impact. Côte d'Ivoire's largest metropolitan area is Abidjan, which is located in the southern coastal region of the country. While Abidjan is undoubtedly the commercial hub for the country, economic activities there are more focused on its industries and services sectors. Bouaké is the second largest city in Côte d'Ivoire with an urban population of more than 500,000 (see figure 10). As the provincial seat of the *Vallée du Bandama District*, it has both urban agglomerations and connectivity to surrounding rural areas (see figure 11). As such, while the economy in the district is still heavily influenced by agriculture, Bouaké also has some agglomeration of firms, support services, and transportation infrastructure that could more likely make entry into fresh segments.

Figure 10: Concentration of Agglomeration Economies

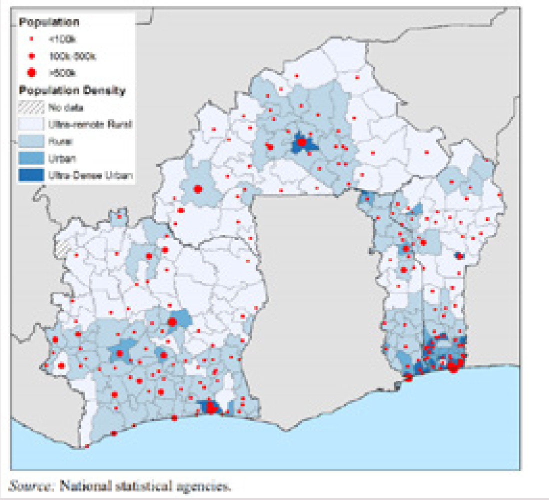
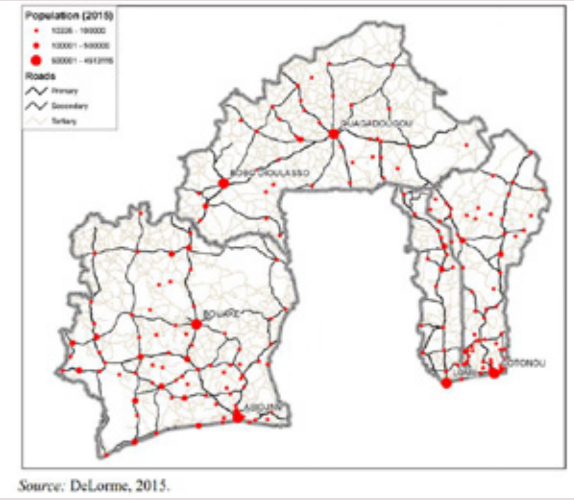


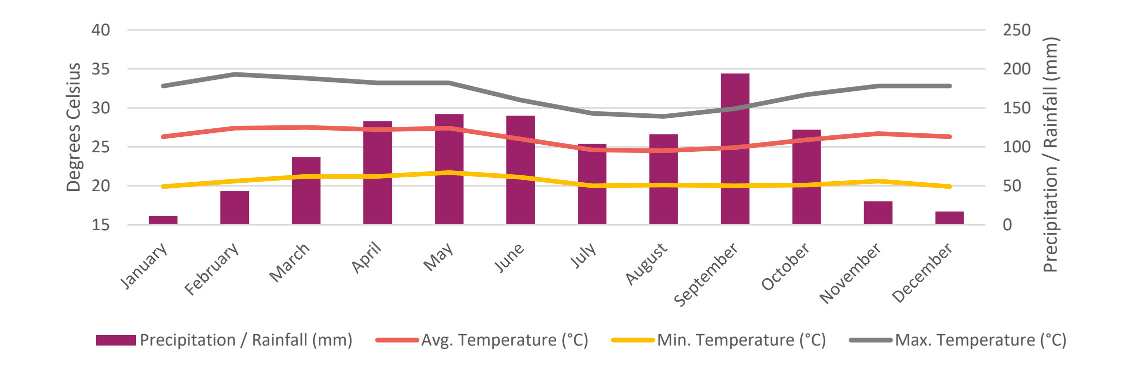
Figure 11: Road Networks in West Africa



Source: Nguyen and Dizon 2017.

The area surrounding Bouaké in the Bandama region is also of particular interest given the concentration of female-led cooperatives in the region. This region is fairly mountainous and situated in the Guinea Zone, which has variable temperatures and levels of precipitation throughout the year as depicted in Figure 12. Thus, water-intensive crops tend to be better grown between March and October. Crops requiring both water and cooler temperatures are better cultivated between July and August.

Figure 12: Climate Data for Bouaké



Source: Climate Data.org, 2018.

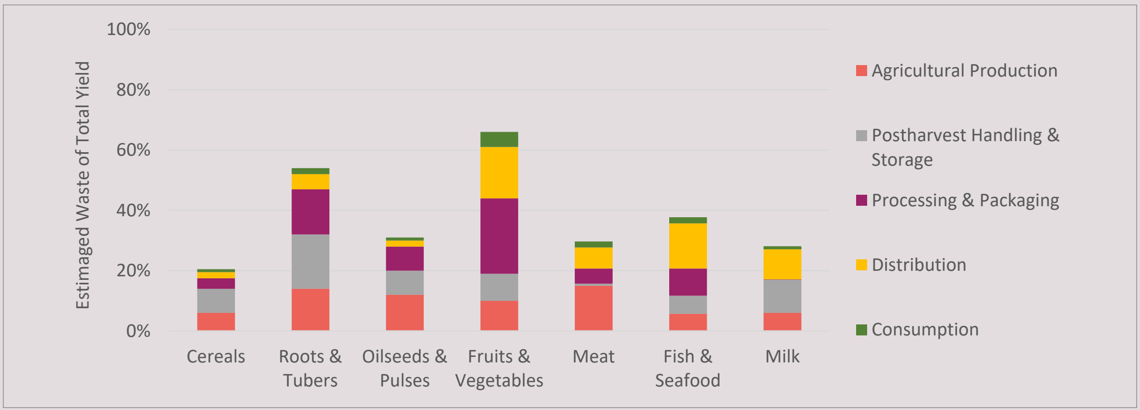
3.1.3. Post-harvest Losses

Côte d'Ivoire's primary sector is largely geared toward the production of stockable items that have low levels of perishability at harvest. Figure 8 shows that nearly two-thirds of primary production is in yams, cassava, or other low-value commodities, each of which tends to be highly stockable. These products are mostly destined for subsistence consumption, heavy processing, or sale in domestic spot markets. Côte d'Ivoire's production of commercial cash crops—including cocoa, tree nuts, and oil palm fruit—is also quite typically stockable as defined by their relatively long shelf lives. As such, the characteristics of these products do not require sophisticated storage infrastructure. Côte d'Ivoire does not engage in production of more perishable crops because of the lack of soft and hard investments in cold chain infrastructure. Without such investments, crop spoilage rates tend to be unsustainably high. For example, crop losses for plantains are estimated at 40–50 percent of the harvest. This is in addition to any losses occurring during transport and marketing (Yao 2017). Additionally, about 30–40 percent of cocoa crops are lost due to diseases (Cocoa Horizons 2018).

Box 2: Studies in Africa on Food Waste across Value Chain Steps

Across Africa, studies have attempted to account for food waste and post-harvest losses across a more detailed set of value chain steps. One FAO study estimated that nearly two-thirds of all fruit and vegetable products were lost on or before consumption, including 25 percent at processing/packaging and 17 percent at distribution (see figure 16). Such losses in product would be quite typical of Côte d'Ivoire as well, which lacks much of the capacity to ensure proper control of product once harvested. Particularly, the lack of a cold chain infrastructure creates considerable post-harvest losses for highly perishable products, which discourages farmers from entering production. As a result, the production quantities tend to be minimal.

Figure 13: Waste for Commodity Groups in Steps of the Value Chain for Sub-Saharan Africa

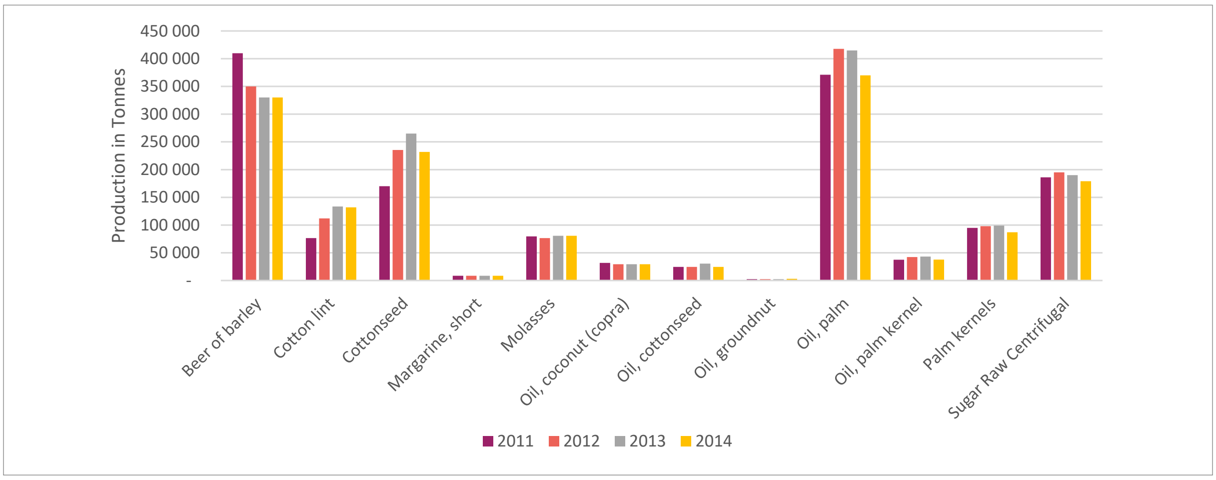


Source: Gustavsson et al. 2011.

3.2. Food Manufacturing

Agro-processing activities are fairly developed in Côte d'Ivoire, but they are split between food manufacturing and the manufacturing of nonfood products (for example, cotton lint). FAO statistics capture some production of typical agricultural commodities, as depicted in figure 14. The figure shows an agro-processing industry, which has a strong production of beer of barley and also oil palm. The country also has notable production of raw sugar and of some cotton byproducts.[31]

Figure 14: Côte d'Ivoire's Recorded Production of Processed Crops



Source: FAOSTAT.

These statistics reflect the production capacities of a handful of large agro-industrial companies, which dominate the agricultural sector in Côte d'Ivoire and in the surrounding countries. Table 7 gives the financial profile of some of the most notable food processing companies in the country. Annex 1 details the operations of each of these companies; however, a summary scan reveals that each of these firms engages in the processing of some agricultural commodities, such as cocoa, oil palm, sugarcane, coffee, and a variety of beverages. Several of them are vertically integrated into primary activities and have established their own industrial plantations.

31 Cotton is not a subject of this study but is depicted for comparison.

Table 7: Financial Profile of Notable Food Manufacturing Companies in Côte d'Ivoire (CFAF, millions 2017)

	Total Assets	Total Operating Revenue	Gross Profit	Operating Profit	EBITDA	Net Profit
SIFCA	587,170	523,140	180,376	62,219	104,104	31,921
Margin			34.6%	11.93%	19.97%	6.12%
PalmCi	127,546	134,831	57,375	11,687	25,850	8,708
Margin			42.56%	8.67%	19.18%	6.46%
LCSI	91,140	56,184	24,962	3,833	14,166	3,147
Margin			44.45%	6.82%	25.22%	5.6%
Solibra	258,729	193,372	45,501	6,707	27,342	4,250
Margin			23.53%	3.47%	14.14%	2.2%
Nestle	145,637	150,525	34,208	952	7,300	−4,308
Margin			23.04%	0.64%	4.92%	−2.9%
SICOR	3,680	1,105	762	140	316	101
Margin			68.95%	12.70%	28.63%	9.10%

Source: EMIS Business Intelligence.

Note: EBITDA = Earnings before interest, taxes, depreciation, and amortization

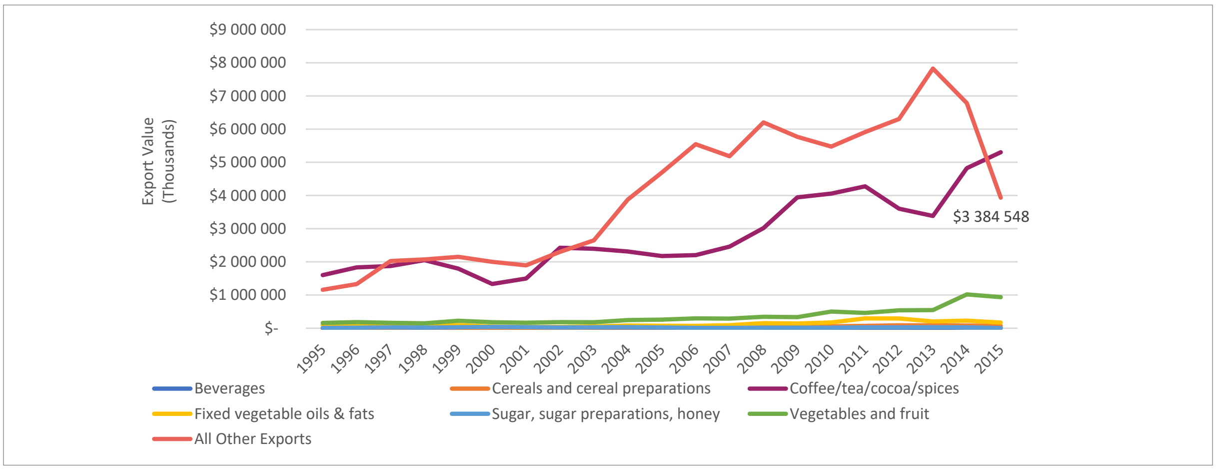
Many of these companies (and others) were created with heavy influence from the government and development partners over the past 60 years. It is notable that the state and/or development agencies have played a major role in the formation or ownership of several of these companies. However, despite the government's stake and investment in these businesses, many of them are still small by international comparisons**.** Additionally, not all have been market viable, for example, while there were eleven industrial rice milling factories in the 1970s now there is only one, which shows some consolidation in domestic producers (Yao 2017).

3.3. Exports

Côte d'Ivoire has shown strong export trade in cash crops—such as cocoa and coffee—which have not only led the exports of the horticulture sector but have also recently surpassed all of the country's other exports. Figure 18 shows the export growth across several horticulture-related product categories in comparison with all other items that the country exports. The clearest export trend has been meteoric but variable growth is seen in exports of coffee, tea, cocoa, and spices. Despite a dip in export earnings from 2011 to 2013—the result of a drop in the global price of cocoa during this period—these products have become the dominant source of foreign exchange earnings. Trade in fruits and vegetables contributes a much smaller amount but has grown significantly over the past several years to nearly US$1 billion per year in 2015. However, in these product categories informal cross-border trade is perhaps more prevalent throughout the region and thus the below statistics may underrepresent true exports.[32] Vegetable oils and sugars only account for a small amount of export value, despite the relatively high production volumes noted in figure 14. This suggests that much of the production is made for domestic markets. Similarly, the limited export competitiveness of cereal products suggests an implicit risk that these products may be subject to import pressures in the coming years.

32 For the intents and purposes of assessing export competitiveness, it may only be necessary to understand which products are being traded formally.

Figure 15: Côte d'Ivoire's Registered Exports of Horticultural Produce and All Other Items



Source: World Integrated Trade Solution (WITS).

Additionally, Côte d'Ivoire's agri-sector exports are highly concentrated leaving the country vulnerable to price shocks. Upon examining figure 16, it is apparent that the majority of exports are in cocoa and cocoa-based derivate products, which comprise more than half of all exports in 2016. Other significant horticulture sector exports include fruits, nuts, and coffee. For an economy or for a sector, a high concentration in markets can lead to systemic risk. Table 8 records the respective export product and market concentration indexes for the country.[33] This index can serve as a proxy for measuring export diversification. The Herfindahl–Hirschman (HH) Product Concentration Index is a measure of the dispersion of trade value across an exporter's products. Similarly, the HH Market Concentration Index is a measure of the dispersion of trade value across an exporter's partners. Thus, it is an indicator of the exporter's dependency on its trading partners and of the danger it could face should its partners increase trade barriers. In absolute terms, values above 0.18 show a relatively high degree of concentration (World Bank, s.d. *Orientation and Growth*). This concentration in relatively few product markets suggests that Côte d'Ivoire's agri-food sector could be vulnerable to trade shocks.

Figure 16: Côte d'Ivoire's 2015 Exports at the Harmonized Commodity Description and Coding Systems (HS) Three-Digit Level (US$, thousands)

33 A country with trade that is concentrated in a very few products/markets will have an index value close to 1. Similarly, a country with a perfectly diversified trade portfolio will have an index close to 0, as the market share would be equally divided. Typically, a HH value of less than 0.1 indicates good diversification, a value between 0.1 and 0.18 indicates moderate concentration, and a value greater than 0.18 indicates high concentration.

Table 8: HH Concentration Index for Côte d'Ivoire's Economy

HS Codes	HH Product Index		HH Market Index	
	2015	Number of Products	2015	Number of Economies
Fruit and vegetable products (HS06-15)	0.3546	233	0.1609	74
Food products (HS16-24)	0.4314	154	0.102	80
All exports	0.1154	2,598	0.0431	156

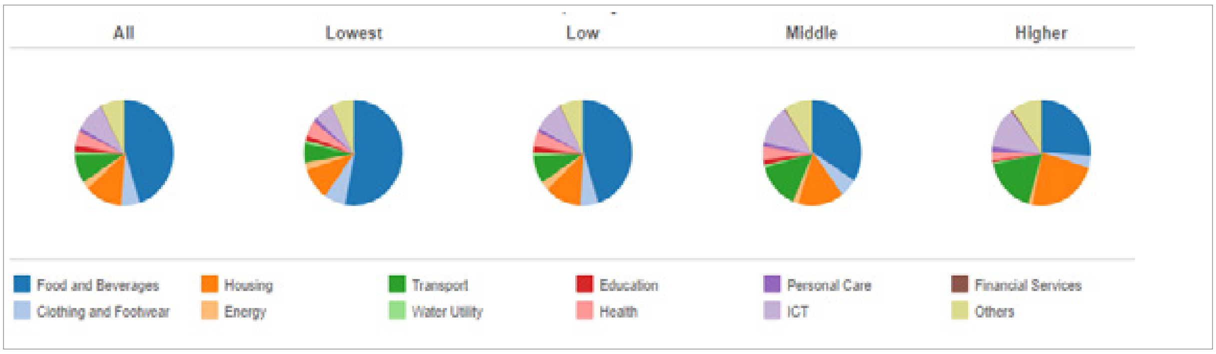
4. Opportunities for Côte d'Ivoire's Domestic Market

In this section, we define the scope of domestic demand, map out typical value chains for identified product segments, and compare typical value chains to current domestic supply chains. This will allow for the identification of potential market opportunities for women farmers in Bouaké and key bottlenecks that hinder optimal engagement in this segment. Based on the findings in this section, key policies and strategies required for successful engagement in identified areas of opportunity will be determined.

4.1. Demand Conditions

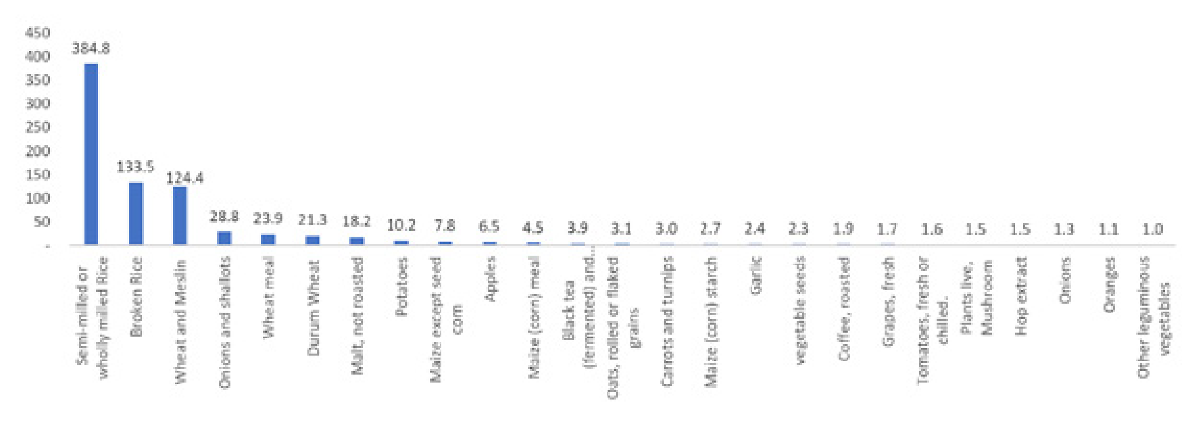
The majority of Ivorians remain poor and spend more than 45 percent of their income on food, resulting in price-sensitive consumers who are unwilling to pay a premium for quality or freshness. Despite the increase in domestic revenue by 80 percent between 2012 and 2015, the commensurate fall in poverty was on a much smaller scale, with the number of Ivorians living on less than CFAF 750 a day (US$1.30) falling from 55 percent in 2011 to 46.3 percent. On average, about 45.1 percent of household spending goes to food, with this decreasing slightly to 44.4 percent in 2015 and to 39.4 percent in 2018. Among this group, more than 50 percent of household spending goes to food (World Bank 2019). Given this, demand is highly driven by the need for basic calories, with consumers unwilling to pay higher prices for better-quality products.

Figure 17: Household Spending by Consumption Segment



Key imports are nonperishable products such as rice and wheat. The highest food product import was rice, both in its semi-milled and broken form. Demand for rice was valued at US$518.3 million in 2016, equivalent to 1.4 million metric tons. Likewise, of the 25 top imports for that year, 40 percent are nonperishable cereal products. In summary, the majority of demand in Côte d'Ivoire was actually for nonperishable products, with moderate demand for moderately perishable products such as tomatoes and limited demand for perishable products, specifically mushrooms. This is depicted in figure 18.

Figure 18: Key Imports by Product for 2016 (US$, millions)

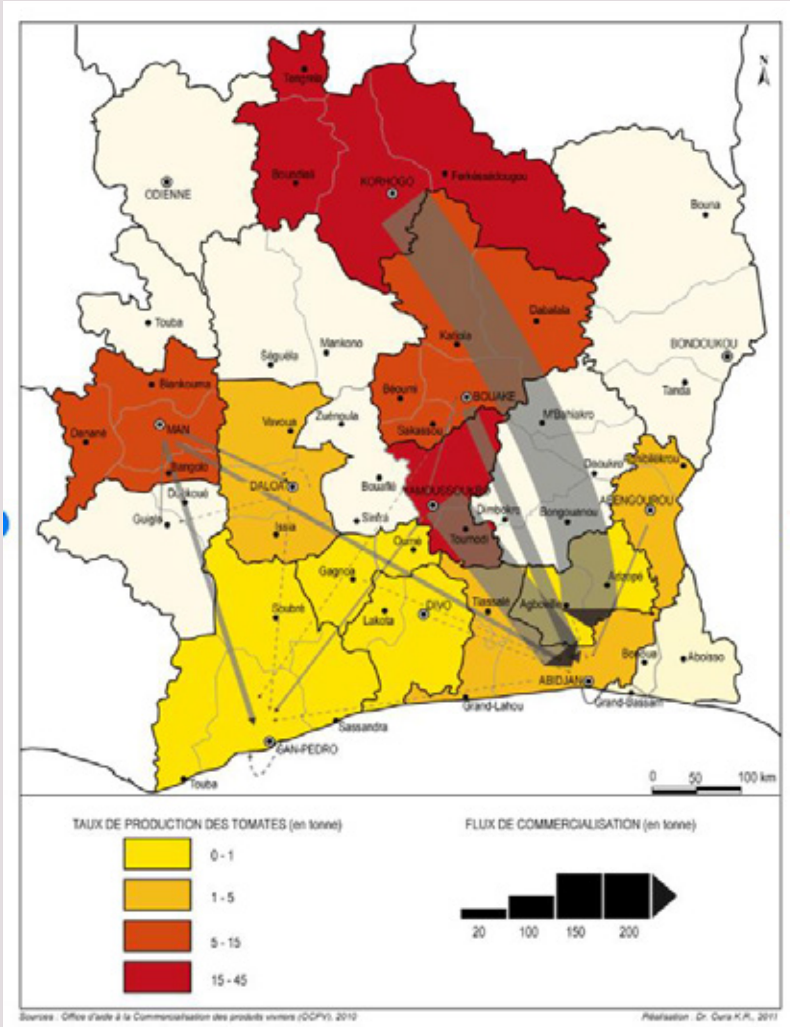


However, the growing middle class, increased tourism, and the rise in formal markets should result in increased demand for alternative market segments. There is a rising middle class in Côte d'Ivoire which should result in changing consumption patterns. Additionally, tourism is becoming increasingly important to the Ivorian economy. Total contribution of tourism to the economy rose from US$0.70 billion in 2010 to US$1.57 billion in 2017 with the number of international visitors increasing from 252,000 to 1.8 million in this period. (UNWTO 2018). These changes have heightened investments in the retail sector—although traditional retail outlets still dominate the market, there is a growing number of modern shopping outlets with the expansion of key brands such as Carrefour, CDCI, and Bonprix (Nielsen 2018) Additionally, the number of hotels in the country almost doubled between 2000 and 2015, with the government targeting another 5,000 new or renovated rooms by 2020. These changing patterns should result in increased demand for fresh and high-quality products (Oxford Business Review 2018a). Additionally, a buyer survey by the team already highlights the need for key moderately and highly perishable products such as tomatoes, gombo, and mushrooms**.**

Box 3: Case Study: Tomato Production in Côte d'Ivoire and Lessons from Morocco

Tomatoes are the most consumed vegetables in Côte d'Ivoire due to its use in a variety of sauces and salads. Though the annual production of tomatoes rose from 33,528 tonnes in 2012 to 40,000 tonnes in 2017 (FAO 2017), this is still not sufficient to meet current demand which is estimated at 100,000 tonnes per year. (National Center for Agricultural Research, Ivory Coast 2017) In addition, this increase in production quantities have solely resulted from the increase in the area under cultivation from 3,200 ha to 3,900 ha, despite the fall in yield, from about 104,775 hg/ha to 102,437 hg/ha. Also, post-harvest losses occur due to poor post-harvest management. Opportunities exist for farmers in higher production areas such as Bouaké to sell these products in lower production centers such as Abidjan as depicted in Figure 19.

Figure 19



In developing the tomato value chain in Côte d'Ivoire, lessons can be drawn from Morocco. In Morocco, tomatoes were the largest agricultural export in 2017, representing 1.76 percent of total exports valued at about US$824 million. In contrast to the case in Côte d'Ivoire, Morocco has experienced increasing productivity with yields rising from 779,507 hg/ha in 2012 to reach 814,303 hg/ha in 2017.

The tomato industry in Morocco is divided into two submarkets: the domestic consumption market and the export-oriented market. Tomatoes for exports are usually produced through technically advanced methods using greenhouses which allow for controlled production using optimal amounts of inputs (Bell 2012).

There is also a fair degree of aggregation and integration in the Moroccan tomato value chain as 40–55 percent of exporters are arranged into farmer cooperatives at the packing station level. Most cooperatives own one or more packing stations. These packing stations provide technical services for packing and wrapping of tomatoes before export. Packing stations are also the most important source of information for producers and sometimes organize the marketing process for these producers. In addition, cooperatives unite to form exporting groups that are tasked with the organization of all the logistics operations such as transportation (Chemnitz and Grethe 2005).

Finally, given the target market for these products, Morocco has been involved in the development of its infrastructure around food safety and traceability with the relevant articles being put in place from 2005. Key regulations include Articles 11–14 concerning food safety requirements, and Articles 4–20 focusing on traceability requirements.

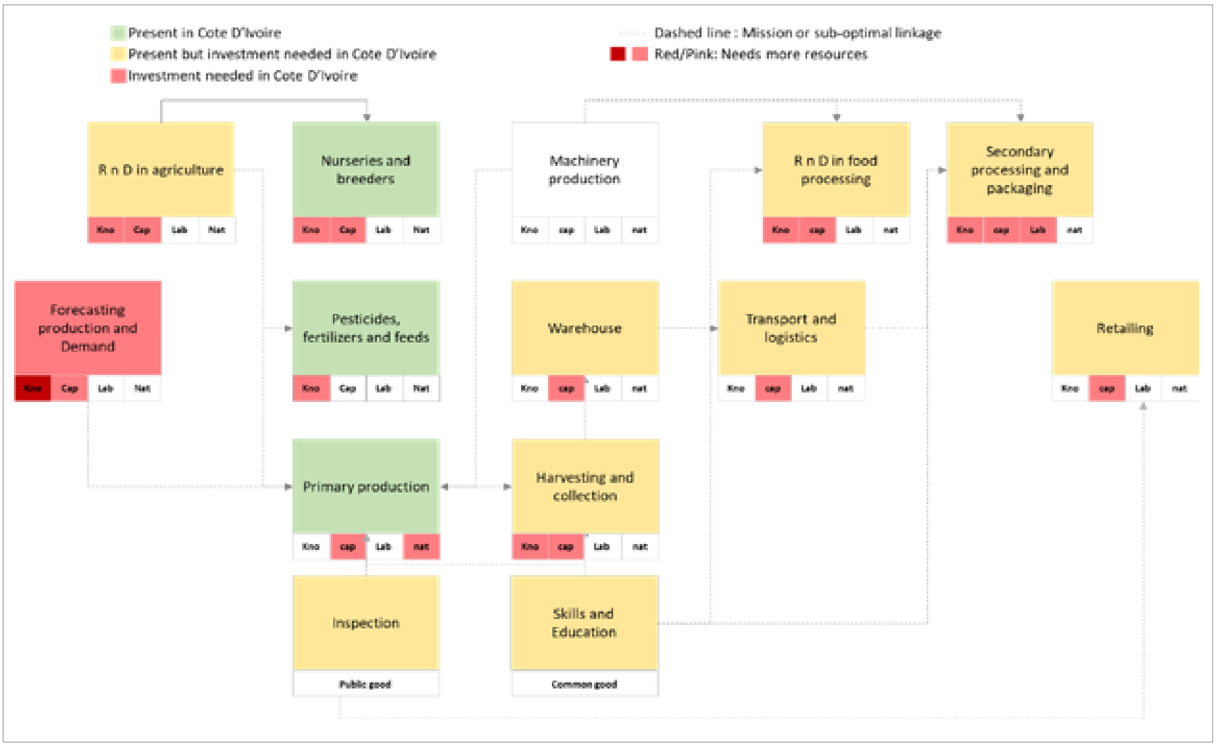
4.2. What Value Chain Activities Are Needed to Compete?

In this section, we map the prototypical value chain for segments A1 (calorie-driven consumers, stockable products) and B1 (calorie-driven consumers, perishable products) as identified in section 2.1. This value chain mapping will identify the key activities that are required for the optimal functioning of these segments of the market. We will then compare these prototypes to the current value chain identified in Côte d'Ivoire to determine areas of gaps requiring government policy or private sector investment. In particular, we will highlight when these gaps differentially affect the productivity and competitiveness of women farmers and agribusiness owners, relative to their male counterparts.

4.2.1. Value Chain Benchmarking: Calorie-driven Stockable Products

Figure 20 depicts the value chain for the stockable segment of the horticulture industry. As can be observed, the value chain in this segment has relatively low complexity. Products are geared toward mass consumption and therefore mass production. As such, this segment is becoming increasingly mechanized in advanced markets, a trend that will extend to all developing economies in due course. Large, capital-intensive transplanting and harvesting equipment will replace much of the manual labor that was traditionally involved in primary production activities. The investment in these expensive crop-specialized equipment (often in excess of US$250,000) often then reduces the number of crops that the farmer may produce, which limits their ability for flexible production (Calvin and Martin 2010). Inputs (seeds, fertilizers, and chemicals) will also be sourced from multinational companies, such as Dow or Monsanto. Finally, since the products have low perishability, they also have low time pressures for delivery, which affects the methods of distribution (Lapres 2018b).

Figure 20: Value Chain Benchmarking



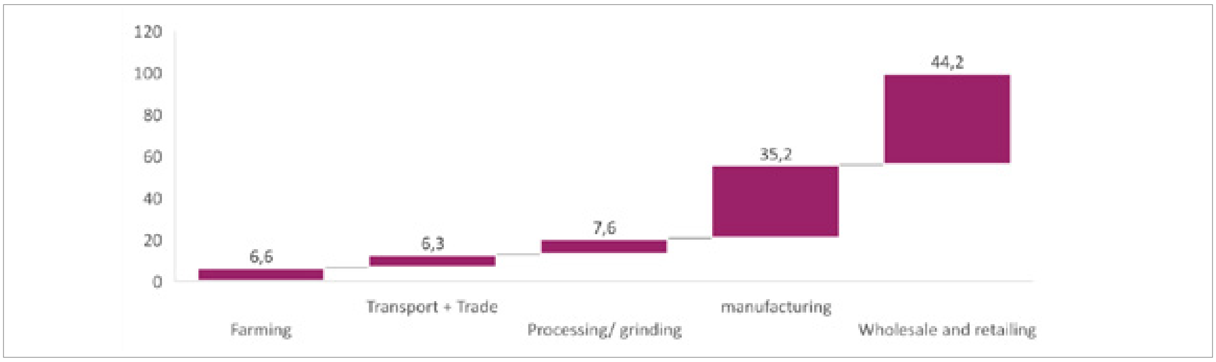
a. **Primary players: Producers, processors**

Majority of production is targeted at the low perishable segment but retaining competitiveness in this segment requires increased scale and mechanization. In the Bouaké region, key stockable crops include cashew, cocoa, and coffee and low perishable products include tubers such as cassava. The shift to mechanized agriculture is changing the factor of production mix required for success in this market segment. Specifically, as outlined earlier, there is a movement toward larger-scale, technology-based agricultural processes. As other regions such as Latin America continue to adapt their production methods to fit the changing dynamics, there will be increasing competition for farmers in Côte d'Ivoire. (World Bank Group, 2017). To maintain market dominance in the long term, farmers must expand their scale of production while also increasing their use of both capital and knowledge.

Similarly, harvesting in Côte d'Ivoire is still heavily labor intensive—with inefficient processes resulting in crop loss and reduced crop quality. Another key primary activity is the harvesting of these stockable products. Proper harvesting maximizes yields, minimizes fruit/vegetable damage, and improves the quality of the final products. Currently, harvesting of stockable products can be done through either mechanized methods, such as is the case with rice, or more manual methods such as is the case with cocoa and coffee. Countries are beginning to use knowledge and capital to improve their harvesting methods. For example, fast-vibrating manual harvesters are used to harvest coffee in Brazil (Rachel 2019). However, harvesting in Côte d'Ivoire is still heavily labor intensive, usually involving ad hoc, untrained labor. Movement to improved harvesting methods could result in increased yield of products in this segment.

There is a growing number of food processors in the stockable segment; however, an understanding of the point of value creation is important in determining processing activities to incentivize. Côte d'Ivoire is the largest source of ground cocoa in the world highlighting the presence of food processors in the stockable segment of this sector. There are both domestic and international processors of coffee, cocoa, cashew, and other key stockable products. The push by the government has been for a movement 'up the value chain'. However, it is important that the points at which value is created are understood. For a crop such as cocoa, the majority of the value creation is done at the wholesale and retail levels—which often requires high levels of knowledge and marketing investment. Therefore, policy makers should consider these points of value creation in determining appropriate policy decisions (Minor and Cummins 2017).

Figure 21: Value of Cocoa By Activity in the Value Chain



(Data from Minor and Cummins 2017)

b. Input Suppliers

While there are domestic and foreign input suppliers of fertilizers, seeds, and equipment, there is still scope for increased input use. There is both government and private sector engagement in the provision of seeds. Public agencies such as the *Centre National de Recherches Agronomiques* (CRNA) and the *Office National de Développement de la Riziculture* (ONDR) are key producers and distributors of stockable seed varieties covering products such as cashew, cocoa, and rice and low perishable tubers such as cassava. However, in recent years, there has been a decline in the productivity of tree crops brought about by ageing and diseased trees, suggesting the need for replanting using improved seedlings. Likewise, for other stockable products such as rice, the productivity in Côte d'Ivoire is much less than in key countries such as China and Brazil. Specifically, the productivity for rice paddy in Côte d'Ivoire is 25,569 hg/ha as compared to 62,096 hg/ha for Brazil and 69,093 hg/ha in China. A contributor to this is the use of improved seedlings by some of these comparator countries. For example, China uses rice seedling that allows for increased second harvest yields (Hart 2018). Likewise, the use of fertilizers remains low in Côte d'Ivoire with average NPK[34] fertilizer use estimated at 51.7 kg/ha in 2016 as compared to 71.1 kg/ha in Morocco, 186.1 kg/ha in Brazil, and 503.3kg/ha in China (World Bank 2016b). Finally, farming processes remain relatively manual with equipment use estimated at 32.1 tractors per 100 m^2 (World Bank 2019).

34 Nitrogen, Phosphorous and Potassium

c. Services

Limited working capital and weak governance structures and know-how prevent direct access to markets for cooperatives/aggregators. There are about 3,920 registered cooperatives in the country; however, a majority of these cooperatives are defunct (GIZ 2015). Producers in the stockable segment such as cocoa and coffee are heavily involved in cooperatives, for example, 50 percent of cocoa farmers are cooperative members. However, only a limited number of these cooperatives can effectively serve the role of aggregator and foster links to markets. Major constraints to this include poor governance structures and limited working capital.

The logistics needs in the stockable segment are less sophisticated and geared toward second-party logistics (2PL) and third-party logistics (3PL) companies (Lapres and Bacic 2017). In Côte d'Ivoire, the logistics sector is valued at 3.8 percent of GDP or US$1.52 billion with significant growth in the transport segment due to the entry of small, unorganized companies. The logistics needs for stockable products are mostly geared toward 2PL or 3PL warehousing facilities (see box 4) that can aggregate products until the time that large shipments can be made to institutional buyers. As such, the logistics operators and traders supporting the segment tend to be less sophisticated. Currently, most of the companies that service this industry are 2PL and first-party logistics (1PL) companies, with prices often negotiated on the spot based on the distance of travel. Given the weakened negotiation position of farmers, transportation costs are often high for these farmers. In addition to this, the absence of the required warehousing infrastructure limits the ability to store these stockable products.

Box 4: A Summary of Logistics Models

There are several models by which the industry (broadly speaking) can carry out logistic functions. In general, these can be divided into the following:

- **First-party logistics (1PL)** describes the operation of logistic and distribution functions by the firm (or farmer) themselves. Under this model, the firm owns its own trucks and takes care of packaging and transport of its own product from one place to another.
- **Second-party logistics (2PL)** describes a logistics model wherein production firms (or farmers) will palletize their own product and hire the space from a second-party firm, which owns the means of transport (such as an airline or trucking company), who then delivers the product to a defined destination using only one mode of transport. These services are generally performed on spot exchanges.
- **Third-party logistics (3PL)** is a term used to define logistic services when all of a company's logistic operations are outsourced to a specialized provider, which then takes responsibility for customizing intermodal transport (for example, air, rail, sea, or truck) using its own equipment or by sourcing services from a third party (for example, a passenger airline). As such, a 3PL provides bundled services—including warehousing, packaging/palleting, cross-docking, customs compliance facilitation, and freight forwarding—and takes ultimate responsibility for delivery using a vast network of different modes, hub infrastructure, and competently outsourced 2PL providers (where required). These services are generally performed using established contractual links between parties.
- **Fourth-party logistics (4PL)** offers all the services a 3PL provider does, but critically the 4PLs take on a more active role in the supply chain's management. In fact, the 4PL will take on aspects related to inventory management, wherein the provider will act as a broker that organizes purchase orders on a daily basis. This is the most sophisticated level of logistic service provided on the market and only a few companies—such as Khuene+Nagel and Panalpina—offer such services for perishable goods.

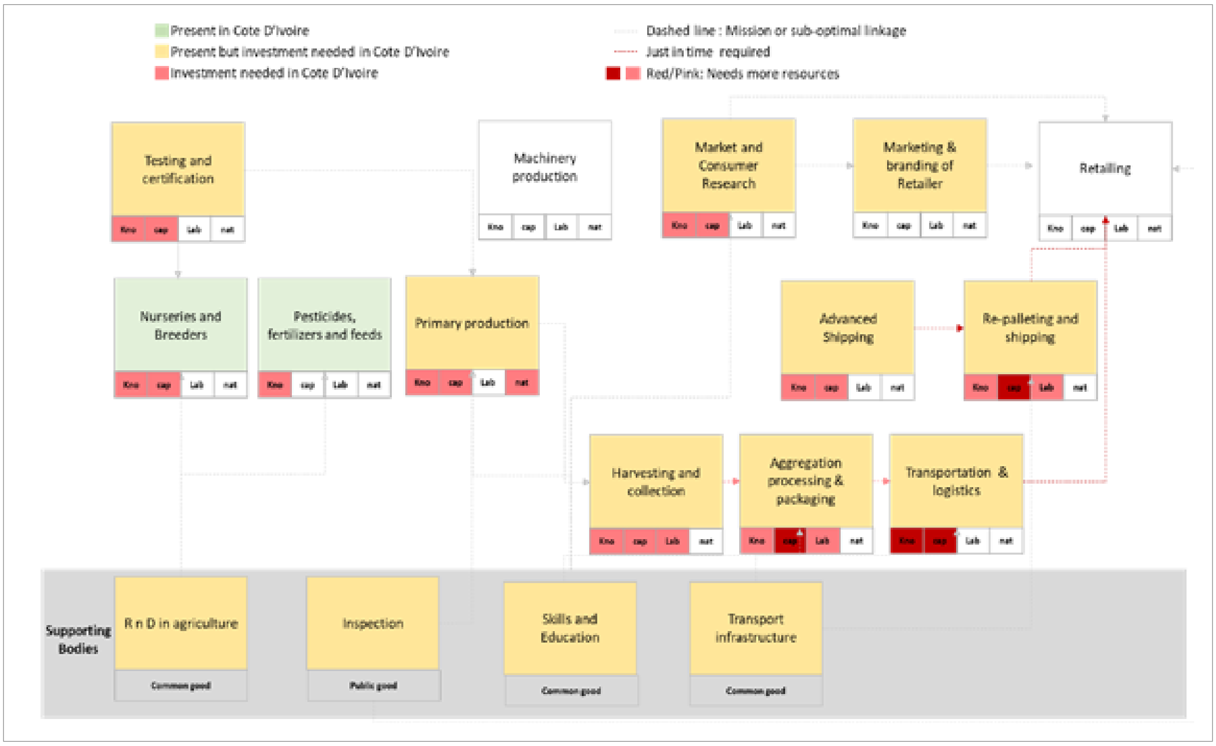
While in the past, most food firms or farmers maintained some control over the distribution of their product in localized markets, increasingly distribution is becoming an outsourced function that is more efficiently and effectively carried out by a 3PL or a 4PL provider. Higher degrees of logistic services are necessary to enable export competitiveness of agricultural industries.

Despite growth in the financial sector, accessibility of financing remains a challenge for women farmers. Since 2011, the banking sector has grown rapidly fueled by the emergence of a middle class, initiation of investment programs, and increased private investment. As of December 2019, there were 27 active commercial banks (including 4 public banks), 2 specialized financial institutions, 62 licensed Microfinance Institutions (MFIs), three mobile money operators and 29 insurance companies. Despite having one of the most developed financial sectors in WAEMU, the Ivoirian financial sector is dominated by banks, which are liquid but risk averse. Furthermore, financial inclusion, though growing from 34 percent in 2015, still remains relatively low as only 41 percent of the adult population had an account by 2018, though a +6 percent increase for women indicates a potentially positive trend. Additionally, the gender gap in financial account access is widening. As in 2014, 39 percent of men had access to an account as compared to 30 percent of women (World Bank Group, 2018). By 2017, while 47 percent of men had access to a financial account, only 36 percent of women had access to an account. Banking services to the agricultural sector are also limited. Credit to the agricultural sector was about 5.2 percent of total credit in 2015 as compared to 29.0 percent for the industry (IMF, s.d.).

4.2.2. Value Chain Benchmarking: Calorie-driven Perishable Segment

Figure 22 depicts the value chain for the perishable segment of the industry. As can be observed, this differs from the traditional value chain mostly due to the relevance of a sophisticated logistics management system. Given the perishability of products in this segment, frequency of delivery, optimized packaging systems, temperature-controlled storage, and transportation of products are increasingly important, resulting in the need for more complex logistics systems.

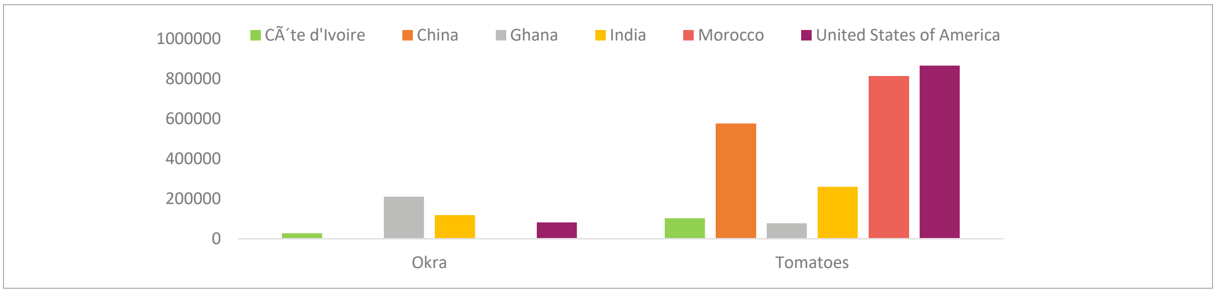
Figure 22: Value Chain Benchmarking



a. Primary Players: Producers, Processors

Though farmers are mostly involved in the production of stockable products such as cashew and low perishable tubers such as yams and cassava, some women farmers already produce moderately perishable products such as tomatoes and highly perishable products such as okra. However, there is limited production of these perishable products due to a combination of low productivity and low scale of production. Yields of these products in Côte d'Ivoire are significantly below those of other producers as depicted in figure 23. For example, the yield for okra is 27,798 hg/ha as compared to 81,609 hg/ha in the United States. For tomato, the yield is 102,437 hg/ha as compared to 577,066 hg/ha for China and 814,303 hg/ha in Morocco.

Figure 23: 2017 Yield by Country



Source: FAO, s.d.

Though scale of production is small, required farm sizes for perishable produce tend to be smaller than those for stockable products. The smaller sizes of farms are an outgrowth of the necessary care at harvest needed for crops, which makes mechanical harvest and mass production less viable. Instead, these characteristics make perishable segments adapt more to smallholder models. Nonetheless, plot sizes of global benchmarks for perishable crops are generally bigger than the average farm size observed in Côte d'Ivoire. For example, approximately half of Morocco's (rather successful) tomato exporters have farms between 5 and 20 ha, while approximately 15 percent have farms above 20 ha as depicted in table 9. Similarly, in the US state of Virginia, producers of highly perishable blueberries have a median plot size of 8 ha.[35]

Table 9: Structure of the Moroccan Export Tomato Sector

Number of Total Export Vegetable Producers	Number	
Number of total export vegetable producers	8,000	
Number of total export tomato producers	400	
Of which number of exporter groups exporting tomatoes	*Circa 12–15*	
Share of the three largest exporter groups on total exports	70%	
Farm size	**% Area**	**% Farms**
Farm size from 0–5 ha	5–10	30–35
Farm size from 5–20 ha	45–55	50–55
Farm size larger than 20 ha	35–40	10–15

Source: Chemnitz and Grethe 2005.

The reason for this need for scale rests in the need for on-farm cold chain infrastructure that can rapidly cool produce to ensure that the respiration rate is slowed immediately after harvest. Only farms with some minimum amount of acreage (circa 5–20 ha) can invest in the capital assets needed (Lapres 2018b). However, the intent of such capital in perishable segments is not to ensure that the product remains on-farm in refrigerated space for very long since the product should be moved to market as soon as possible and ideally no later than 24 hours after harvest. However, the ability to coordinate such movements requires the presence of proficient logistics operators.

Water adequacy is also a challenge for farmers. Water needs for perishables such as tomatoes are above those of current key crops such as cocoa and coffee. Despite this, only 15 percent of irrigatable land is equipped for irrigation, this is equivalent to 73,000 ha of the 475,000 ha of land that can be irrigated (FAO 2017). Boosting access to irrigation facilities for farmers would allow for year-round production and increased yield.

35 In the US state of Virginia, the mean berry farm size was 36 ha while the median was only 8 ha. This compares to the mean farm size (for all crops) which was 73 ha (Monson and Mainville 2009).

b. Input Suppliers

Seeds for key perishable products such as okra and tomatoes are available domestically; however, there is a need for hybrids and improved seedlings. Key seed providers have distribution channels in Bouaké. However, there are challenges associated with available seed species, as it is estimated that 90 percent of varieties used are old-fashioned varieties. Additionally, most farmers opt to use self-saved seeds which are often low-yield seeds already infected with diseases. Hybrids, apart from those for cabbage and some tomatoes, are rare to find in Côte d'Ivoire. Additionally, these are often developed for more Mediterranean climates, which means that they can only be grown during specific periods in Côte d'Ivoire, leading to sharp seasons. Due to this, Ivorian supermarkets prefer to import vegetables where supply consistency is guaranteed (Nugteren 2018). Challenges with fertilizer use and mechanization are as highlighted for the stockable segment.

c. Services

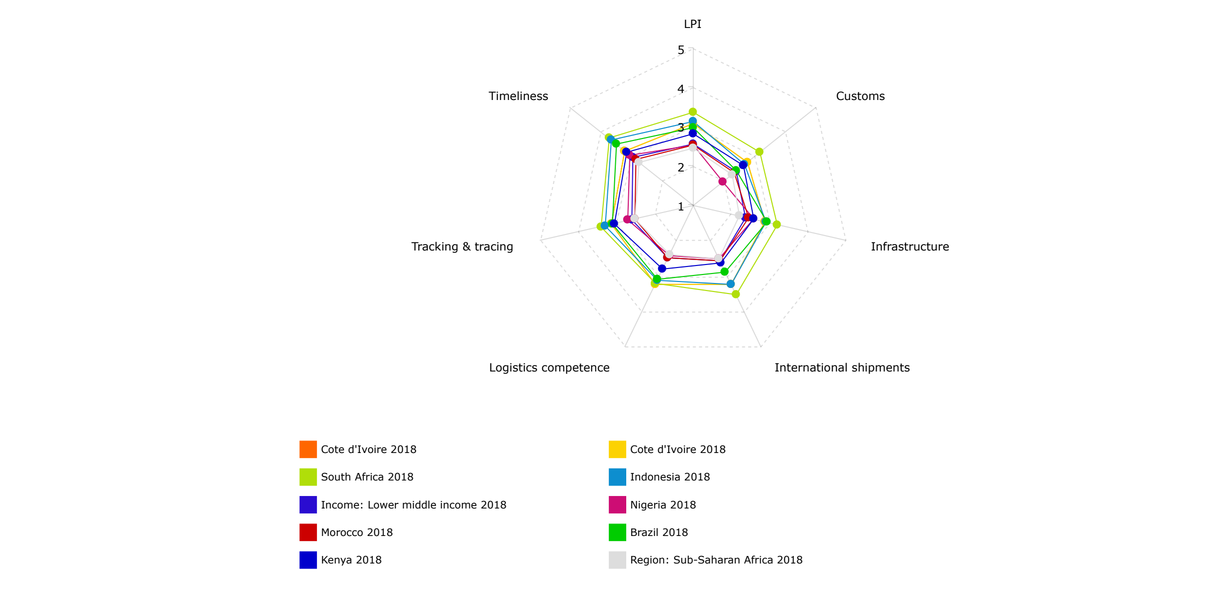
Given the level of perishability, these products are often more sensitive than stockable products and require more care at harvest. This is a function of (a) the fragility of the item (for example, fleshy and soft berries tend to be more fragile and less able to be harvested with mass manufacturing equipment than say tubers which are more easily harvested) and (b) necessity of respiration control using (i) cooling to halt temperature rises immediately after harvest and (ii) atmosphere control to halt enzymes that lead to premature ripening (Garcia and Barrett s.d.). Due to this, the supply chain is often more labor intensive and requires more on-/near-farm investment in cooling infrastructure (Lapres 2018b).

However, current harvesting methods do not take the need for care into consideration resulting in crop loss and quality reduction. Current harvesting usually involves the use of ad hoc staff employed just for the harvesting period. These staff often lack knowledge on proper harvesting methods and processes. Additionally, harvested products are not treated with the necessary respiration control and handling care, with products often collected and put in wooden boxes or big bags. These inefficient processes lead to heavy losses and reduction in product quality (Nugteren 2018).

Additionally, current aggregation techniques erode profit margins from the farmer. In competitive horticultural economies, investments by 3PL/4PL operators are needed to aggregate products at centralized hubs—which are often collocated with transport infrastructure such as ports—where they can be palletized and shipped by destination. Currently, aggregation in Côte d'Ivoire is carried out by wholesalers that purchase fruits and vegetables at the farmgate (Lapres 2018a), often at low prices ensuing that the farmer only receives a limited share of the crop value.

Improving logistics performance presents opportunities for Côte d'Ivoire. Côte d'Ivoire ranks 50th in the most recent logistics performance index (LPI). There has been a steady increase in the logistics capabilities in the country as the LPI improved from 2.36 in 2007 to 3.08 in 2018 with improvements in infrastructure, compliance, international shipments, tracking and tracing, and timeliness. Additionally, Côte d'Ivoire scores better than comparator countries in key logistics performance metrics as illustrated in figure 24. Specifically, the LPI for Côte d'Ivoire is above key comparators such as Kenya, Nigeria, Brazil, Sub-Saharan Africa, and Morocco.

Figure 24: Logistics Performance Index



Côte d'Ivoire also has a good road network with over 50,950 miles of roads: 4,903 miles are primary roads, 3,963 miles are paved secondary roads, 85 miles are highway with key transport networks as highlighted in figure 29. Since 2012, there has been significant primary road construction and existing road maintenance. At a distance of 356 km from Abidjan, Bouaké is a 4 hour and 30 minute drive from the markets in Abidjan. However, the conditions of the secondary and local roads are still generally bad with limited maintenance and ability to cater to high-capacity trucks with capacity of 10 to 15 tons (Logistics Capacity Assessment 2018).

Figure 25: The Road Networks in Côte d'Ivoire

Côte d'Ivoire also has rail and sea transport infrastructure. The autonomous port of Abidjan is the most sophisticated port in West Africa and the second most important in Africa after the Durban Port in South Africa. The Port of San-Pedro has 144 refrigerated areas with power supply for refrigerated containers. The port has three adjoining warehouses with a total area of 13,800 m² including 3,000 m² of cold room storage space. Côte d'Ivoire also has numerous railway lines that perform a key role in the nation's logistics transport infrastructure. Some of these lines include the Bamako-Ferké (Ferkessédougou)-Abidjan rail/road corridor that stretches over 135 km in Côte d'Ivoire and 479 km in Mali and the 1,260 km of rail connecting Abidjan to Kaya in Burkina Faso which is currently undergoing rehabilitation (IFC 2019).

Figure 26: The Railway Networks in Côte d'Ivoire

Breakdown of Railway Line between Abidjan (Cote d'Ivoire) and Ouagadougou (Burkina Faso)

Country	Freight Station	Distance from Abidjan (km)
Cote d'Ivoire	Abidjan-Treichville	-
Cote d'Ivoire	Dimbokro	186
Cote d'Ivoire	Bouaké	335
Cote d'Ivoire	Katiola	381
Cote d'Ivoire	Ferkessédougou	556
Cote d'Ivoire	Ouangolodougou	606
Burkina Faso	Niangoloko	660
Burkina Faso	Banfora	706
Burkina Faso	Bobo-dioulasso	806
Burkina Faso	Koudougou	1,055
Burkina Faso	Ouagadougou	1,055

However, the service capacity for the 'frequency of delivery' in the perishables segment implies a need for sophisticated logistics systems in this segment (Lapres 2018a), which is often unavailable in Côte d'Ivoire. Perishable products not only require efficiently run and consistent logistics options, but also require temperature-controlled logistics (TCL) systems. Although there are organized 3PL service providers in the country (both multinational and domestic), majority of TCL is done in-house by end users, therefore a 1PL structure. However, these companies are only responsible for 10 percent of the total TCL market. Key retailers, players in the frozen food industry and international hotel chains primarily use their own in-house TCL systems. Small-scale farmers often work with the unorganized players who do not have access to these TCL solutions. Instead, products are mostly transported via unrefrigerated trucks or containers to San Pedro and Abidjan which raises waste levels and limits product value (IFC and Frost and Sullivan 2019).

Additionally, to ensure that producers meet the demands of this evolving market, it is necessary to invest continuously in market and consumer research. Market and consumer research can be used to identify both the precise geographies of demand and the nature of demand (that is, types of perishable products and consumer segment trends). While such research is sometimes done by independent agencies, in more recent years, it has been a service that has been vertically integrated into specialized 4PLs that ensure that products being shipped would have a buyer in the foreign markets before harvest. Since the market demand for perishable products changes on a weekly (if not daily) basis, such information needs to be reliably fed back into the system of primary production so that the value chain can adapt to the market. Thus, industries operating in perishable segments must be willing to invest in brokers that can enable a high information exchange between buyers, distributors, and producers. Such services would provide invaluable access and coordination functions that enable market viability. Currently, there is no considerable investment in market research and very few firms go a step further and hire qualified and licensed brokers, that could push the product in both domestic and export destinations (Lapres 2018a).

d. Supporting Bodies

In the perishables sector, adherence to sanitary and phytosanitary (SPS) and food safety controls is extremely important. Despite the existence of several bodies tasked with the institution of systems for quality control including the National Institute of Public Hygiene for sanitary approval, Codinorm for certificates of conformity, the Ivorian Office of Industrial Property, and the Chamber of Commerce and Industry that recently carried out work on the creation of quality labels, adherence to quality remains a challenge in Côte d'Ivoire with fresh fruits having the highest noncompliance rates (Montet Didiera. 2017)

The knowledge and skills ecosystem surrounding the industry is important to consider. Typically, knowledge and skills can be found in the system of universities and faculties, vocational schools, and independent research bodies. Publicly funded research in the agriculture sector is carried out by a mixture of public (and some private) universities and research institutes. The in-country research capacity has increased markedly in recent years both with reference to government and research institutions. The number of FTE agricultural researchers has increased from about 7 per 10,000 farmers in 2011 to 10.1 per 10,000 farmers in 2016 with the most pronounced growth occurring at the university level (ASTI by IFPRI 2017). Additionally, Côte d'Ivoire has more advanced research infrastructure, produces more publications and new varieties, and maintains better links with extension services than other West African countries. However, research spending has remained relatively stagnant over time (Gert-Jan, Domgho, and Sékou 2018). Beyond research, there is also currently a deficit in specialist in horticulture and the current extension services particularly the public one does not have enough specialized experts or technicians in horticulture.

Limited coverage of digital connectivity: Even though national connectivity has increased, rural connectivity is still lagging, and women have lower access to ICT services compared to men. Access to ICT services is needed for greater efficiency of agriculture services: extension services, finance, traceability (ex: blockchain technology)

Lack of adequate marketing infrastructure: there is a lack of marketing and logistic infrastructure (assembly centers, storage, wholesale markets) near the production areas as well as the consumption centers.

e. Link to Retailers

Despite the dominance of traditional retail stores, changing country demographics should increase the demand for more organized retail structures. Traditional retail stores such as kiosks, open markets, and convenience stores still dominate food trade in Côte d'Ivoire as Ivorian shoppers value the ability to bargain and the existence of all products in one concentrated area. Specifically, convenience stores and open markets are responsible for 67 percent of consumer packaged goods sales. However, increasing urbanization, the growing middle class, and the increasing demands of Ivorian citizens for more organized shopping have spurred the growth of modern retail structures leading Côte d'Ivoire to have one of the more developed modern grocery retail market sectors in Sub-Saharan Africa. Currently, the organized retail market is fragmented with a lot of small independent retailers. Some of the major chains already have outlets in the Bouaké region.

For more organized buyers, it is essential to meet the publicly mandated SPS standards to become a supplier. 3PLs and 4PLs can often assist in documenting product compliance with mandatory SPS standards. Grocery store buyers are also often unwilling to rely on national systems alone to ensure compliance with their increasingly advanced demands. Therefore, they also use a mixture of individually published product qualities and private certification regimes to ensure compliance in the supply chain. Some of the more common requirements noted by the grocery retail industry, include the following:

- Reduction in the use of pesticides and other chemicals in primary production, as verified by product testing that shows detectible residues below published thresholds. Use of nongenetically modified varieties is commonly required
- Supply chain traceability of all products from farm to market
- Certification for social and environmental standards in primary activities, such as the international certification regime for global good agricultural practices (GAP), which ensures standards in primary production
- Product quality specification, which—although defined specifically by the individual crop—often includes dimensions for product appearance, ripeness, and acceptable levels of decay at the time of delivery. Consistency of such quality across batches is also weighed heavily by retailers
- Packaging and labeling which (a) maintains the quality of the perishable product for as long as possible and (b) presents it for the consumer segment being targeted (Lapres 2018a).

4.3. Suggested Solutions to Gaps in the Value Chain

The value chain mapping in section 4.2 revealed several challenges that undermine women farmers and agribusiness owners' competitiveness in the stockable and perishable product segments of the horticulture value chain.[36] In the stockable segment, women will need to overcome constraints to increase scale of production while in the perishable segment, increasing the availability of agribusiness support and logistics services, as well as women's use of these services. Women operating in both segments would benefit from increased public and private sector investment in smart irrigation equipment, services, and infrastructure, national quality infrastructure, extension services adapted to the specific challenges women farmers face, and targeted provision of productive inputs such as fertilizers and improved seed varieties. Meanwhile improvements in the legal and administrative land frameworks and policies aimed at closing the gender financial gap could foster a more supportive legal and regulatory environment for women farmers in both segments. This section explores in greater detail the government and private sector actions and investments that could help boost women's competitiveness in the horticulture sector over the short-term, medium-term, and long-term.

4.3.1. Maximizing Financing for Development: Private Sector Solutions

Cooperatives as Key Service Providers

By fostering the negotiation power associated with aggregation, cooperatives have helped small-scale farmers get better access to resources and inputs. This is particularly relevant for women farmers who are at a larger disadvantage as they have less bargaining power, are less connected to social networks, and have less initial capital. Cooperatives could play an integral role in tackling some of the identified bottlenecks by allowing women farmers to collectively negotiate better price terms and access a range of resources and services (FAO 2012).

Currently, cooperatives in Côte d'Ivoire perform the role of middlemen by primarily buying products from the farmer and selling them directly to wholesalers and retailers. A redesign of this system would move these cooperatives into the position of key service providers. Specifically, cooperatives could provide key services such as the following:

- **Brokering.** Linking the farmers to potential buyers and aggregating supply to levels required to meet buyer needs.
- **Market and consumer research.** Cooperatives can also serve as sources of information on the scope and type of market demand, supplier requirements and policies, and so on.
- **Aggregation and packaging.** Cooperatives could work with farmers to provide aggregation and packaging services ensuring that fruits and vegetables are packaged and stored in a way that minimizes wastage and optimizes quality.
- **Warehousing and storage.** Cooperatives can provide logistics services such as warehousing and transportation service management. Transportation service management would involve liaising with transportation facilities to ensure consistent and cost-effective logistics services.

Private sector investment will be critical to developing the capacity of cooperatives to provide additional farmer and agribusiness support services. Prioritizing capacity-building efforts (e.g. skills development, capital provision, networking support) with women-led cooperatives would have a dual impact of not only developing women farmers' expertise and ability to generate income through the provision of these services, but also could enable the female members of the cooperatives to benefit from the increased availability and use of these services. As discussed in section 4.2, these types of support services are currently limited in Côte d'Ivoire creating a bottleneck in horticulture value chains. Women farmers could help fill these gaps in the value chain, and in doing so, improve the functioning of stockable, and especially perishable, value chain segment activities.

36 While many of the constraints to productivity and competitiveness identified in section 4.2 are applicable to both women and men farmers and agribusiness owners, these constraints often disproportionately affect women farmers who have lower capital base, more limited networks, and less frequently use extension services and other key productive inputs, relative to their male counterparts.

Employing Smart Irrigation Strategies

Poor access to water remains a constraint for both men and women farmers in Côte d'Ivoire. The dependence on rain-fed agriculture leaves farmers vulnerable to climate risks and reduces yield. Increasing access to irrigation would allow for year-round farming while also increasing productivity. Several irrigation options are available to farmers, from small-scale traditional irrigation methods such as the use of motorized pumps and water pumps to more innovative irrigation options (see Annex B1.1). Some of these innovative options include the following:

- Microdosing, which involves the application of water in small amounts to allow for efficient water use, for example, drip irrigation. In Ghana, a pilot project using drip irrigation on onion farms led to farmer income growth of over 100 percent;

- Sprinkler irrigation, which also controls the way water is distributed and includes center-pivot irrigation systems, floppy sprinkler systems, and so on;

- Irrigation using renewable energy such as solar powered pumps. In Benin, these irrigation techniques led to an 80 percent increase in the standard of living of pilot farmers (Malabo Montpellier Panel 2018).

Women farmers may face additional constraints to accessing and using smart irrigation technology. A woman's ability to adopt a smart irrigation technology may be shaped by multiple factors, including her ability to obtain financing for the technology, receive tailored training on the technology, and navigate power dynamics of asset ownership within the household, among others. In addition to providing the required irrigation infrastructure, it is essential to develop innovative financing systems that will increase the financial viability of the introduction and maintenance of these irrigation systems. Indeed, farmers often cite the lack of financing options as one of the main barriers to adopting modern agricultural technologies. For women farmers, these financial constraints are often greater than they are for men, due to women's lower likelihood of owning land or assets that can serve as collateral for larger individual loans.

Additionally, training adapted to the specific needs of women farmers—in terms of content and timing/location of delivery—could help build the requisite knowledge base for the functioning of these systems. Engaging men through these trainings may be of particular importance, given that men often hold priority control of productive assets within households, even when they are jointly owned with women. Evidence from Mozambique indicates that when women and men within a household jointly owned livestock, men were the primary decisionmakers over technology use and production practices **(**Quisumbing et al. 2015). Trainings that involve joint action planning between couples in agricultural households could help ensure more equitable decision-making over allocation of resources on the farm. Preliminary results from an impact evaluation in Côte d'Ivoire showed that when couples participated in a training on agricultural best practices, which taught skills in rubber cultivation and involved the creation of a joint action plan for rubber cultivation, women's management of cash-crop tasks increased, spouses perceived women's agricultural knowledge to be better, and the couple shared more agricultural decisions. Households also saw substantial increases in the value of household agricultural production and productivity.

Promoting Private Sector Investment in the Required TCL

Sufficient demand is a key requirement for private sector engagement in the provision of TCL equipment, infrastructure, and services. The limited domestic demand for perishable products and buyer price sensitivity act as deterrents to private sector engagement in this sector. However, private sector engagement can be incentivized by the following:

- **Consolidating and aggregating demand across product categories.** The demand for products requiring cold chain is significant and spans beyond perishable horticulture products to include animal products such as dairy, fish and seafood, and meat. The total value of this market is estimated at US$45 million. Incentivizing private sector investment might require a focus on the wider market as opposed to narrow segments within the market.

- **Promoting exports.** As already outlined, there is significant and profitable world demand for perishable products. Promoting product exports could create the financial incentive required to incentivize private sector engagement. However, increasing women's engagement in cultivating and marketing perishable products for export may entail tailored training and incentives to shift women into different, more profitable segments of the value chain, especially those more often occupied by men. Promising evidence from Uganda shows that small incentives and a cooperation-based couples' training which encouraged men to transfer or register new out-grower contracts to their spouses increased women's participation in cash crop value chains, suggesting that engaging men may help shift gender norms around cash crop production (Ambler et al. 2018). Furthermore, developing women farmers' socioemotional skills, through psychology-based trainings for example may be another promising avenue, given that findings from Malawi suggest women farmers' higher non-cognitive abilities are linked with higher production of cash crops (Montalvao et al. 2017). In addition, women may opt out of producing perishable products for export based on the perception that producing such products at commercial scale requires large upfront investments and high exposure to price fluctuations in the market. Therefore, insurance products adapted to women's specific needs could potentially decrease the risks they face and encourage them to switch to more valuable crops—although more research is needed to verify these benefits (Delavallade et al. 2015).

- **Enforcing government policies**
    - The update and implementation of improved food quality standards which should result in increased demand for cold storage;
    - Targeted financial incentives such as loans at affordable interest rates; and
    - Investments in public goods such as road infrastructure.

Improved Efficiency of Existing Logistics Platforms

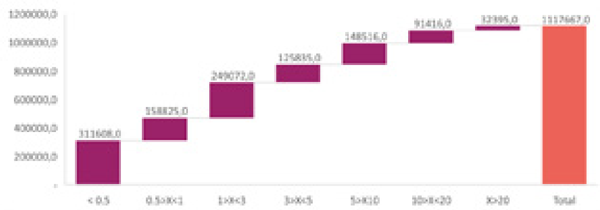
Aggregation and improved planning would streamline and increase the efficiency of current logistics processes. For example, transportation platforms can be used to match producers and transport companies while also fostering price transparency and product aggregation. This would serve to reduce the transactional costs associated with the transportation of products. Additionally, while working to improve investments in the required temperature-controlled infrastructure and equipment, short-term solutions should be explored such as the use of covered or insulated vans and solar technology options. As a relatively nascent sector in Côte d'Ivoire, an opportunity exists to proactively recruit and train women to improve their employment opportunities in the TCL sector. Lessons from an impact evaluation in Nigeria showed that training can be crucial to motivating women to seek employment burgeoning sectors, especially for women with pre-existing biases against women as professionals. For instance, evidence from Nigeria's ICT sector shows that two years after participating in a training program, which equipped recent university graduates with training on communication, computer, and cognitive skills, participants were 26 percent more likely to work in the ICT sector than non-participants. Meanwhile, women with pre-existing biases against thinking of women as professionals were three times more likely to take up work in the ICT sector (Croke et al. 2017). These findings suggest that training could play a role in supporting women to shift into non-traditional sectors.

4.3.2. Policy Reforms

Promoting Land Reforms

As highlighted earlier, agricultural holdings are predominantly small farms, with about 30 percent of agricultural land occupying less than 0.5 ha, as depicted in figure 27. This is further compounded for women who on average have smaller plots of land. To enjoy the benefits of economies of scale and compete effectively, land reforms that encourage increased land holdings, especially for women, must be adopted.[37]

Figure 27: Land Ownership by Land Size



37 Source: Côte d'Ivoire agricultural census 2001.

In addition to increasing the size of land holdings, there is a need to increase access to formal land titles, especially for women. Recognizing the challenges with land ownership and security, the government enacted law no. 98-750 of December 1998. This law aims to transform customary land rights into ownership across 24 million ha of rural land. By 2016, implementation of this law was poor, with only 4,500 land certificates issued throughout the country out of an estimated 1 million and this was done at an average cost of US$1,230 per plot (World Bank 2017b). Since 2017, the Government of Côte d'Ivoire (GoCdI) has worked closely with the World Bank to strengthen rural land institutions, reform the land information system, and support joint titling for married women as a means of fostering the implementation of this law.

Lessons for the implementation of this law can also be drawn from the Rwanda Land Tenure Regularization (LTR) project. This project's use of technology for land titling served to improve the efficiency and cost-effectiveness of the registration process. The LTR project used aerial pictures and digital systems to record and store boundary and ownership information. The use of technology and human capital resulted in the ability to demarcate more than 10.3 million parcels of land at an average cost of approximately US$6–7 per title (DAI 2014). By encouraging joint titling, this program also increased women's land ownership. Furthermore, in Uganda, providing a subsidy for titles conditional on the wife's name being included raised the demand for co-titling by 50 percent without any negative impacts on the overall titling rate (Cherchi et al. 2019).

In Côte d'Ivoire, the World Bank Land Policy Improvement and Implementation Project (PAMOFOR) land registration process offers additional insights on effective interventions to promote women's land tenure security. Pilot results show that highlighting the benefits of women's land ownership—for family harmony, economic efficiency, and security—through a brief video can induce husbands to reallocate land to their wives. Notably, two-thirds of husbands agreed to certify a plot of land solely in the wife's name after being exposed to a short 'edutainment' video featuring these themes. Therefore, providing an educational video can also be an effective tool to raise the demand for co-titling (Donald et al. 2020).

Establishing women's formal land rights can incentivize women farmers to invest in their land and adopt improved agricultural practices. Strengthening land tenure security can also increase women's access to finance, as formal land rights can be used as collateral for loans.[38] Prioritizing policies and programming that expand women's land rights is especially crucial given that female-headed households have experienced greater reductions in land area cultivated compared with male-headed households over the past decade, which has had an impact on agricultural productivity. While the gap in agricultural productivity between male- and female-headed households decreased by 14 percent from 2008 to 2016 driven by mostly by increases in export crop productivity, women's land loss is starting to impact food crop productivity—where a gender gap persists (Donald et al. 2020).

Promoting Access to Capital

Some progress has been made by the GoCdI in promoting access to credit. First, the reduction in the Central Bank of West African States' rates from 4.25 to 3.5 percent in 2014 led to a fall in lending and borrowing rates. Borrowing rates fell to between 7 and 8 percent in Côte d'Ivoire in 2014. In addition, the privatization push in 2015 led to the privatization of the *Banque de Financement de l'Agriculture* as well as the sale of 49 percent of public shares of *Societe Ivorienne des Banques*. But given that the perishable segments involve a greater amount of risk, especially in light of the myriad of market failures that exist within the value chain, no private financier would be willing to invest in a model to overcome it. There is a notable lack of capital inflow into firms engaged in perishable value chains. Farms that need capital to invest in productive assets (such as on-farm equipment that can aid in the rapid cooling/chilling of perishable produce) would need access to long-term financing at reasonable rates. However long-term financing remains a challenge in Côte d'Ivoire, with approximately 67 percent of all short-term loans highlighting the need for interventions aimed at promoting long-term financing.

Policies and programs that foster women's access to credit should also be prioritized. This could include the expansion of ongoing projects on movable collateral registries targeted at women. Furthermore, digital financing solutions are closing the gender gap in access to finance: while women in Côte d'Ivoire were substantially less likely to have a financial account compared to men in 2017 (47 percent versus 36 percent), the situation has improved somewhat compared to 2014, driven largely by growth in female account ownership from mobile money, where we see a 10-percentage point increase in account ownership over the three years. The share of women currently with a mobile account in Côte d'Ivoire is the highest among the

38 The World Bank Côte d'Ivoire Land Policy Improvement and Implementation Project can support this process.

WAEMU countries (29.9 percent versus 19.3 WAEMU average). However, the gender gap in mobile account ownership is still sizable at 21 percent. Mobile money platforms could be an important tool for unlocking finance for women farmers and agribusiness owners. For instance, in Tanzania, training sessions for women-owned micro-firms on M-Pawa, a mobile savings account linked to M-Pesa that also gives customers access to credit, had large impacts on investment and business outcomes. Women saved almost four times more on M-Pawa and were 16 percent more likely to obtain a loan than a comparison group (Donald 2020). In Côte d'Ivoire, providers are experimenting with digital credit, for example, MTN and Bridge Bank launched MoMoKash, a savings and credit product in 2018 to almost 1.9 million customers in a year (Riquet & McKay 2017). Given this, it is important to further incentivize both digital financing solutions and financial literacy for women.

Policies and Programs Targeted at Promoting Access to Markets

Several factors including restricted mobility and limited access to information and transportation services prevent women farmers' access to both domestic and export markets. Programs that incentivize women farmers' to cultivate and market more high-value export products—such as providing women with targeted insurance products, socioemotional skills trainings, and cooperative programs involving husbands and men to shift gender norms, as noted in section 4.3.1—should be developed. In addition, psychology-based business trainings that foster an entrepreneurial mindset can help shift women farmers and entrepreneurs towards a greater market orientation and boost their profits. For example, in Togo a psychology-based Personal Initiative training increased the profits of women micro-entrepreneurs by 40 percent and induced them to be more innovative, introduce new products, take out more and larger loans, and make larger investments in their firms (Campos et al. 2017). Preliminary findings from a study in Mozambique, which assessed an adaptation of the Personal Initiative training for farmers—coupled with agricultural extension training—also shows that providing women farmers with a psychology-based entrepreneurial mindset training not only increased the effectiveness of the extension training and women's productivity, but also helped support women in starting off-farm businesses. In addition to these trainings, the use of technology for information dissemination and the link of women to transport services should be encouraged as a means of promoting women's access to markets. In Niger, access to mobile technology, combined with an education program, led to women planting more cash crops and households diversifying their crops (Aker & Ksoll 2016).

Policies Promoting Equal Access to Inputs

As highlighted earlier, women often have less access than men to quality inputs including fertilizers, pesticides, and seedlings. Government programs that provide women with financing to acquire these inputs and educate them on the need and process for applying inputs should be developed and implemented. Agricultural extension services that are targeted and designed to meet the needs of women farmers could potentially ease women farmers' access to inputs. Some evidence from Mozambique suggests that female farmers were more likely to learn and adopt a new technology from a female extension agent (Kondylis et al. 2017). Digital platforms for disseminating agricultural extension information—about input prices and suppliers, for instance—could help promote input use. In Uganda, video-enabled agricultural extension messaging increased female farmers' adoption of practices and inputs, improved their productivity, and enhanced their participation in agricultural decision making (Lecouture et al. 2019). However, any support for such digital platforms should be accompanied by improved connectivity in rural areas, and promotion of ICT services for women, which could led to greater efficiency of agricultural services (e.g. extension services, finance, traceability).

The Government of Côte d'Ivoire has made progress on increasing the inclusion of women in agriculture programs. Over the past decade, the gender productivity gap in agriculture has narrowed substantially both in terms of export crop and food crop productivity. Gains in non-labor inputs (including fertilizers and pesticides) help explain the closure of the export crop productivity gap (Donald et al. 2020).

4.3.3. Investments in Public, Common, and Club Goods

Box 5: Distinguishing between Public, Private, Common, and Club Goods

Interventions can be defined by reference to two characteristics: (a) whether they are *excludable* or *nonexcludable*—that is, whether it is possible to exclude consumers who have not paid for a good from having access to it and (b) whether they are *rivalrous* or *nonrivalrous*—that is, whether the consumption of a good diminishes its availability for another. The interaction between these two characteristics determines whether goods are public, club, common, or private.

Table 10: Private, Common, Club, and Public Goods

	Nonexcludable	Excludable
Nonrivalrous	*Public good*	*Club good*
Rivalrous	*Common good*	*Private good*

A public or collective good is available to all members of society (nonexcludable) and is not diminished through a greater number of people having access to it (nonrivalrous). Classic examples are air and national defense. Such goods have an intrinsic value for their users, but no single user would produce them because of the likelihood of 'free riding' (that is, consumers using the goods without paying for their use—since they are nonexcludable). Therefore, such goods must usually be provided by governments and financed through mandatory taxes.

A club good is nonrivalrous but excludable—that is, it is not diminished as access is broadened, but users can be prevented from accessing it. Classic examples of club goods are cinemas, private parks, or satellite television. In the context of industrial development, club goods are often underprovided. This happens for two reasons: (a) it is difficult to enforce the exclusion of nonpayers (and hence the club good becomes a public good, with problems of 'free riding') or (b) individuals cannot coordinate among themselves to finance the provision of the club good or club service.

A common good is nonexcludable (available to all members of society), but it is diminished as more agents have access to it (that is, it is rivalrous). Classic examples of common goods are fish stocks in the ocean. Similar to public goods, common goods are difficult or impossible to charge for use, since they are nonexcludable (unless the ocean can be fenced off), and they hence bring a problem of 'free riding'. However, common goods are rivalrous, so users or consumers compete to maximize their own benefits from the resource. This often causes overuse, which leads to the deterioration of the good. Often, governments must regulate the use of such goods to ensure their maintenance, institute a system of taxes to pay for them, or make them excludable and assign property rights to them.

Private goods are both excludable and rivalrous—that is, users can be prevented from accessing the good and it is diminished through use. These characteristics make it straightforward for such goods to be provided privately. Consumers must buy such goods to use them, free riding does not occur, and consumption by one agent prevents consumption by another. This means governments would not usually need to intervene in the markets for private goods let alone provide such goods. However, market failures do sometimes arise in the provision of private goods. These failures prevent firms from providing private goods, thus creating a suboptimal outcome. Such failures may be through innovation-related issues, information asymmetries, or coordination failures.

The critical question is which ones should be prioritized to be addressed through use of public resources. A guiding principle for public funds should be to act only where the private sector cannot finance or coordinate the activity itself. Moreover, public interventions in markets will be most efficient if they are tailored to the root causes of each problem. Examining the industries and value chains from which the market failures stem is the only way to reveal their causes. Often, several market failures may be present in the same market. Thus, public interventions may need to cater to multiple problems at once.

Improved National Quality Infrastructure for SPS Controls and Food Safety

Farmers must ensure food quality meets internationally predetermined standards. This is particularly important in the perishables sector where multiple barriers to adherence to SPS and food safety control conditions exist. For food safety to be guaranteed, the National Quality Infrastructure for SPS controls must be sound. This requires (a) sound regulations governing inputs, primary production, and processing; (b) the existence of governing bodies/or private organizations to inform and monitor adherence to these regulations; (c) adequate capacity by these bodies for monitoring adherence to set standards.

Regularity Framework

There are more than 200 standards for agricultural and food products in Côte d'Ivoire (Montet Didiera 2017). These standards were developed by the Côte d'Ivoire normalization agency (Codinorm). These were then adapted by technical committees comprising representatives of administration, manufacturers, inspection bodies, research institutes, and consumer associations. However, most of these regulations are outdated, as depicted in figure 28. In addition, several aspects are not considered in these regulations such as responsibility, traceability, transparency, emergency situations, and prevention.

Figure 28: Classification of the Main Standards for Agricultural Products and Food Stuffs in Côte d'Ivoire

Categories	Nomber of norms	Years of publication
Total Vegetable Productions	**69**	
Generalities	3	1989(1), 1993 (2)
Stimulants and produits derivatives	15	1985(8), 1989(5) 2006 (02)
Fresh fruits and derivatives	13	1989(7), 1993(4), 2009 (02)
Fresh vegetables and derivatives	15	1989(14), 1993 (1)
Seeds and oilseeds	11	1993(11)
Cereals and legumes plants	12	1993(11), 1995 (1)
Total Animal Productions	**21**	
Fishing products	10	1993(8), 2001(1), 2002(1)
Meat and meat products	11	1990(9), 1993(2)
Total food industries	**81**	
Generalities	10	1989(8), 1995(1), 2001(1)
Milk and dairy products	34	1993(26), 2001(6), 2002(2)
Drinks	25	1993(4), 2001(5), 2002(3), 2008 (13)
Flours and starches	9	1995(8), 2007 (1)
Food addictives (Salt)	3	2001(1), 2002(2)

Governing Bodies

There are multiple agencies and private sector organizations responsible for monitoring adherence to these standards. Despite the existence of these agencies, there is lack of coordination among them—leading to duplication of efforts and production of isolated reports and process which ultimately result in ineffective monitoring processes. There are also financial and human resource constraints that limit monitoring abilities (Montet Didiera 2017). Increased coordination and increased resources for monitoring are required to increase adherence.

Table 11: Food Safety Bodies in Côte d'Ivoire

Relevant ministries	Ministry of Agriculture (Directorate for Plant Protection, Control and Quality), the Ministry of Animal Production and Fishery Resources (Directorate of Veterinary and Quality Services), Ministry of Health and the Fight against AIDS (National Institute of Public Hygiene, National Nutrition Program), Ministry of Commerce and Industry (Directorate of Distribution and Consumer Affairs, Directorate of Metrology, Competition, Quality Control and Enforcement, (Directorate for Industry, Private Sector Development Directorate, Quality and Standardization Directorate)
Public laboratories	LANADA National Agricultural Development Support Laboratory, INHB, LNSP National Laboratory for Public Health, LANEMA National Laboratory for Quality, Metrology and Analysis)
Private and academic laboratories	*Fonds interprofessional pour la recherche et le conseil Agricole* (FIRCA) Agricultural Research and Advisory Fund, FENACOVICI, Federation of Consumers, etc.

Investment in Research and Development

Research and development is crucial for the sustainable development of the agricultural sector. Private sector investment should be encouraged through the use of scientific grants and tax incentives. Strong intellectual property policies would also serve to increase private incentives to invest in research and development. Also, the benefits to research and development are often not fully experienced by the researcher, especially for products that can be easily replicated, leading to underinvestment by the private sector. In addition, the benefits of research and development are larger if multiple people are able to exploit it, therefore the social returns are often higher than the private returns suggesting a role for the government (Bernanke 2011).

Extension Services

Côte d'Ivoire has successfully implemented extension services through various models. These include:

1. Combined public and private extension services. Examples include :
    - Côte d'Ivoire's public extension services are mostly managed by three key agencies. First, the National Agency for Rural Development (ANADER)[39] which was started as a public-private partnership in 1993 and then fully privatized in 1998. FIRCA with the mandate of funding and coordinating research programs, extension, training, and support to farmer organizations. Finally, the National Center for Agricultural Research which provides the research that then feeds into the extension process (Michaud 2016).
    - The emergence of extension services as part of a marketing strategy has also created a place for private extension services, and the cocoa industry has benefitted significantly from this. In this industry, various stakeholders have launched numerous programs to support smallholder farmers; some of these programs include cocoa plan by Nestle, vision for change by Mars, and so on. Through these programs, private companies provide extension services to farmers to encourage GAP (CIRAD 2015).
2. Alternative extension methods such as farmers field schools. These have been done through a combination of private and public sector engagements. For example, in the 2011/2012 cocoa season alone, ANADER reported more than 879 farmers field schools reaching about 26,000 farmers, despite being post the SCTP funding (Vellema 2016).

However, these trainings have focused mostly on preidentified nonperishable products—so there is a need for the government to prioritize extension services for the perishable sector.

39 ANADER was started based on the World Bank's national support project to extension services.

In addition to this, services should be structured to encourage the engagement of female farmers. Women farmers have historically had less access to information and extension services than men farmers. This is often because of the timing of these sessions clashing with household responsibilities, limited mobility of women, or cultural norms. For this reason, extension services should consider the time limitations that are relevant to women farmers and should be implemented at times that are appropriate for these farmers. In designing extension services, cultural norms should be considered. The use of women extension workers or women networks and cooperatives to provide this information and extension services could serve to eliminate some of these barriers. In addition to this, the setup of community-based childcare centers could serve to reduce the burden of household chores for women farmers (ONE Campaign and World Bank 2015).

Finally, the use of technology to further reduce the cost of training and increase the reach of extension services should be explored.

5. Potential Areas of Support for Programs Aiming to Boost Women in horticulture (Fruits and Vegetable) Value Chains

Given the outlined opportunities, challenges, and solutions, we would suggest the following objectives and potential areas of support. Support should aim to improve the welfare of women farmers through increased income. To accomplish this, we would suggest that activities that target this segment of women focus on three specific objectives:

- Increased productivity of key agricultural products
- Increased focus on higher value-added products
- Increased access to markets.

To accomplish this, we would suggest the following strategies:

(1) **Increased access to key services through improved functioning of women farmer cooperatives**

- Capacity building of cooperatives to develop understanding in key areas such as market and consumer research, product handling and logistics management, negotiation, and sales
- Improving of cooperative capacity to foster market links through:
  - Training on and support for buyer specification mapping to determine buyer needs and requirements
  - Training and support for cascaded member training on business improvement requirements
  - Fostering of business relationships between buyers and cooperatives through the initiation of business meetings and forums to link cooperatives to potential buyers.
- Joint development and implementation of an aggregation and packaging process.

(2) **Increasing the productivity of women farmers with a view to moving towards gender equality in agriculture**

- Tailoring extension services to meet women farmers' needs,
- Expanding women's land rights
- Increasing women's access to agricultural labor
- Facilitating women's access to markets
- Encouraging women to "cross-over" to more profitable high-value export crop cultivation.
- Given the limited engagement of women in traditional export crop cultivation, it is important to also boost the productivity of the food crops, which women already typically farm.

(3) **Strengthening women's control over agricultural assets and revenues**

- Greater investment in training and skills of farmers through extension services and training.
- Strengthening women's socioemotional skills through psychology-based trainings
- Engaging men (for example by targeting couples in training) including joint agricultural planning
- Improved access to inputs and smart irrigation, equipment and services
- Increasing women's access to formal land titles.

(4) **Fostering access to logistics services**

- Development and implementation of a transportation platform that matches transport demand to supply
- Matching grants for logistics services
- Support to government to institute policies that would incentivize the further development of logistics services.

(5) **Innovative financing options for women**

- Long-term financing
- Higher take-up of mobile money and movable collateral registries

Annexes

Annex 1 : Perishability of crops at harvest and at processing and Price Data.

Table A1.1: Perishability at Harvest: Examples of Crop Respiration Rates When Held at 5°C

Class	ml CO_2/kg-hr	Indicative List of Crops
Very Low	<5	Dates, nuts, fruits, and vegetables that undergo high or substantial methods of processing
Low	5–10	Apple, citrus fruits, garlic, melon, kiwifruit, onion, papaya, persimmon, pineapple, pomegranate, potato, pumpkin, sweet potato, watermelon, and so on
Moderate	10–20	Apricot, banana, blueberry, cabbage, cantaloupe, carrot, cucumber, fig, gooseberry, lettuce, mango, nectarine, pear, plum, radish, tomato, pepper, and so on
High	20–40	Avocado, blackberry, cauliflower, leek, raspberry, strawberry, lima bean, and so on
Very High	40–60	Artichoke, bean sprouts, broccoli, brussel sprouts, cherimoya, cut flowers, passion fruit, snap bean, water crest, and so on
Extremely High	>60	Asparagus, mushroom, parsley, peas, spinach, sweet corn, durian, okra, and so on

Sources: Paltrinieri, s.d.; Sharma 2018; Silva 2010; UC Davis, s.d.

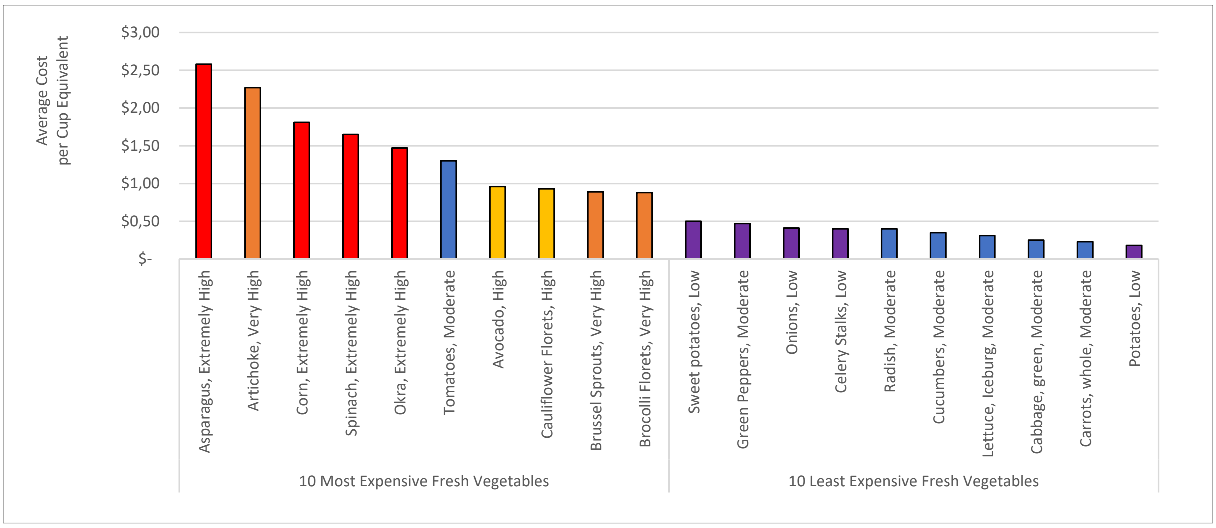
Table A1.2: Perishability at Processing: Types of Agro-processing and Their Factor Intensities[40]

Processing Method's Effect on Respiration	Processing Activity	Relative Labor Intensity	Relative Capital Intensity	Relative Knowledge Intensity
Decreases rate of respiration	Cooking	Low	Moderate	Low
	Pasteurization	Low	Moderate	Moderate
	Canning	Low	Moderate	Moderate
	Dehydration	Moderate	Moderate	Low
	Freezing	Low	Moderate	Low
	Extraction	Moderate	Moderate	High
	Chemical alteration	Low	High	High
Maintains rate of respiration	Cleaning	High	Low	Low
	Grading	High	Low	Moderate
	Chilled storage	Low	High	Moderate
	High pressure treatment[41]	Low	Very High	High
	Pulsed electric treatment[42]	Low	Very High	High

40 Expert opinions were used to indicate notional capital, labor, and knowledge factor intensities against each activity. Relative capital intensity is measured as Very High (US$, millions); High (US$ hundreds of thousand); Moderate (US$ tens of thousands); Low (US$ thousands).
41 High pressure processing (HPP) is a process of using atmospheric pressure to kill bacteria and deactivate enzymes to preserve a product while ensuring that taste, flavor, color, and texture of the products are not altered by the treatment.
42 Like HPP, pulsed electric treatment is a process that uses electricity to preserve food without drastically altering the product.

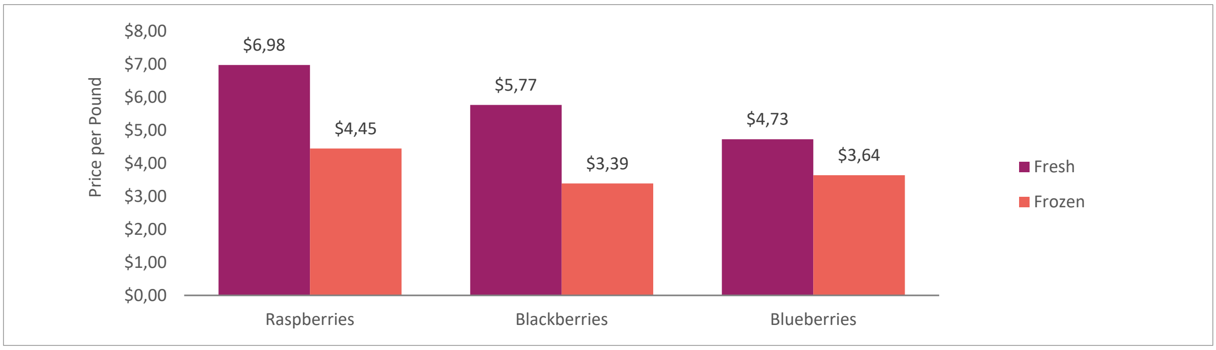
Accelerates rate of respiration	Milling	Moderate	Moderate	Moderate
	Cutting	High	Low	Moderate
	Mixing	Moderate	Low	Low
	Pressing	Moderate	Low	Low
	Assembly[43]	Moderate	Moderate	Low

Figure A1.3 Prices of Vegetables at Retail in the United States



Source: USDA Economic Research Service 2013.

Figure A1.4 Difference between Fresh and Frozen-Processed Retail Prices



Source: USDA Economic Research Service 2015.

43 Assembly is an activity in food manufacturing, such as is done in the composition of ready-made sandwiches.

Annex 2 : Comparison of Traditional Small-scale Irrigation Methods and Innovative Irrigation Technologies

Table B1.1. Comparison of Traditional Small-scale Irrigation Methods

Method	Rope-and-bucket	Rope-and-washer	Hip pump	Treadle pump	Motorized pump	Solar pump
Type	Water-lifting	Water-lifting	Water-lifting	Water-lifting	Water-lifting	Water-lifting
Main user/ Average plot size	Smallholder farmers	Smallholder farmers / < 0.2 ha	Smallholder farmers / < 0.5 ha	Smallholder farmers / < 0.8 ha	Small- to medium-size farmers / 0.5 – 10 ha	Small- to medium-size farmers / 0.3 – 10 ha
Investment costs (US$/unit)	15	40	50	20-250	300-1,500	2,450-15,400
Maintenance costs (US$/year/ unit)	1	2	1	8-35	580[vii]	50-100
Advantages	▪ Low cost ▪ Locally available materials	▪ Low cost ▪ Less manual power needed ▪ Might improve water supply ▪ Locally available materials	▪ Low cost ▪ Can be combined with drip irrigation ▪ Time saving ▪ Portable ▪ Easy to repair	▪ Can be combined with drip irrigation ▪ Portable ▪ Time saving ▪ Easy to repair	▪ Reduces drudgery of lifting water ▪ Time saving ▪ Can be combined with drip irrigation or sprinkler ▪ Can be used for small and medium sized plots	▪ Environmentally friendly energy source ▪ Time saving ▪ Reduces drudgery of lifting water ▪ Can be used for small and medium size plots ▪ Can be combined with drip irrigation or sprinklers
Disadvantages	▪ Requires substantial manual power ▪ Only suitable for very small plots ▪ No efficient water use ▪ Time consuming	▪ Only suitable for very small plots ▪ No efficient water use ▪ Time consuming	▪ Only suitable for very small plots ▪ No efficient water use	▪ Only available through selected retailers in some countries ▪ Costs might be higher in some countries	▪ Only available through specific retailers ▪ Rather high initial and maintenance costs – depending on fuel prices ▪ Contributes to pollution ▪ Spare parts might be difficult to access ▪ Needs skills to repair	▪ High initial costs ▪ Only available through selected retailers ▪ Spare parts might be difficult to access ▪ Needs skills to repair

Table B1.2. Comparison of Innovative Irrigation Technologies

Technology	Gravity-fed drip irrigation	Center-pivot	Floppy Sprinkler	Soil sensor	Hyperspectral camera
Type	Irrigation	Irrigation	Irrigation	Irrigation assistance	Irrigation assistance
Main user & suitability / Average plot size	Small-scale farming / 0.05 ha	Medium- to large-scale farming / 4.5-200 ha	Small-, medium-, large-scale farming / 0.2 – several '000 ha	Small-, medium-, large-scale farming / 1-3 ha covered by one sensor*	Small-, medium-, large-scale farming / every size possible – can run as a drone
Advantages	▪ Very low initial and maintenance costs ▪ Locally available materials ▪ Very efficient water use ▪ Can be combined with different water lifting systems	▪ Very efficient system ▪ Can be managed remotely	▪ Very efficient system ▪ Can be managed remotely	▪ Assists efficient water usage ▪ Can be combined with irrigation system ▪ Indicates drought-inflicted damages to crops ▪ Allows remote access to irrigation systems ▪ Helps to identify and assist in planting related issues concerning soil and nutrients	▪ Assists efficient water usage ▪ Indicates drought-inflicted damage to crops ▪ Helps to identify and assist in issues concerning plant growth and nutrients
Disadvantages	▪ Only suitable if there are gravity differences, e.g. through slopes ▪ Takes long time for irrigation, depending on the pressure created by gravity ▪ Pipes are prone to insect damage	▪ Only suitable for medium-size plots and bigger ▪ Very high investment costs ▪ Requires efficient water supply ▪ High loss of potential yield through round irrigation shape	▪ Very high investment costs ▪ Requires efficient water supply	▪ Expensive for smallholder farmers ▪ Requires mobile technology to control and access data in the cloud	▪ Expensive for smallholder farmers ▪ Requires mobile technology to control and access data in the cloud

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