

# Value Chain Analysis Report

COFFEE VALUE CHAIN

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## **List of Acronyms**

KCGA-Kenya Coffee Growers Association  
CRF-Coffee Research Foundation  
NCE-Nairobi Coffee Exchange  
KALRO-Kenya Agricultural and Livestock Research Organization  
CB-Coffee Board  
KPCU- Kenya Planters Cooperatives Union  
CMB-Coffee Marketing Board  
CBK-Coffee Board of Kenya  
KCPA-Kenya Coffee Planters Association  
TRF-Tea Research Foundation  
KARI-Kenya Agricultural Research Institute  
CRI-Coffee Research Institute  
KCPA-Kenya Coffee Producers and Traders Association  
KCTA-Kenya Coffee Traders Association  
MH-Mbuni Heavy  
ML-Mbuni Light  
UG-Ungraded  
HE-Hulled Ears  
CCS-Coffee Cooperative Societies  
ComFund-Commodity Fund  
FAO-Food and Agriculture Organization  
GDP-Gross Domestic Product  
CBD- Coffee Berry Disease  
SEI-Stockholm Environmental Institute  
SCA-Specialty Coffee Association  
MoALF-Ministry of Agriculture, Livestock and Fisheries  
KCSAP- Kenya Climate Smart Agriculture Project  
CIAT-Centre for Tropical Agriculture  
CGIAR- Consultative Group on International Agricultural Research  
CCAFS-Climate Change, Agriculture and Food Security  
VC-Value Chain

## 1.0 Executive Summary

### 1.2 Introduction

Coffee is the largest traded commodity in the world after oil and one of the most popular non-alcoholic beverages globally, prized for its aroma and caffeine content. Globally coffee is an important source of income. Worldwide, about 10,035,576 tons of coffee is produced annually.

The coffee industry has been one of the key pillars of Kenya's economy since independence from Britain in 1963. Coffee is an important earner of foreign exchange for the economy and provider of jobs. Kenyan coffee is grown by both smallholder and estate farmers. The smallholders account for approximately 65% of the total production. The smallholder farmers are organized into about 500 cooperatives, while the estates number is approximately 3000. Coffee is grown in 32 counties with a total area of about 114,500 hectares. Annual coffee production is estimated to be 42,000 metric tons per year.

The coffee sector employs about 30% (approximately 5,000,000 people) of the labour force in the agriculture sector, directly and indirectly. Out of which an estimated 800,000 growers, mainly smallholder farmers in rural Kenya, are involved in coffee growing. Culturally land is owned and dominated by men. Women who own farms are largely those who have been widowed. The rural youth prefer migrating to urban centres to pursue careers and in search of employment. As such, the coffee business is dominated by the elderly.

Coffee in Kenya is grown on deep, well drained, red loam soils, rich in phosphates around the slopes and foothills of Mount Kenya, the Aberdare ranges, Mt Elgon, the Kisii Highlands, and parts of the Rift Valley. These regions favour coffee production as they lie in an altitude above 1220 m above sea level, have temperatures around 19°C, and well distributed rainfall throughout the year of 1000mm annually.

The main coffee growing Counties in Kenya include Nairobi, Kiambu, Muranga, Nyeri, Kirinyaga, Embu, Meru, Machakos, Makueni, Taita Taveta, Kajiado, Nakuru Kericho, Nandi, Uasin Gishu, Elgeyo Marakwet, Baringo, Trans Nzoia, West Pokot, Narok, Bomet, Kisii, Nyamira, Migori, Homa Bay, Kisumu, Siaya, Busia and Bungoma. Kiambu County is the leading coffee producer. Table 1 below shows coffee produced in the LREB Counties in the years 2019/2020 and 2020/2021.

Table 1: Coffee Production on LREB Counties<sup>1</sup>

County	2019/2020			2020/2021		
	Estimated Area (Ha)	Yield (Metric Tons)	% contribution	Estimated Area (Ha)	Yield (Metric Tons)	% contribution
Bungoma	5,775	2105	5.71	7,660.00	1,897	5.49
Kericho	8,758	2198	5.96	4,758	2,965	8.59
Kisii	5,863	2274	6.17	4,563.00	548	1.58
Nyamira	2,708	1014	2.75	2,708.00	295	0.85
Transnzoia	2,242	480	1.3	2,158	786	2.27
Nandi	1,760	576	1.56	1,845	993	2.87
Migori	767	135	0.37	787	100	0.28
Homabay	427	35	0.1	427	16	0.04
Bomet	201	13	0.03	201	31	0.08
Kisumu	98	13	0.04	98	42	0.12
Kakamega	334	15	0.04	334	19	0.05
Busia	84	6	0.02	150	9	0.02

<sup>1</sup> <http://coffee.agricultureauthority.go.ke/index.php/statistics/reports>

Vihiga	14	0.9	0	10	0.3	0
Siaya	23	0	0	23	0.3	0

## 2.2 Value Chain Actors

The total area under coffee production is approximately 119,617 hectares. One third is the large-scale plantation sector and the rest falls under the small holder sector. About 800,000 Kenyans are engaged in coffee production. It is estimated that there about 204 million coffee trees as recorded in 2019. Annual production is estimated to be about one million bags per year. Arabica coffee is the mostly grown type of coffee in Kenya. Kenyan coffee industry comes fourth after tourism, tea and horticulture industries as foreign exchange earner. They key steps and actors in the value chain in Kenya include:

### *Production*

Kenya coffee is produced by small scale farmers who form co-operative societies and plantation growers who own their own farms with representation of 60% and 40% respectively. Producers receive extension services and relevant inputs from Coffee Research Foundation (CRF), Kenya Coffee Planters Association (KCPA) and private sector actors.

### *Harvesting*

Coffee is traditionally harvested by hand either through the strip picking technique, which removes all the beans together from the branch without distinction between ripe and unripe coffee berries, or most commonly through selective picking of well-ripened cherries. Hand picking is labor intensive and costly. To select the highest quality of coffee cherries, the red ripe ones are separated for processing. Farmers are only involved in removing the first fruit layer covering the seeds.

### *Processing*

After harvesting coffee berries that are are then transported to the factories for processing. At the factory, the cherries are sorted before processing and unripe, overripe or diseased cherries are removed. The cherries are then pulped to remove the outer skin. The slimy sugary coating (mucilage) – which remain on the beans is removed through fermentation process that's takes about 36 hours. The cherries are then sun dried on tables. Almost all Kenyan coffee is processed by a wet method in order to ensure the best quality. After the coffee is fully dried it is bagged and sent to the mills.

### *Milling and grading*

Milling simultaneously removes the dry pulp and parchment through hulling, polishing, grading and sorting by hand or through a machine in order to avoid contamination with over-fermented, insect-damaged, and un-hulled beans, and ensure a high quality and price. Currently there are 7 licensed commercial coffee mills and several private mills. At the mills the dry parchment is hulled, polished and mechanically separated into various grades according to size, density and shape of the bean. The seeds are also graded depending on their size, where and what altitude it was grown, how it was prepared and packed, how it tastes, its cup quality and how many imperfections (defective beans, pebbles and sticks) they have per sample. The grade sizes are: AA, AB, PB, C, E, TT and T from the smallest to the largest).

### *Storage*

Green coffee is transported to storage units in jute bags, which may pose coffee at risk of contamination with external factors and thus quality degradation. Coffee bags are then placed on wooden pallets that are raised from the ground as well as away from walls to avoid re-wetting and moisture absorption under heavy rainfall conditions and flooding risks. Storage lasts for 6 months after which coffee is transported to millers for the final processing.

### *Quality assurance*

After grading and processing, Coffee Board of Kenya (CBK) does rigorous testing to ascertain the quality of the coffee seeds. This is to ensure only the farmer with the best quality is awarded. Since the best quality fetches the highest prize and Kenya is known globally for its quality of Coffee.

### *Marketing*

After grading, the coffee beans are then passed to the marketing agents who market them for auction at the Nairobi Coffee Exchange (NCE). The NCE is managed by a Management Committee of 9 members comprised of 5 Producers, 2 Traders, 1 Representative of Commercial Millers & Marketing Agents and 1 from the Coffee Directorate. Traders consequently purchase from the auction and sell to the exporters. Some local roasters also buy from the auction centre for local processing and selling for local consumption.

Belgium is the top destination for Kenyan coffee for the last two coffee years with 64,529-60 kg bags in 2020/21 and 52,771-60 kg bags in 2021/22. Germany is the second top destination followed by USA and Korea Republic in that order. Germany has been the leading destination often in position one or two in the past seven coffee years.

*Table 2: Top 5 International Markets for Kenyan Coffee 2018/2019-20/2021<sup>2</sup>*

Year	2018/2019		2019/2020		2020/2021	
Rank	Country	%age	Country	%age	Country	%age
1	Germany	20	USA	20	Belgium	21
2	Belgium	18	Germany	19	USA	15
3	USA	13	Belgium	16	Germany	13
4	Korea	9	Korea	9	Korea	10
5	Sweden	6	Sweden	6	Sweden	7

### *Research*

Research on Coffee in Kenya started in 1908. The first ever research institute was established in 1944 by the colonial government at Ruiru as the Coffee Research Station. In 1964, the Coffee Research Foundation (CRF) was established. It was financed by the growers and undertook specialized research in all matters pertaining to the production, processing, and marketing of coffee. It housed the Kenya Coffee College, which offers both local and international training on all aspects of coffee to ensure that information on the best and most modern coffee farming technologies are disseminated to all stakeholders in real time.

### *Policy and Legal advisory*

The coffee directorate is mandated by the government to ensure adherence to the coffee standards, the coffee industry code of practice and the Coffee regulations. Kenya Coffee Producers and Traders Association (KCPA) is mandated by its constitution as the coffee producers' advocate. It is at the forefront of policy dialogue. Through Research, KCPA undertakes effective lobbying to provide accurate information on coffee issues and realistic action plan to address the issues. KCPA, in partnership with other development partners, heavily invests on research to inform its advocacy initiatives.

### **Profitability**

Although hampered by many challenges, coffee farming is profitable. Discussion with government officials and farmers from Nandi and Transnzoia Counties, two of the key coffee growing areas in LREB showed that if coffee farms are well managed could realise gross margins of up to Kes 336,000 per acre for the preferred Ruiru 11 variety. Table 3 below shows the gross margins calculations.

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<sup>2</sup> Coffee Directorate. (2021). Coffee Year Book 2020/21. Nairobi: Agriculture and Food Authority, Coffee Directorate.

Table 3: Gross margins for Ruiru 11 variety<sup>3</sup>

GROSSMARGIN ANALYSIS				
Enterprise: Coffee (1 ACRE), 1012 trees	Variety: Ruiru 11			
VARIABLE COSTS:		No. of Units	Unit Cost (Kshs)	Cost
Weed Control (Manual)-4 times/year	Labour	4	3,000	12,000
Manures (3kg/tree) -3 tons	Manure	3	1,000	3,000
	Transport	3	2,000	6,000
	Labour (MDs)	10	200	2,000
Fertilizers	CAN (50kg)	4	5,500	22,000
	Transport	4	100	400
	Labour (MDs)	4	200	800
	NPK 17:17:17 (50kg)	4	6,000	24,000
	Transport	4	100	400
	Labour (MDs)	4	200	800
Disease control (CBD, Leaf rust)	Fungicides (Copper-based)	0	0	0
	Spraying Labour (MDs)	0	0	0
Canopy Management	Main Pruning (Ksh.6/tree)	1012	6	6,072
	De-Suckering (Ksh. 3/ tree)	1012	3	3,036
Harvesting	Cherry picking (Labour Ksh. 7.5/kg)	6072	7.50	45,540
	Transport (24 times)	24	400	9,600
Miscellaneous Expenses (10% of TVC)				13,565
Total Variable Costs				149,213
Gross Output (6kg cherry per tree @kshs.80)		6,072	80	485,760
Gross Margin/Acre/Year				336,547

### Challenges facing the sector.

Despite the importance of the sector to the Kenya economy, the exposure of the industry to the world economy and other emerging challenges in the country risks loss of coffee industry relevance and importance. The total annual coffee production has been fluctuating widely due to climate change and socio-economic factors.

The rise of climate change poses a threat to the coffee sector and consequently puts the livelihoods of many people who depend on the coffee industry at risk. Climate change is also making it critical to meet the ever-increasing demand for coffee all over the world. This is particularly for exporting countries who are the mainly hard hit by climate change effects.

Price fluctuation & unreliable incomes are also a major challenge facing the sector. Due to increased inflation in the country and the decreasing value of the Kenyan shilling against the dollar, costs of coffee production are high and yet the farm gate price per kilogram of coffee remains low. This is affecting both commodity coffee and specialty coffee producers.

Coffee is also facing competition from other crops. Because of many problems that coffee farmers are facing, some have neglected the coffee trees in favour of horticultural crops. Low farmers' incomes make coffee unprofitable and therefore unattractive to the youth. The average age of coffee farmers remains about 60 years thus resulting in decline in coffee production.

<sup>3</sup> Field interviews with Tinderet Agriculture office, Nandi County and Siboti Cooperative in Transnzoia County



It is the low productivity level in the smallholder agricultural practices that is today globally responsible for over a quarter of greenhouse gas emissions. It is estimated that in the next 30 years 75% of available, unforested land suitable for Arabica farming will be lost due to climate change. Therefore, the land currently being used by coffee farmers in many regions will become unsuitable economically. Smallholder coffee farmers will be forced to abandon coffee production due to its unproductivity.

It is expected that higher temperatures will reduce yields of Arabica coffee as coffee ripens more quickly with increase in temperature leading poor quality. Arabica coffee thrives at a temperature range of 15°C – 24°C. Temperatures over 25°C reduce photosynthesis. Temperatures above 30°C lead to leaf damage. In addition, high soil temperatures increase the rate of evaporation and organic matter breakdown which lead to poor soil structure and increased susceptibility to erosion. High temperatures are associated with coffee leaf rust heavy insect parasites.

High rainfall amount influence drying and processing of coffee berries reducing coffee quality and affecting its marketability. High rainfall is also associated with the coffee berry disease. While erratic rainfall results in random flowering, with flowers and berries at different stages of growth being on the same primary branch.

It is therefore very relevant to address climate change effects such as low incomes, volatile prices and the lack of an enabling operational framework that continue to challenge the livelihoods of coffee farmers.

In 2020, the government, through the Ministry of Agriculture, launched Coffee Revitalization Project that aims to increase coffee production in partnership with World Bank. KShs 1.5 billion was set aside for the coffee industry in phase one of the two years. This programme aims also to improve the efficiency of coffee co-operative societies, support research development and technology and development of alternative coffee markets. In the first phase the project will focus on 8 main coffee producing counties which account for approximately 70% of the national production (Kiambu, Machakos, Muranga, Nyeri, Embu, Tharaka Nithi, Kirinyanga and Meru) as a pilot.

The counties will receive the money as loans. 20% of the fund will be directed towards the provision of subsidized fertilizers, propagation of seeds and distribution of planting materials. While 60% of the fund will be used to improve the efficiency of the primary processing infrastructure and the quality of coffee by automating co-operatives systems and modernizing equipment. Part of the fund will be used to strengthen coffee co-operative societies institution and governance and integration of data base, backstopping and monitoring.

There have been various other initiatives supporting the sector. For instance, KCPA in collaboration with the relevant industry stakeholders and development partners has currently and in the past continued to aggressively develop and implement initiatives aimed at addressing the issues affecting the coffee farmers. The following are some of the projects:

- Computerized management information system project by Agriterra
- Coffee reference point project by HIVOS
- Strengthening smallholder farmer participation in the coffee value chain project by We Effect
- Coffee tree shade project by We Effect
- Building the lobby and advocacy capacity of KCPA to represent the interests of farmers in the National Coffee Platforms project by Rainforest Alliance,

#### **Climate adaptation specific Recommendations**

1. There is need for coffee growers to integrate coffee and livestock farming and practice animal manure composting to generate organic fertilizers.

2. In order to control the micro-climate temperature and stability of the soil moisture it is recommended that farmers intercrop shade trees, practice single-stem farming, block and labelling, or precision farming where coffee trees are planted in blocks and labelled.
3. Promote the use of Ruiru 11 variety which is resistant to pests and diseases, although with lower quality of coffee berries, or the Batian variety which also has higher yields in all agro-ecological zones, lower costs of fungicide application and higher income opportunities due to its resistance to coffee berry disease and leaf rust, its early maturity and ripening timing, while providing high yields and quality
4. Use adequate trees for agroforestry practices, and appropriate organic materials for mulching.
5. Use eco-pulper machine technology in factories that mechanically separates the beans from the cherry without the need for water or sun-drying the coffee cherries.
6. Utilization of renewable energy resources such as biogas, solar and wind across the coffee value chain could help build resiliency within the industry.
7. Promote the processing and use of by-products such as coffee pulp through drying and recycling for application as manure to reduce use of chemical fertilizers and costs for farmers.
8. Ensure adequate levels acceptance of dried coffee beans at 11-12.5% of moisture content, using appropriate electronic moisture control devices such as hygrometers
9. Integrate rainwater harvesting and drainage systems to prevent water entry.

## **0. Introduction**

### **0.1. Background and objectives of the value chain analysis**

#### **1.1.1 Global, National and County overview of the value chain**

Coffee is the largest traded commodity in the world after oil and one of the most popular non-alcoholic beverages globally, prized for its aroma and caffeine content. Globally coffee is an important source of income. Worldwide, about 10,035,576 tons of coffee is produced annually. Brazil is the leading coffee producing country in the world, followed by Vietnam and then Colombia <sup>4</sup>. In 2021 Brazil exported about 3.2 million 60-kilo sacks of coffee which is about 40% of all the coffee produced in the world. Ethiopia is the 5<sup>th</sup> leading coffee producer in the world. Ethiopia and Uganda are the leading producers of coffee in Africa, producing 62% of African coffee. Kenya comes 5<sup>th</sup> in Africa. Finland is the leading coffee consuming country in the world, where long, dark, and cold winters are prevalent, making coffee highly prized <sup>5</sup>.

The coffee value chain in Kenya starts at production level. Production activities include land preparation, application of fertilizer, spraying, tools/facilities maintenance, irrigation and harvesting. Production is divided into small scale and largescale. Production is facilitated by input and service supplies from Kenya Coffee Growers Association (KCGA) and Coffee Research Foundation (CRF) and private agro-dealers <sup>6</sup>. Farmers harvest the coffee beans by selectively handpicking the ripe ones. Once harvested the coffee is transported to factories for processing. The coffee pulp is removed from the coffee seed which is then dried. They undergo dry or wet processing method which determines the flavors of roasted and brewed coffee. Typically, the beans are dried in the sun by air circulation to 12-13% moisture content. Once the coffee seeds are dry they are then graded from the highest to the lowest quality. Grading is based on size, growth conditions, processing and packaging conditions, taste, cup quality, and sample quality (defective beans, pebbles and sticks). Coffee from the best growth conditions in terms of climate, altitude, soil quality etc., is graded high quality. After grading, the beans are passed on for auction by the marketing agents at the Nairobi Coffee Exchange (NCE) where traders purchase and sell to the exporters and local roasters <sup>7</sup>.

The main coffee growing Counties in Kenya include Nairobi, Kiambu, Muranga, Nyeri, Kirinyaga, Embu, Meru, Machakos, Makueni, Taita Taveta, Kajiado, Nakuru Kericho, Nandi, Uasin Gishu, Elgeyo Marakwet, Baringo, Trans Nzoia, West Pokot, Narok, Bomet, Kisii, Nyamira, Migori, Homa Bay, Kisumu, Siaya, Busia and Bungoma. Kiambu County is the leading coffee producer<sup>8</sup>.

The coffee industry has been one of the key pillars of Kenya's economy since independence from Britain in 1963. Coffee is an important earner of foreign exchange for the economy and provider of jobs. However, the exposure of the industry to the world economy and other emerging challenges in the country risks loss of coffee industry relevance and importance to Kenya's economy.

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<sup>4</sup> Nguyen, G. N., & Sarker, T. (2018). Sustainable coffee supply chain management: a case study in Buon Me Thuot City, Daklak, Vietnam. *International Journal of Corporate Social Responsibility*, 3(1), 1-17.

<sup>5</sup> ICO. (2020). COFFEE DEVELOPMENT REPORT, THE VALUE FOR COFFEE, Sustainability, Inclusiveness, and Resilience of the Coffee Global Value Chain. London: International Coffee Organization

<sup>6</sup> Muthoni, M. P. (2014). Coffee Value Chain Analysis in Kenya (A case of Kenya Planters Cooperative Union). *Journal of Business and Management*, 6(5), 207-215.

<sup>7</sup> Coffee Directorate. (2022). COFFEE PRODUCTION, MARKETING AND EXPORTS STATUS REPORT-MARCH 2022. Kenya: Agriculture and Food Authority.

<sup>8</sup> Coffee Directorate. (2022, November 24). Overview. Retrieved from Agriculture and Food Authority, Directorate of Coffee: <http://coffee.agricultureauthority.go.ke/index.php/sectors/overview>

Coffee industry is very important to Kenyan economy. It earns foreign exchange revenue which has been used in the country's development. As a source of employment, coffee growing offers employment to many Kenyans either directly such as picking of coffee and indirectly through the related industries. Coffee production has contributed to development of coffee related industries such as coffee processing factories which has really helped in industrialization of the country. Living standards of coffee farmers have improved as a result of the direct sale of their coffee. In order to transport coffee from farms to factories, roads have been constructed, others have been graded and improved and this has led to improvement of infrastructure in the country.

Recently, the coffee industry is experiencing challenges that may threaten its sustainability. Climate change and irregular rainfall patterns is a major threat to the coffee sector. The rising temperatures and new rainfall patterns due to climate change may threaten the Arabica coffee species.

Price fluctuation & unreliable incomes are also a major challenge facing the sector. Due to increased inflation in the country and the decreasing value of the Kenyan shilling against the dollar, costs of coffee production are high and yet the farm gate price per kilogram of coffee remains low. This is affecting both commodity coffee and specialty coffee producers. Coffee is also facing competition from other crops because of many problems that coffee farmers are facing, some have neglected the coffee trees in favour of other horticultural crops such as hass avocados. Low farmers' incomes make coffee unprofitable and therefore unattractive to the youth, meaning that the average age of coffee farmers remains about 60 years thus resulting in decline in coffee production.

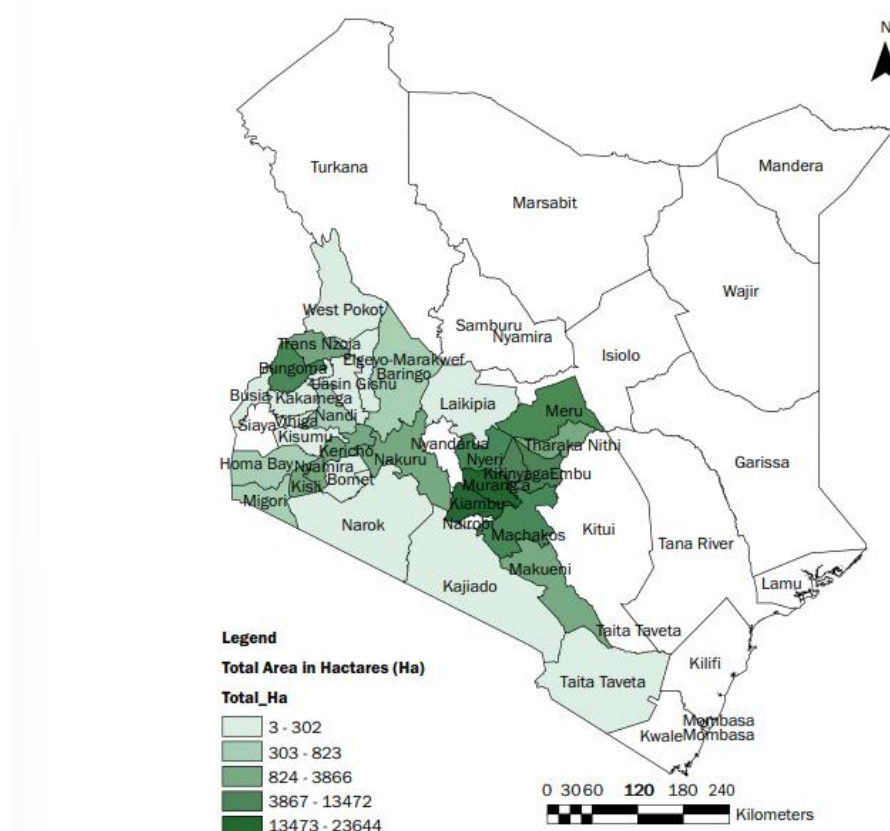


Figure 1: Coffee growing counties as of 2019<sup>9,10</sup>

<sup>9</sup> <https://feem-media.s3.eu-central-1.amazonaws.com/wp-content/uploads/968-rpt-supplychainanalysis-coffee-kenya.pdf>

<sup>10</sup> The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

### 1.1.2 Key statistics on value chain performance

Coffee in Kenya is grown on deep, well drained, red loam soils, rich in phosphates around the slopes and foothills of Mount Kenya, the Aberdare ranges, Mt Elgon, the Kisii Highlands, and parts of the Rift Valley. These regions favour coffee production as they lie in an altitude above 1220 m above sea level, have temperatures around 19°C, and well distributed rainfall throughout the year of 1000mm annually. The land is broad, with gently rounded ridges, sloping not too steeply into valleys adorned with swift perennial streams. Most of the districts in Kenya fall in these zones making the total area under coffee production to be approximately 119,617 hectares. One third is the large scale plantation sector and the rest fall under the small holder sector. About 800,000 and more Kenyans are engaged in coffee production. It is estimated that about 204 million coffee trees were recorded in 2019 <sup>11</sup>. Annual production is estimated to be about one million bags per year. Arabica coffee is the mostly grown type of coffee in Kenya. Varieties include Batian, Truse, Ruiru II, SL 34, SL 24 and K7. Only small amounts of Robusta coffee are grown <sup>12</sup>.

Kenyan coffee goes through a well-organized procedure from seed to cup to guarantee the best of Kenya's coffee to the consumers. Production starts from nursery, farm, pulping, milling and grading. The coffee berries are hand-picked and hand sorted, sun dried and processed to ensure that the resulting bean is extraordinarily well balanced in body, acidity, intense flavour, and pleasant aroma with notes of blackcurrant, honey, caramel and chocolate. This makes it one of the most sought-after coffees in the world. There are two different flowering seasons in a year; March/April and October to December. The early crop starts ripening in May to July and the main crop ripens from October to December, thus making coffee available throughout the year <sup>13</sup>.

Kenya's Arabica coffee is the finest in the world and it's the most sought after for its intense flavor, full body, and pleasant aroma.

Coffee market is based on:

- Bean types (Arabica, Robusta and others),
- Coffee types (Ground Coffee, Instant Coffee, Whole-Bean, Coffee Pod and Capsules),
- Distribution channel (Hypermarkets/Supermarkets, Online Channels, Cafes and Food Services and Others),
- Applications (Hot Drinks, Ready to Drink, Flavoured Beverages and others)
- Competitive landscape
- Marketing channel (Auctioning at Nairobi Coffee Exchange or direct farmer sales mediated by marketing agents)

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<sup>11</sup> Coffee Directorate. (2022). COFFEE PRODUCTION, MARKETING AND EXPORTS STATUS REPORT-MARCH 2022. Kenya: Agriculture and Food Authority.

<sup>12</sup> KALRO. (2019). Coffee (Coffea arabica & Coffea canephora) Production and Utilization in Kenya. Kenya: Kenya Agricultural and Livestock Research Institute.

<sup>13</sup> Coffee Directorate. (2022). COFFEE PRODUCTION, MARKETING AND EXPORTS STATUS REPORT-MARCH 2022. Kenya: Agriculture and Food Authority.

Table 4: Coffee production per county 2017/2018-2020/2021<sup>14</sup>

Production per County													
		2017/2018			2018/2019			2019/2020			2020/2021		
	County	Estimated Area (Ha)	Yield (Metric Tons)	% Contribution	Estimated Area (Ha)	Yield (Metric Tons)	% Contribution	Estimated Area (Ha)	Yield (Metric Tons)	% Contribution	Estimated Area (Ha)	Yield (Metric Tons)	% Contribution
1	Kiambu	23,147	7,528	18.19	18,827	9,755	22%	18,827	7468	20.25	20,309	7,804	22.61
2	Nyeri	13,490	5,031	12.16	14,138	5,318	12%	12,148	3951	10.71	9,829	3693	10.70
3	Kirinyaga	9,978	6,196	14.97	12,745	6,443	14%	12,745	5444	14.76	10,009	6,028	17.46
4	Murang'a	14,017	5,538	13.39	14,555	4,040	9%	14,555	4701	12.75	9,405	3100	8.982
5	Embu	6,855	2,347	5.67	6,873	2,247	5%	6,873	2561	6.95	6,873.	1593	4.615
6	Bungoma	5,452	2,317	5.60	5,502	2,180	5%	5,775	2105	5.71	7,660.	1,897	5.49
7	Meru	8,582	1,727	5.32	8,582	1,593	4%	8,582	1532	4.16	8,650.	1622	4.69
8	Kericho	4,318	2,200	5.32	8,590	3,858	9%	8,758	2198	5.96	4,758	2,965	8.59
9	Machakos	7,607	1,388	3.35	7,632	2,554	6%	7,632	1136	3.08	7,973	731	2.11
10	Kisii	4,563	2,434	5.88	4,563	1,420	3%	5,863	2274	6.17	4,563.	548	1.58
11	Makueni	1,772	89	0.22	1,784	109	0%	1,784	121	0.33	1,695	52	0.15
12	Tharaka-Nithi	3,667	834	2.02	3,667	1,386	3%	3,667	531		3,681	860.	2.49
13	Nyamira	2,501	1,583	3.83	2,508	774	2%	2,708	1014	2.75	2,708.	295	0.85
14	Trans Nzoia	2,445	658	1.59	2,190	750	2%	2,242	480	1.30	2,158	786	2.27
15	Nakuru	1,953	353	0.85	1,976	944	2%	1,991	371	1.01	1,991	832	2.41
16	Nandi	1,839	688	1.66	1,735	849	2%	1,760	576	1.56	1,845	993	2.87
17	Uasin Gishu	153	19	0.04	184	55	0.12%	208	24	0.07	281	104.	0.30
18	Migori	759	105	0.25	767	154	0.34%	767	135	0.37	787	100	0.28
19	Homa Bay	422	38	0.09	422	63	0.14%	427	35	0.10	427.	16	0.04
20	Bomet	193	4	0.01	201	28	0.06%	201	13	0.03	201	31	0.08
21	Baringo	1,026	65	0.16	1,069	136	0.3%	1,124	93	0.25	1,123	147	0.42
22	West Pokot	89	25	0.06	103	30	0.07%	114	20	0.05	168	34	0.09

<sup>14</sup> <http://coffee.agricultureauthority.go.ke/index.php/statistics/reports>

23	Elgeyo Marakwet	148	46	0.11	160	59	0.13%	169	43	0.12	144	74	0.21
24	Laikipia	46	7	0.02	52	5	0.01%	52	4	0.01	52	4	0.01
25	Narok	29	0.5	0.00	96	2	0%	96	1	0.00	97	9	0.02
26	Kisumu	24	39	0.06	98	70	0.16%	98	13	0.04	98	42	0.12
27	Kakamega	312	26	0.06	334	29	0.06%	334	15	0.04	334	19	0.05
28	Kajiado	12	0	0.00	5	2	0%	5	0	0.00	5	6	0.01
29	Busia	12	0	0.00	58	3	0%	84	6	0.02	150	9	0.02
30	Taita	10	0	0.00	2	0	0%	2	0	0.00	10	0	0
31	Vihiga	9	1	0.00	14	1	0%	14	0.9	0.00	10	0.3	0.00
32	Nairobi	135	99	0.24	187	133	0.3%	47	6	0.02	181	114	0.33
33	Siaya	5	0	0.00	8	0	0%	23	0	0.00	23	0.3	0.00
	<b>Total</b>	<b>115,570</b>	<b>41,375</b>		<b>119,627</b>	<b>44,987</b>		<b>119,675</b>	<b>36,873</b>		<b>108,199</b>	<b>34,512.16</b>	

Table 5: Coffee Production in LREB Counties

	2017/2018			2018/2019			2019/2020			2020/2021		
County	Estimated Area (Ha)	Yield (Metric Tons)	% contribution	Estimated Area (Ha)	Yield (Metric Tons)	% contribution	Estimated Area (Ha)	Yield (Metric Tons)	% contribution	Estimated Area (Ha)	Yield (Metric Tons)	% contribution
Bungoma	5,452	2,317	5.6	5,502	2,180	5%	5,775	2105	5.71	7,660.00	1,897	5.49
Kericho	4,318	2,200	5.32	8,590	3,858	9%	8,758	2198	5.96	4,758	2,965	8.59
Kisii	4,563	2,434	5.88	4,563	1,420	3%	5,863	2274	6.17	4,563.00	548	1.58
Nyamira	2,501	1,583	3.83	2,508	774	2%	2,708	1014	2.75	2,708.00	295	0.85
Trans Nzoia	2,445	658	1.59	2,190	750	2%	2,242	480	1.3	2,158	786	2.27
Nandi	1,839	688	1.66	1,735	849	2%	1,760	576	1.56	1,845	993	2.87
Migori	759	105	0.25	767	154	0.34%	767	135	0.37	787	100	0.28
Homabay	422	38	0.09	422	63	0.14%	427	35	0.1	427	16	0.04
Bomet	193	4	0.01	201	28	0.06%	201	13	0.03	201	31	0.08
Kisumu	24	39	0.06	98	70	0.16%	98	13	0.04	98	42	0.12

<b>Kakamega</b>	312	26	0.06	334	29	0.06%	334	15	0.04	334	19	0.05
<b>Busia</b>	12	0	0	58	3	0%	84	6	0.02	150	9	0.02
<b>Vihiga</b>	9	1	0	14	1	0%	14	0.9	0	10	0.3	0
<b>Siaya</b>	5	0	0	8	0	0%	23	0	0	23	0.3	0



### 1.1.3 Reason for chain selection

Coffee is one of the most economically important tropical crops globally. It is one of the most traded agricultural commodities all over the world. It contributes significantly to economies of both exporting and importing countries<sup>15</sup>. It is a favorite drink for a growing number of consumers all over the world. Kenyan coffee sector contributes to the livelihoods of about 800 000 smallholder farmers through securing family farm incomes. The sector also contributes to foreign exchange earnings, employment creation and food security. Kenyan coffee industry comes fourth after tourism, tea and horticulture industries as foreign exchange earner<sup>16</sup>.

The rise of climate change poses a threat to the coffee sector and consequently puts the livelihoods of many people who depend on the coffee industry at risk. Climate change is also making it critical to meet the ever-increasing demand for coffee all over the world. This is particularly for exporting countries who are the mainly hard hit by climate change effects. It is therefore very much relevant to address climate change effects such as low incomes, volatile prices and the lack of an enabling operational framework that continue to challenge the livelihoods of coffee farmers<sup>17</sup>.

Climate changes such as rising temperatures, more severe and frequent extreme events such as droughts, floods, hurricanes and storms, greater pest and disease incidence, and soil degradation are a major reason for reduced yields of coffee around the world. Smallholders, who produce most of the world's coffee, are both the most vulnerable and the least resilient to its effects with women producers being majorly affected due to gender inequality issues and lack of land tenure security for women. As a result, women are hindered to access finance, coffee production inputs, training opportunities and information on climate smart solutions. Climate change has rendered certain producing areas less suitable or even completely unsuitable for coffee growing. Coffee, especially Arabica coffee species, is a sensitive crop as it is traditionally grown at higher altitudes for maximum productivity and quality. Efforts to establish new locations suitable for coffee production are most likely to lead to loss of biodiversity and carbon sinks<sup>18</sup>.

## 1.2. Methodology

Mixed methods approach

The analysis employed a mixed-methods approach comprising mainly qualitative data through varied techniques including literature/desk reviews, key informant interviews, Focus Group Discussions, and interviews.

### 0.1.1. Desk Research

Thorough literature reviews of all documents relevant to the review assignment (Subject to availability) to get a better understanding of the research and to sharpen the research processes.

### 0.1.2. Key Informant Interviews

The secondary data research was complemented through qualitative interviews with key informants. This will generate further information especially County level issues and interventions

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<sup>15</sup> Bozzola, M., Charles, S., Ferretti, T., Gerakari, E., Manson, H., Rosser, N., & von der Goltz, P. (2021). The coffee guide.

<sup>16</sup> International Coffee Organization. (2019). Country Coffee Profile: Kenya. Nairobi: International Coffee Council.

<sup>17</sup> Bozzola, M., Charles, S., Ferretti, T., Gerakari, E., Manson, H., Rosser, N., & von der Goltz, P. (2021). The coffee guide.

<sup>18</sup> Bozzola, M., Charles, S., Ferretti, T., Gerakari, E., Manson, H., Rosser, N., & von der Goltz, P. (2021). The coffee guide

### **0.1.3. Focus Group Discussion**

A qualitative focus group discussion guide will be developed that will seek to generate insights. Data generated from the FGDs will be triangulated with data collected from other sources to offer explanations for trends and insights observed.

## **0.2. History of Value Chain**

### **1.3.1 Brief history of the sector/commodity**

Coffee is one of the most popular non-alcoholic beverages globally, prized for its aroma and caffeine content. It is believed that coffee originated in Ethiopia, a country in sub-Saharan Africa in the 9<sup>th</sup> Century, and individual islands in the Indian Ocean. An Ethiopian national myth credits the goat herder, Kaldi, with discovering the potential of coffee beans, after observing how energetic his goats were after eating berries from the coffee plant<sup>19</sup>.

Coffee found its way into Kenya in 1893 during the British rule. It was imported from Brazil by missionaries. The first plantation was in Bura, Taita Hills. It was then planted in Kibwezi in 1900 and in Kikuyu in 1904. Only white settlers were allowed to grow, process and market coffee. It was until 1960 that Kenyans were allowed to grow and market coffee but under many restrictions by the government, who managed their activities under the Coffee Board of Kenya to regulate and promote coffee business. Coffee Arabica type is the most commonly grown in the Kenyan highlands with rich volcanic soils and mild and wet weather throughout the year.

Coffee is largely produced by smallholder farmers. The farmers are members of coffee cooperative societies who process and market coffee collectively. Kenyan coffee is a popular brand all over the world loved for its bright acidity, a wonderful sweetness with a dry winy aftertaste, black-current flavor and aroma <sup>20</sup>. The government plays a big role in ensuring that Kenya produces the best quality coffee through reward incentives to farmers who produce the best quality coffee. The Coffee Directorate does a rigorous testing for the best quality coffee.

In 2020, the government, through the Ministry of Agriculture, launched Coffee Revitalization Project that aims to increase coffee production in partnership with World Bank. KShs 1.5 billion was set aside for the coffee industry in phase one of the two years. This programme aims also to improve the efficiency of coffee co-operative societies, support research development and technology and development of alternative coffee markets. In the first phase the project will focus on 8 main coffee producing counties which account for approximately 70% of the national production (Kiambu, Machakos, Muranga, Nyeri, Embu, Tharaka Nithi, Kirinyanga and Meru) as a pilot. The counties will receive the money as loans. 20% of the fund will be directed towards the provision of subsidized fertilizers, propagation of seeds and distribution of planting materials. While 60% of the fund will be used to improve the efficiency of the primary processing infrastructure and the quality of coffee by automating co-operatives systems and modernizing equipment. Part of the fund will be used to strengthen coffee co-operative societies institution and governance and integration of data base, backstopping and monitoring <sup>21</sup>.

### **1.3.2 Previous development activities**

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<sup>19</sup> NCA. (2022, November 23). The History of Coffee. Retrieved from National Coffee Association: <https://www.ncausa.org/About-Coffee/History-of-Coffee>

<sup>20</sup> ICO. (2020). COFFEE DEVELOPMENT REPORT, THE VALUE FOR COFFEE, Sustainability, Inclusiveness, and Resilience of the Coffee Global Value Chain. London: International Coffee Organization.

<sup>21</sup> Ndirangu. (2020, April 20). Government Launches Coffee Revitalization Project. Retrieved from Kenya News Agency: <https://www.kenyanews.go.ke/government-launches-coffee-revitalization-project/>

The colonial government restricted Kenyans from growing coffee until the Devonshire White Paper Report of 1923, when it allowed controlled planting of coffee outside the European settled areas in Kisii and Meru. There was no legal control over coffee production, in terms of crop husbandry, production, processing, grading and marketing. Coffee marketing was by individuals through rudimentary institutions between 1900 and 1933. In 1932, the coffee farmers requested the colonial government and enacted the Coffee Industry Ordinance in 1932. In 1933, it established Coffee Board (CB) to regulate and promote the coffee industry through licensing of coffee actors, besides inspectional and promotional services <sup>22</sup>.

Kenyan Coffee first appeared on the international coffee market in 1931 as a result of British settlers forming the Kenya Planters Coffee Union (KPCU). First exports were made in 1941 to Britain. The Union promoted coffee marketing abroad and negotiated for higher prices.

The Kenya Coffee Auctions, responsible of selling Kenyan coffee, was established in 1934. And the first ever coffee auction was inaugurated in 1935 when the first coffee was auctioned. While the liquoring department of Coffee Board was created in 1935 and its role was to enhance the grading and selling of coffee. The Coffee Marketing Board (CMB) was established in 1946 and became fully operational in 1947. It was established to manage coffee marketing activities through central warehousing, sale of coffee at central auction, liquoring and financing.

At independence, 1963, the coffee industry was playing a significant role in the Kenyan economy as one of the leading foreign exchange earner. The coffee board of Kenya (CBK) was established in 1960 which was the regulatory arm of the government through the Ministry of Agriculture mandated to fully control the coffee business. In 2001, the government enacted new roles for CBK which up-to-date include corporate services to coffee industry players; regulation and compliance to ensure adherence to the coffee standards, the industry code of practice and the Coffee General Regulations of 2019; market research & product development; and technical & advisory services <sup>23</sup>.

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<sup>22</sup> Coffee Directorate. (2022, November 23). Profile, Background. Retrieved from Agriculture and Food Authority, Coffee Directorate: <http://coffee.agricultureauthority.go.ke/>

<sup>23</sup> Coffee Directorate. (2022, November 23). Profile, Background. Retrieved from Agriculture and Food Authority, Coffee Directorate: <http://coffee.agricultureauthority.go.ke/>

### 1.3.3 Current state and structure of the value chain

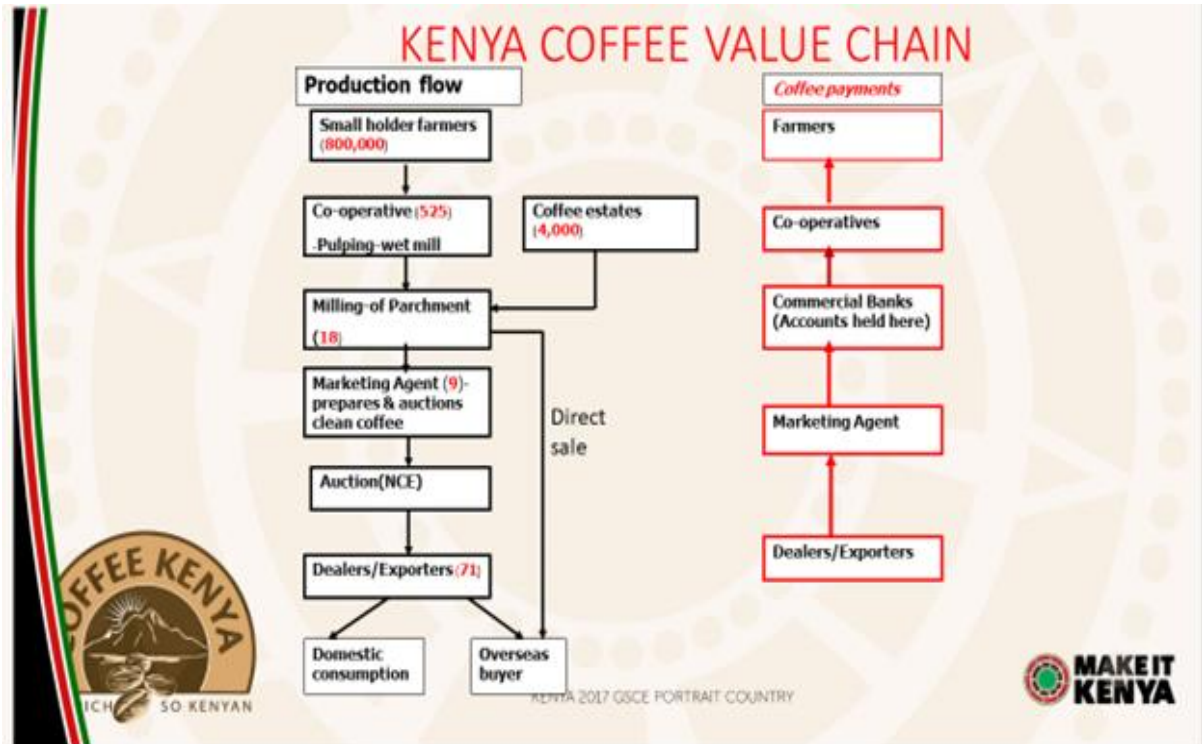


Figure 2: The Kenyan Coffee Value chain<sup>24</sup>

## 1. Functional Analysis

### 1.1. Value Chain Map

#### Production:

Kenya coffee is produced by small scale farmers who form co-operative societies and plantation growers who own their own farms with representation of 60% and 40% respectively.

Tree stumps, bushes and grasses are dug out, and the soil is made fine tilth after 4-5 ploughing and harrowing practices. It is important to wait for 6 months before planting coffee in land cleared of trees to avoid the risk of the Armillaria fungal disease-causing root rot. In addition, soil fertility and suitability should be tested before applying required nutrients. Planting holes are dug at a depth, height, and weight of 60cm during the dry season, at least three months before planting and the onset of the rains. One month before planting, planting holes are covered by topsoil mixed with 20 kilograms of decomposed manure or well-rotten coffee pulp. Phosphorus and lime are also applied few months before planting the seedlings – 100g TSP or 200g SSP if the soil pH is below 4.4 and 100g of lime.

Therefore, during the rainy months of April and October, coffee is planted. Mulching around the stems helps to maintain soil moisture and mild soil temperatures, and repelling weeds. Weeding is also performed by hand around young trees using the half-moon jembe. Seedlings might be covered with a bucket before spraying herbicides. Under dry spells, seedlings are watered at least twice a week until they reach stable growth.

<sup>24</sup> Coffee Directorate. (2022, November 24). Overview. Retrieved from Agriculture and Food Authority, Directorate of Coffee: <http://coffee.agricultureauthority.go.ke/index.php/sectors/overview>

Producers receive extension services and relevant inputs from Coffee Research Foundation (CRF), Kenya Coffee Planters Association (KCPA) and private sector actors.

The total annual coffee production has been fluctuating widely due to climate change and socio-economic factors. Currently total coffee production stands at about one million bags per year. There are two distinct flowering seasons in a year, shortly after the beginning of the rains in March through July and October through December<sup>25</sup>.

#### **Harvesting:**

Coffee is traditionally harvested by hand either through the strip picking technique, which removes all the beans together from the branch without distinction between ripe and unripe coffee berries, or most commonly through selective picking of well-ripened cherries. Hand picking is labor intensive and costly. To select the highest quality of coffee cherries, the red ripe ones are separated for processing. Farmers are only involved in removing the first fruit layer covering the seeds. In addition, coffee cherries that fall from the tree are directly left drying under the trees (such berries are called Mbuni) and collected by farmers to be delivered to the millers. Therefore, farmers are not involved in adding-value activities except for land preparation, fertilizer and herbicide application, and harvesting. In larger farms, additional high-value activities include irrigation and the maintenance of the facilities.

Overall, decreased quality of Kenyan coffee has been caused by a series of barriers:

- Farmers are discouraged to effectively apply fertilizers and control coffee diseases due to low, uncertain, and slow (up to six months after the coffee is sold) payments by KPCU combined with high costs for inputs and limited support from extension services, which leads farmers to invest in other crops or dairy production to reduce risk of income losses. In some cases, coffee plants get uprooted.
- Limited availability of organic manure has reduced soil quality.
- The use of the strip picking techniques reduce the overall quality of coffee cherries compared to selective picking methods.
- The approximatively drying and processing methods applied by farmers after harvest reduce coffee quality<sup>26</sup>.

#### **Processing:**

Harvesting is done once the coffee berries are fully ripe, and are then transported to the factories for processing. At the factory, the cherries are sorted before processing and unripe, overripe or diseased cherries are removed. The cherries are then pulped to remove the outer skin. The slimy sugary coating (mucilage) – which remain on the beans is removed through fermentation process that's takes about 36 hours. The cherries are then sun dried on tables where it is regularly turned to obtain the bluish color for which makes Kenya coffee famous.

The method used determines the flavors of roasted and brewed coffee. Almost all Kenyan coffee is processed by a wet method in order to ensure the best quality. After the coffee is fully dried it is bagged and sent to the mills.

#### **Milling:**

Milling simultaneously removes the dry pulp and parchment through hulling, polishing, grading and sorting by hand or through a machine in order to avoid contamination with over-fermented, insect-damaged, and unhulled beans, and ensure a high quality and price.

#### **Grading**

At the mills the dry parchment is hulled, polished and mechanically separated into various grades according to size, density and shape of the bean. The seeds are also graded depending on their size, where and what

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<sup>25</sup> Coffee Directorate. (2022). COFFEE PRODUCTION, MARKETING AND EXPORTS STATUS REPORT-MARCH 2022. Kenya: Agriculture and Food Authority.

<sup>26</sup> <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.821.6464&rep=rep1&type=pdf>

altitude it was grown, how it was prepared and packed, how it tastes, its cup quality and how many imperfections (defective beans, pebbles and sticks) they have per sample. The grade sizes are: AA, AB, PB, C, E, TT and T from the smallest to the largest). For the finest coffee, the origin of the beans (farm, estate region or cooperative) is very important. Mechanical and electronic grading by weight, size, shape, and color takes place after milling. This aids to isolate the best coffee beans while also removing defective beans that may add an off-taste to an otherwise premium gourmet coffee<sup>27</sup>. The following criteria is used to classify coffee: Processing method, Screen size, Number of defects, Altitude, Density, Region, Variety and Cup quality.

Table 6: Kenyan Coffee grading system<sup>28, 29</sup>

Scale	Grade	Description	Rating
1	AA	Large beans (&.20 mm screen). graded by floor size. Coffee beans lying on the largest floor grid 17/18 (equivalent to 7.2 mm diameter) and without defects. Normally grown at more than 2,000 meters above sea level. It is firm as well, and heavier than the lower graded beans. Specialty Coffee	Highest Quality ↑
2	AB	This grade is a mix of A and B (6.80 mm screen). AB stands for a screen size above 16. Is also popular and is considered a premium coffee.	
3	C	Smaller bean than B. Separated on the 14/15 floor. High-quality coffee.	
4	E	Elephant beans. The largest beans. coffee beans on a 20-inch (1/64 inch) sieve, equivalent to a diameter greater than 8mm. Obtained from beans with two conjoined kernels (a genetic defect). Are single-seeded coffee beans. Accounts for 5-10% of normal seeds. High-quality coffee.	
5	PB	Peaberry. Round beans usually one in a cherry.	
6	TT	Any light coffee blown away from all grades including ears mostly from elephants. Is the result of weight grading (lighter beans will be blown out of the air) from Kenya AB and Kenya AA.	Lowest Quality
7	T	The smallest and thinnest beans mostly broken and faulty. the coffee bean is broken, too small, or debris detached from Kenya TT class.	
8	MH	M'buni Heavy. Large Mbuni Bead. Are scattered coffee beans that are collected and processed dry, so the taste is often very unpleasant. MH and ML account for about 7% of Kenyan coffee production.	
9	ML	M'buni Light. Small Mbuni particle. Are scattered coffee beans that are collected and processed dry, so the taste is often very unpleasant. MH and ML account for about 7% of Kenyan coffee production	

Currently there are 7 licensed commercial coffee mills and several private mills.

<sup>27</sup> Nairobi Coffee Exchange. (2022, November 23). Kenya Coffee Grading. Retrieved from Nairobi Coffee Exchange: [https://nairobicoffeexchange.co.ke/index.php?option=com\\_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134](https://nairobicoffeexchange.co.ke/index.php?option=com_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134)

<sup>28</sup> Nairobi Coffee Exchange. (2022, November 23). Kenya Coffee Grading. Retrieved from Nairobi Coffee Exchange: [https://nairobicoffeexchange.co.ke/index.php?option=com\\_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134](https://nairobicoffeexchange.co.ke/index.php?option=com_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134)

<sup>29</sup> <https://helenacoffee.vn/coffee-grading-in-kenya/>

## Storage

Green coffee is transported to storage units in jute bags, which may pose coffee at risk of contamination with external factors and thus quality degradation. Coffee bags are then placed on wooden pallets that are raised from the ground as well as away from walls to avoid re-wetting and moisture absorption under heavy rainfall conditions and flooding risks. Storage lasts for 6 months after which coffee is transported to millers for the final processing. Farmers mainly make use of communal storage facilities operated by cooperatives. At the same time, storage facilities often lack adequate technologies for preventing climate impacts, such as poor ventilation and insulation for controlling relative humidity exchanges. 30

### Quality assurance:

After grading and processing, CBK does rigorous testing to ascertain the quality of the coffee seeds. This is to ensure only the farmer with the best quality is awarded. Since the best quality fetches the highest prize and Kenya is known globally for its best quality of Coffee. Therefore, CBK wants the country to maintain this state. Coffee quality and safety has been an issue of great concern to coffee producers and consumers all the world over. As a result, the Coffee Directorate, as the regulatory authority, puts coffee quality at the center of its mandate. Every coffee miller and marketing Agent is by law required to forward a coffee sample for every lot handled for quality analysis and arbitration in case of dispute. Growers also come to the Coffee Directorate for quality analysis of their coffee samples before making their marketing decisions<sup>31</sup>.

### Marketing:

After grading, the coffee beans are then passed to the marketing agents who market them for auction at the Nairobi Coffee Exchange<sup>32</sup>. The NCE is managed by a Management Committee of 9 members comprised of 5 Producers, 2 Traders, 1 Representative of Commercial Millers & Marketing Agents and 1 from the Coffee Directorate. Traders consequently purchase from the auction and sell to the exporters. Some local roasters also buy from the action center for local processing and selling for local consumption.

Currently, there are two coffee marketing systems in Kenya. The time tested central auction system has coffee auctions conducted weekly, on Tuesdays throughout the year. At the auction, coffee is bought by the licensed coffee dealers through competitive bidding.

The Direct Sale or "Second Window" requires that a marketing Agent directly negotiates with a buyer outside the country and a sales contract is duly signed and registered with the Coffee Directorate. The Directorate confirms the contract after carrying out an inspection and analyzing the coffee for quality and value as per the contract.

There are two categories of Marketing Agents namely; the Commercial Marketing Agents who offer their services purely for commercial purposes and the Grower Marketing Agents who are growers marketing their own coffee.

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30 <https://feem-media.s3.eu-central-1.amazonaws.com/wp-content/uploads/968-rpt-supplychainanalysis-coffee-kenya.pdf>

<sup>31</sup> Coffee Directorate. (2022, November 23). Our services. Retrieved from Agriculture and Food Authority, Coffee Directorate: <http://coffee.agricultureauthority.go.ke/index.php>

<sup>32</sup> Nairobi Coffee Exchange. (2022, November 23). Kenya Coffee Grading. Retrieved from Nairobi Coffee Exchange: [https://nairobicoffeeexchange.co.ke/index.php?option=com\\_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134](https://nairobicoffeeexchange.co.ke/index.php?option=com_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134)

Table 7: Coffee millers 2020/2021<sup>33</sup>

No	Coffee Millers	Total Volume of coffee handled	%age market share
1	NKG Coffee Mill	8,476,235.38	25
2	Central Kenya Coffee Mill	5,989,323.00	17
3	Kofinaf Coffee Mill Ltd	5,871,917.00	17
4	Sasini Limited	4,066,064.66	12
5	Kahawa Bora	3,627,443.00	11
6	CMS-Eldoret	1,262,488.70	4
7	Kipkelion District Cooperative Union	1,022,244.40	3
8	Thika Coffee Millers	862,831.00	3
9	NKPCU-Meru Mill	497,899.00	1
10	Embu County Coffee Mill	472,581.00	1
11	NKPCU-Dandora	428,251.00	1
12	Tharaka Nithi County Coffee Mill Co-Operative Union Ltd	420,680.30	1
13	Gatatha Farmers Company Limited	327,482.00	1
14	Mt Elgon	295,527.10	1
15	Meru County Coffee Millers Co-Op Union Ltd	269,193.00	1
16	Gusii Farmers Coffee Mill	259,796.00	1
17	NKPCU-Sagana	150,907.75	0
18	Lecom	127,753.00	0
19	Great Rift Valley	40,494.90	0
20	Gikanda Farmers Co-operative Society Ltd Mill	25,808.50	0
21	Hema	12,410.00	0
22	Busia Robusta Coffee Fcs	4,825.00	0
	<b>Grand Total</b>	<b>34,512,155.69</b>	<b>100%</b>

Table 8: Coffee Marketers<sup>34</sup>

Coffee Marketer	Amount of coffee handled	Average price per 50 Kg (\$)	%Market share
<b>Tropical Farm Management (K) Ltd.</b>	9,544,537.00	342.68	27%
<b>Coffee Management Services</b>	9,388,589.00	336.60	27%
<b>Sucastainability (K) Ltd</b>	4,956,511.00	324.61	14
<b>Aristocrats Coffee &amp; Tea</b>	3,606,161.00	308.06	10
<b>Oaklands Coffee Marketing</b>	3,572,752.00	324.53	10
<b>Sustainable Management Services</b>	1,424,735.00	323.26	
<b>Thika Coffee Marketing</b>	896,236.00	292.30	4%
<b>New KPCU Ltd</b>	760,650.00	285.20	1%
<b>Kenya Cooperative Coffee Exporters</b>	447,751.10	328.51	1%
<b>Classic Coffee Ltd</b>	2,095,729.36	326.31	1%
<b>Meru County Coffee Marketing</b>	258,105.00	257.70	1%

<sup>33</sup> Coffee Year Book 2020-21

<sup>34</sup> Coffee Directorate Statistical Report for Oct2021-Mar2022



<b>Total</b>	<b>35,177,149.10</b>	<b>328.85</b>	<b>100%</b>
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Table 9: Coffee Dealers 2021/2022<sup>35</sup>

No.	Dealer	Count
1	Coffee Dealer/Trader	84
2	Commercial coffee millers	15
3	Commercial Marketing Agents	11
4	Grower Marketers	22
5	Commercial warehousemen	7
6	Private Warehousemen	14
7	Management Agents	4
	<b>Total</b>	<b>157</b>

### Promotion:

The Coffee Directorate has the responsibility together with other stakeholders of promoting Kenya Coffee. This is done through:

- Identifying and developing strategic networks through foreign Embassies, consumer and industry organizations in order to increase awareness of the quality and the consistency of Kenya Coffee.
- Gathering Trade and Industry intelligence on consumption and industry developments in a bid to identify opportunities, threats and advise stakeholders accordingly.
- Establishing linkages with locally based exporters and dealers so as to gather and analyze data on market trends and consumer patterns.
- Developing respective country and consumer profiles in existing markets as well as emerging markets of Eastern European Europe, Asia and others in order to guide industry's marketing efforts.
- Participating in local and international Trade Fairs and Exhibitions as a means of increasing consumer awareness.
- Encouraging the growers and the buyers of Kenya Coffee to enter into relationship marketing so as to shorten the marketing chain, hence increase returns to growers.

### Research

Research on Coffee in Kenya started in 1908. The first ever research institute was established in 1944 by the colonial government at Ruiru as the Coffee Research Station. Construction of research laboratories was completed in 1949 funded by the Kenyan Government. In 1964, the Coffee Research Foundation (CRF) was established. The Coffee Research Foundation was the premier research institution and one of the best in the world. It was financed by the growers and undertook specialized research in all matters pertaining to the production, processing and marketing of coffee. It housed the Kenya Coffee College, which offers both local and international training on all aspects of coffee to ensure that information on the best and most modern coffee farming technologies are disseminated to all stakeholders in real time.

In 2014, The Kenyan Government dissolved and merged 4 State Corporations namely; Kenya Agricultural Research Institute (KARI), Tea Research Foundation (TRF), Coffee Research Foundation (CRF) and Kenya Sugar Research Foundation (KESREF to form Kenya Agricultural and Livestock Research Organization

<sup>35</sup> <http://coffee.agricultureauthority.go.ke/index.php/sectors/stakeholders>

(KALRO). The Coffee Research Foundation was consequently transformed into Coffee Research Institute (CRI) as one of the institutes under KALRO<sup>36</sup>.

### **Policy and Legal advisory**

The coffee directorate is mandated by the government to ensure adherence to the coffee standards, the coffee industry code of practice and the Coffee regulations<sup>37</sup> (Coffee Directorate, 2022)(Coffee Directorate). It achieves this through:

- Facilitating development and review of policy and regulatory framework for the coffee industry;
- Maintaining register of all players in the industry
- Undertaking registration and licensing of Coffee buyers, Warehouseman's, Processed Coffee importers, Independent Cupping Centres and liquorers;
- Enforcing compliance with the coffee industry standards and regulations through inspections and surveillance.
- Undertaking capacity building of county governments on licensing, coffee industry standards, and the industry code of practice;
- Ensuring harmony within the coffee industry through arbitration of disputes

Kenya Coffee Producers and Traders Association (KCPA) is mandated by its constitution as the coffee producers advocate. It is at the forefront of policy dialogue. Through Research, KCPA undertakes effective lobbying to provide accurate information on coffee issues and realistic action plan to address the issues. KCPA, in partnership with other development partners, heavily invests on research to inform its advocacy initiatives<sup>38</sup>.

## **1.2. End-market Analysis**

### **2.2.1 Demand**

Coffee is typically grown in the least developed regions of the world, but largely consumed by the most developed countries. Kenya exports 95% of its coffee to international markets while 5% is consumed locally. This can be attributed to the traditional and predominant tea preference, and low purchasing power among the population. Annual coffee consumption is about 15,000 tones which is much lower than tea consumption. Although coffee has a low consumption rate on the local market, this scenario is gradually changing following the rise of the Kenyan middle class. Recently, there has been a fast-rising coffee drinking culture. Lower quality instant coffee is becoming dominant among Kenya's growing middle class populations in urban areas, most likely because of their higher disposable incomes. Instant coffee is the most commonly consumed coffee product in Kenya <sup>39</sup>. The volumes of instant coffee consumed are far higher than those of specialty coffee. Nescafe, Mccoffee and Dormans instant coffees are more popular in both rural and urban Kenya. The young consumers perceive 'visiting coffee shops' as trendy. Coffee shops like Java House, Dormans, and Art café among others keep sprouting up in major towns depicting a growing trend in coffee consumption in the country

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<sup>36</sup> KALRO. (2022, November 23). Coffee Research Institute. Retrieved from Kenya Agricultural and Livestock Research Institute: <https://www.kalro.org/coffee/?q=homepage>

<sup>37</sup> Coffee Directorate. (2022, November 23). Our services. Retrieved from Agriculture and Food Authority, Coffee Directorate: <http://coffee.agricultureauthority.go.ke/index.php>

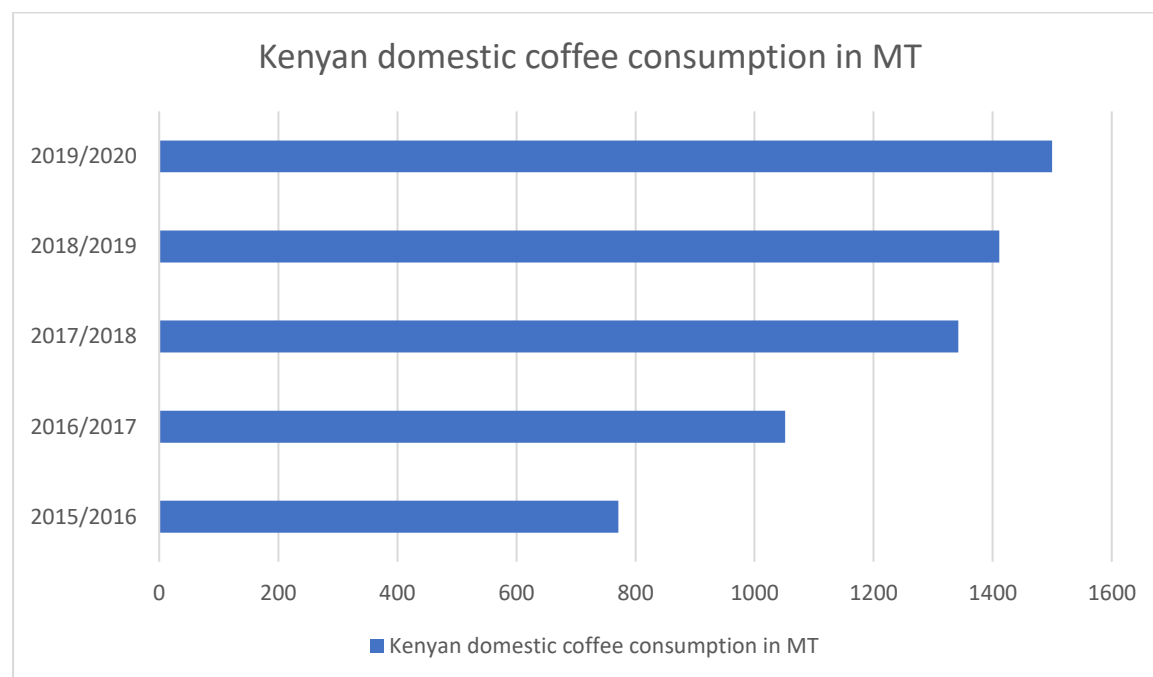
<sup>38</sup> KCPA. (2022, November 24). STRATEGIC OBJECTIVES. Retrieved from Kenya Coffee Producers Organization: [http://kcpa.co.ke/?page\\_id=164](http://kcpa.co.ke/?page_id=164)

<sup>39</sup> CO. (2020). COFFEE DEVELOPMENT REPORT, THE VALUE FOR COFFEE, Sustainability, Inclusiveness, and Resilience of the Coffee Global Value Chain. London: International Coffee Organization.

<sup>40</sup>. Across the entire coffee sector, consumption is increasing and more brands are starting to appear. Greater variety of coffee brands now are appearing in the supermarkets especially in Nairobi city. Occasions such as Kenya Barista Championships are geared towards popularizing local consumption of coffee in Kenya <sup>41</sup>.

The table below depicts coffee consumption in Kenya the last five years:

*Table 10: Coffee consumption 2015/2016-2019/2020*



## 2.2.2 Market structure

Smallholders are members of Cooperative Societies who process and market the coffee on behalf of its members. Large scale coffee growers produce and market their own produce. Kenya has two coffee marketing systems, the Central Auction system and the direct sale. In a central auction, licensed dealers buy coffee through competitive bidding every Tuesday, at the Nairobi Coffee Exchange. Coffee is auctioned every week. The Nairobi Coffee Exchange is mandated to manage the coffee central auction in the country. The coffee is packed in single sisal bags of 60 kg, but the bids are made per 50 kg bag.

On the other hand, in a direct sale, a marketing agent directly negotiates with a buyer outside the country and a sales contract is signed and registered with the Coffee Directorate. Marketing agents are individuals or companies who are contracted by farmers to present coffee for sale at the Nairobi Coffee Exchange Commercial. Marketing agents offer services for commercial purposes. We also have grower marketers, who are growers licensed to market their own coffee. Kenyan farmers choose their marketing agents once a year, during an annual general meeting with the term of the contract generally starting in early October. This is during the harvest season, which runs from October to December.

More than 85% of Kenyan coffee is traded at the Nairobi Coffee Exchange.

<sup>40</sup> International Coffee Organization. (2019). Country Coffee Profile: Kenya. Nairobi: International Coffee Council.

<sup>41</sup> CO. (2020). COFFEE DEVELOPMENT REPORT, THE VALUE FOR COFFEE, Sustainability, Inclusiveness, and Resilience of the Coffee Global Value Chain. London: International Coffee Organization.

The coffee offered through the auction is bought by licensed coffee traders or exporters for onward export overseas. Coffee traders are the buyers of the coffee that is offered at the auction for subsequent export to the overseas buyers or local roasters for the local and international market.

Before coffee is presented at the auction, warehouse-men store the coffee on behalf of the Marketing Agents before presentation to the market.

*Table 11: Coffee Market actors*

#	Actor	Role
1	Marketing agents	Contracted by farmers to present coffee for sale at the Exchange Prepare sale catalogues Draw and present Representative Samples to the trade Sample room Auction the coffee on behalf of the farmers Prepare invoices for the buyers Receive payments from the respective traders for coffees bought at the auction Prepare and remit coffee warrants to the traders after payments have been made. Process payments for the farmers Arrange for warehousing of coffee within Nairobi county.
2	Traders	Collect and analyze coffee samples Bid/buy coffee from the auction Export coffee to overseas roasters and import trade or roast for local consumption.
3	Warehouse-men	Store coffee on behalf of the Marketing Agents Prepare warrants for coffees on offer at the auction on behalf of the Marketing Agents.
4	KCPA (Millers, Marketing Agents, Warehousemen, Coffee Equipment suppliers and Transporters)	Represent all member companies engaged in the coffee industry, either in the export trade or its related services Act as a forum for discussion and exchange; Disseminate coffee industry information to its members Assist in the promotion of Kenyan coffee and its industry on the international market. Oversee coffee auction at Nairobi Coffee Exchange
5	Financiers	Finance coffee industry actors
6	NCE	Runs the coffee auctions in Nairobi
7	Coffee Directorate	Industry Policy and Regulatory Framework Compliance Market Research and Product Development

Once the coffee has been sold, the marketing agent pays the cooperatives within 14 days, Cooperatives have money in their banks within 14 days but coffee payments are not made to the producers until June-July. Consequently, farmers don't have cash for fertilizer or pest control, or have to borrow expensively. Also the farmers lack feedback from the market on whether the prices were up or down at the time they sold their coffee and farmers are highly dissatisfied. The industry must find a way to address the lengthy payment cycles from Cooperatives to farmers <sup>42</sup>.

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<sup>42</sup> Muthoni, M. P. (2014). Coffee Value Chain Analysis in Kenya (A case of Kenya Planters Cooperative Union). *Journal of Business and Management*, 6(5), 207-215.

## 2.2.3 Drivers

### 1.3. Analysis of Value Chain Elements -Value Chain Nodes, Actors & Activities

The coffee value chain starts at the producer level, where majority are small holder farmers who account a total of 800000 and more. Small holders are members of cooperatives who aggregate coffee for collective marketing through the marketing agents. We also have the coffee estates who are about 4000. From the farm, the harvested coffee is taken to factories owned by Cooperatives or Coffee estates where pulping and wet mill of the coffee is done. All the processed coffee from the factories is taken to the mills. There are about 18 coffee millers in the country. Coffee from the mills is taken by the Marketing agents to the warehouses before it is presented for auctioning at the Nairobi Coffee Exchange. Currently there are about 9 marketing agents recognized by the Coffee Directorate. At the auction coffee dealers and agents buy the coffee for sales either for Domestic consumption or overseas buyers. There are about 71 coffee dealers and exporters present every Tuesday of the week at the Nairobi Coffee Exchange.

Coffee payments flow from the Dealers/exporters to marketing agents who deposit the money on commercial bank accounts of cooperatives. The cooperatives then pay the coffee farmers mid-year around June-July.

## 2.3.1 Value Chain Actors

### 2.3.1.1 Production, collection/aggregation, processing, wholesaling, and retailing

#### Farming

Coffee farming is undertaken by smallholder growers and the plantations. They manage the crop from seedlings until harvesting. There are about 800 000 smallholder coffee growers and about 3000 coffee plantations. The smallholders own about 75% of land under coffee production, with production of slightly above half of the Kenya's total annual coffee production. This is due to inability to afford intensive use of fertilizers and spraying due to associated high costs, hence poor production. Plantations produces almost half of the coffee out in Kenya because of the heavy utilization of fertilizers, pesticides, herbicides, fungicides and irrigation.

Land preparation is by uprooting of all tree stumps, roots, bushes and grasses, followed by 4 or 5 ploughing and harrowing to bring the soil to a fine tillage.

It is important to do soil testing to measure the soil fertility and its suitability. Thereafter, based on soil test reports, the required nutrients are added to the soil before planting the seedlings. Fertilizers such as phosphorus and lime are added in the soil a few months before transplanting the coffee seedlings in the field. This is by ploughing and disking the soil thoroughly.

A planting layout of seedlings is recommended because different varieties of coffee have different holes spacing and population density for planting. Planting holes should measure 60cm x 60cm x 60cm (2ft x 2ft x 2ft) and are dug during the dry season, at least three months before planting/onset of rains. Then, 1 month before planting, holes should be filled with the topsoil mixed with a minimum of 1 "debe" (20 litre bucket) of well decomposed manure or well-rotten coffee pulp. In addition, 100g TSP or 200g SSP is added if the soil pH is below 4.4 and 100g of lime is added to the mixture, otherwise added as per soil test results. Coffee seedlings are obtained from KALRO's Coffee Research Institute or any licensed coffee nursery and purchase fertilizers and chemicals from Agro-vet dealer shops.

Coffee seedlings are grown in nursey bags for 6 to 7 months. They are transplanted in the main field at a height of 20 to 25 cm. The tree seedlings are planted at a distance of 3-5 m in rows that are 15-20 cm parts. Planting is usually done during the rainy seasons, basically the months of April and October. Young coffee plants are mulched to conserve soil moisture, suppress weeds and control soil temperatures. Mulch is applied around the stem, ensuring that the mulch and the stem do not come in contact to avoid insect

pest attack. Once established a coffee bush is expected to produce coffee beans up to 60 years from its establishment<sup>43</sup>.

During crop establishment, seedlings are watered at least twice a week until they are well established, especially in the dry season. Weed control is by hand weeding around the young trees and in between the rows. Stubborn weeds like couch grass, are controlled using herbicides. The crop is covered by a bucket or bag before weeds are sprayed with a suitable herbicide.

In Central Kenya, there are typically two seasons of rainfall, resulting into two distinct flowerings March to April and October. Whereas in Western Kenya, rainfall is evenly distributed resulting into 5 flowerings in a year and five harvestings of Arabica coffee<sup>44</sup>.

Coffee production costs are dependent on levels of productivity and coffee varieties under establishment. The main production costs include labour costs for pruning, inputs, weed control and hand- picking of ripe coffee berries. Estates have additional costs of administration and primary coffee processing.

### **Harvesting and Sorting**

Coffee is mainly harvested by selective hand-picking whereby only well-ripened coffee berries/beans are picked. Occasionally, coffee can be harvested by strip picking whereby trees are harvested entirely at one time by picking all the beans off the branches, ripe as well as unripe cherries. Hand picking is the wide spread method of harvesting coffee cherries. Coffee growers and pickers select the highest quality coffee cherries. After harvesting, good cherries are separated from the bad cherries to ensure that only the best red ripe cherries are processed. Some coffee cherries spontaneously drop off from the coffee tree and dry on the farm land. This kind of cherry is popularly known as Mbuni. Growers usually pack it at the farm and deliver it to the factory to be transported to the millers (KCTA).

### **Collection/aggregation**

The factories serve as collection/aggregation centers for smallholder coffee growers. Immediately after harvesting, the growers deliver their coffee berries at the factory by a lorry or track, for primary processing. The farmers empty their bags at the delivery unit of the factory for weighing and a receipt is provided to the farmer for the amount delivered.

The small holders through the cooperative jointly produce, process and market their own coffee. There are about 525 coffee cooperative societies each with about 2000 small holders of all the more than 800000 smallholder coffee growers. A cooperative can have one or more factories based on the level of production and geographical location of coffee farms. The cooperatives undertake wet processing of the coffee berries before the dry parchment is taken to the millers for further processing. The main objectives of the cooperative societies are; to promote sustainable economic growth, diversify the coffee products, improve access to markets and enhance marketing efficiency. The committee members of the societies are elected through the annual general meetings. Basically the cooperative society is at the lower end of the value chain just after the producer level, undertaking the bulking of raw materials for the millers. There is no much coffee value addition at the cooperative level. Therefore, the cooperative has less bargaining power over coffee prices at the NCE. As a result, majority of smallholders have opted out of the cooperative societies and others have abandoned completely coffee production for more profitable businesses<sup>45</sup>.

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<sup>43</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

<sup>44</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

<sup>45</sup> Mwangi, R. W. (2018). Value Addition Practices in Coffee Cooperative Societies and Sustainability Of The Coffee Industry In Kenya (Doctoral dissertation).

Once the coffee is sold, estate growers get paid directly while smallholder growers get paid through the coffee cooperative societies. Payment periods depend largely on the efficiency of the marketing agents and availability of buyers.

## **Primary processing**

### ***Wet milling***

At the factories ripe coffee berries undergo wet processing at washing stations which are owned by co-operative societies and estate farmers. Only a small amount of coffee is dry processed into mbuni (dried coffee that has not undergone pulping).

Wet milling is the primary processing of coffee that results in the production of parchments. There are about 1,001 co-operatives pulping stations and 3,000 estates pulping stations registered by the Coffee Directorate<sup>46</sup>.

During the wet milling process, the skin and the pulp of the ripe and fresh coffee cherry are removed by a pulping machine, which consists of a rotating disk that presses the coffee cherry against a sharp-edged plate, disengaging the pulp from the seed. A thin mucilaginous layer of the pulp that clings to the coffee seed is removed by fermentation. The seeds are fermented in tanks for between 48 to 72 hours. During fermentation, naturally occurring pectic enzymes decompose the pulp. After which, the seeds are washed to clear all remaining traces of pulp from the coffee seeds. Thereafter, parchments of grade 1 are conveyed to fermentation tanks, while grades 2 and lighter are further processed through a smaller pulper called a re-passer. After pulping coffee beans have a moisture content of about 55%, so it is dried to reach a moisture content of 11% either by exposure to sunlight or by passing through hot air driers. Controlled sun drying is predominantly used mainly by co-operatives through spreading of coffee on wire mesh tables for several days (normally about 14 days), until fully dry. In the rainy season the coffee is covered by polythene sheets to avoid wetting. Some of the big commercial estates use mechanical drying.

Once dried, the pulped coffee is sorted by size and density and graded as parchment 1-3.

Parchment 1 is the heaviest coffee. Parchment 2 is the medium density coffee. Parchment 3 or P-Lights is the lightest one. The grading of the coffee does not affect its quality, but rather its class instead.

Coffee is also evaluated based on colour, imperfections, and damage which may occur during drying. The parchments are then weighed, packed into bags and transported to millers for milling.

### ***Dry Milling***

In the dry milling process, the green coffee is placed on wire mesh tables and left to dry until the required moisture content of 11% is attained. Once it is dried, the coffee beans are hulled where the dry pulp and parchment are removed in a single operation.

The dry parchment is then packed in sacks and stored in stores that have good air circulation. Coffee is placed in sacks and stacked on wooden pallets that are 0.5 m above ground level and 0.5 m away from the walls and maximum care is taken to prevent the coffee from absorbing any moisture. The coffee is stored for a maximum of 6 months and is transported by lorries to mills in order for secondary processing <sup>47</sup>.

## **Secondary processing**

Secondary processing occurs at the mills. Mills receive dry coffee parchments from the factories. At the mill, coffee is weighted using a digital weighting machine followed by a quality analysis before the processing

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<sup>46</sup> International Coffee Organization. (2019). Country Coffee Profile: Kenya. Nairobi: International Coffee Council.

<sup>47</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

step. Quality analysis is by visual inspection of the coffee size in a sample of 1 kg per bag of 50 kg and a moisture content check. For traceability, an outturn number is assigned to each 50 kg coffee bag depending on the week the coffee is delivered within a coffee year.

After quality analysis, coffee then undergoes hulling. Machinery is used to remove the parchment layer (endocarp) from wet processed coffee. Hulling dry processed coffee refers to removing the entire dried husk, the exocarp, mesocarp and endocarp of the dried cherries. The hulled coffee is then polished. This is optional. During polishing any skin that remains on the beans after hulling is removed by machine. Polished beans are considered superior to unpolished ones, however in reality there is little difference between the two. After polishing, coffee beans graded and sorted by size and weight, and beans are also reviewed for colour flaws or other imperfections. Beans are sized by being passed through a series of screens. They are also sorted pneumatically by using an air jet to separate heavy from light beans. Finally, defective beans are removed either by hand or by machinery. Poor quality beans are removed. Grading is done in order to group the coffee beans homogeneously into commercial lots that meet defined quality standards and for pricing<sup>48</sup>.

Coffee grades range from 1 (worst) to 10 (best), this allows to further sort coffee within a grade. Grades E, AA, AB and PB are regarded as the premium grades. Kenya AA is considered to be one of the world's finest specialty coffees. Grade AB consist of bean types A and B mixed together and is the most plentiful in a particular consignment and used to represent other grades. Other grades include: SB (sorted beans), UG (ungraded) cherry and HE (hulled ears). Mbuni coffee is graded as MH (Mbuni Heavy) and ML (Mbuni Light) depending on the density.

### **Marketing**

Coffee is marketed mainly through the weekly auctions at the Nairobi Coffee Exchange (NCE). The NCE accounts for over 80% of the total sales. The rest of the coffee is marketed through the direct sales. Commercial marketing agents are the key agents at the NCE. They are contracted by farmers through coffee cooperative societies to sell their coffee to the highest bidder in the auction. The marketing agents and other coffee dealers are registered and licensed by the Coffee Directorate each year to be eligible participate at the auction. The marketing agents, present coffee for auctioning and the coffee exporters buy the coffee for both local and export sales. The exporters make coffee payments within 7 days of purchase by the dealers and within 14 days to growers from the date of the auction. Direct sales channels involve the licensed grower-marketers, who are coffee growers with licensed to market their own coffee directly to overseas buyers. In cases where the grower is incapable to market their coffee directly, commercial marketing agents facilitate the process by drawing up sales agreements between producers and buyers and handling other marketing logistics. Currently there are 11 licensed commercial marketing agents and 22 grower marketers.

### **Warehousing**

There are 7 commercial warehouses and 14 private warehouses registered and licensed by the Coffee Directorate. They store the coffee for the commercial marketing agents as they await to present it at the Nairobi coffee exchange for auctioning and afterwards for export at the port. Warehousemen ensure quality of coffee through provision of storage and logistics expertise (issue coffee warrants which are important legal and trade documents) on behalf of both the farmer and exporter (KCTA).

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<sup>48</sup> Nairobi Coffee Exchange. (2022, November 23). Kenya Coffee Grading. Retrieved from Nairobi Coffee Exchange: [https://nairobicoffeexchange.co.ke/index.php?option=com\\_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134](https://nairobicoffeexchange.co.ke/index.php?option=com_content&view=article&id=24:kenya-coffee-grading&catid=20&Itemid=134)



## Exports

Both Kenya and the international coffee markets depend heavily on coffee traders/exporters to supply green coffee for roasting and packing. Almost 95% of the Kenya's coffee is exported in green form every year, and only 5% is exported in roast and ground form mainly within the Africa. This is because the consuming countries prefer freshly ground and brewed coffee. According to Coffee Directorate, there are 84 registered and licensed coffee dealers/exporters. Sasini Ltd, Domarns Coffee Limited, Nairobi Java House are some of the known coffee dealers.

Kenyan coffee export market is segmented into traditional, specialty and emerging markets. About 60% of the coffee is exported to the traditional market which is made up mainly of countries in the European Union. About 20% of coffee is exported to the specialty market that is led by the USA and includes Japan, Canada and some countries from the European Union. About 15% of the coffee goes to the emerging coffee markets which includes the Gulf region, China, Korea, Malaysia among others and have developed affinity for Kenyan coffee grades: T, C, MH, ML, and UGs<sup>49</sup>. The rest of the coffee is roasted, packaged and sold domestically.

Coffee exporters are key to the supply chain linking the origin country and consuming destination and bridging the time gaps between supply and demand. They also provide finance to both sellers and buyers (taking on the price risk). They undertake the overseas marketing and commercialization of coffee. They do logistics functions and have coffee quality expertise.

## Domestic markets

There are about 25 coffee roasters in Kenya, of which 4 are grower marketers and 1 university. The growers and private roasters are licensed to roast, pack and market Kenyan coffee locally and internationally. Coffee is purchased through auction and after roasting is retailed in major urban centres and coffee shops. The domestic market consumes both locally produced and imported coffee products. The locally produced coffee brands include Java, Dormans and Gibsons coffee and are sold in retail outlets in Uganda, Tanzania and Rwanda. Furthermore, the domestic market is highly diversified from mainstream coffee blends to informal coffee hawkers, a number of independent coffee shops exist alongside big chains such as Java coffee shop, Savannah, Café Deli & Delicatessen, Artcaffe and Bakery Ltd, and Avanti Group of restaurants among others<sup>50</sup>.

### 2.3.1.2 Technologies used in each node- advantages/ disadvantages

The techniques and methods used to convert coffee cherries into quality coffee beans requires extensive and delicate processing and vary based on several factors including location, climate and even season. Given the scenario, the most natural technology with the highest proven quality, the least amount of waste and the lowest possible impact on the environment is adopted<sup>51</sup>.

#### i) Wet processing

The wet processing method requires the use of specific equipment and a lot of water but produces better quality coffee than dry processing. The pulp is washed away with water and is dried and recycled as mulch or all-purpose manure. The water produced by wet processing of coffee can be toxic to the coffee plants.

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<sup>49</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

<sup>50</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

<sup>51</sup> Bozzola, M., Charles, S., Ferretti, T., Gerakari, E., Manson, H., Rosser, N., & von der Goltz, P. (2021). The coffee guide.

On plantations, the wastewater along with the shell and mucilage are reprocessed in specially segregated area as compost manure and used in other soil fertilization programs.

- **Harvesting-** This is done by hand-picking of ripened coffee berries. It is quite expensive and time consuming to farmers.
- **Sorting-**Coffee cherries are harvested when red. On reaching the factory, the under-ripe and overripe cherries are sorted out from those that have the perfect ripeness.
- **Pulping-** The ripe red cherries are pulped as soon as they are picked and no longer than 24 hours, otherwise, they begin to ferment. It is done at the factories owned by cooperatives. Coffee cherries are pulped by squeezing through screens that separate the pulp from the interior seed/coffee bean.
- **Fermentation-** Still at the factory, the seeds are then fermented in ceramic tile tanks full of clean spring water for 36-48hours. The seeds are fermented to remove the slick layer of mucilage that is still attached to the parchment. It is removed while the beans are resting in the tanks by naturally occurring enzymes which cause the layer to dissolve.
- **Washing-** After fermentation, the beans will feel rough, rather than slick, to the touch. The beans are rinsed by being sent through additional water channels. The fermented water and remaining coffee pulp on the bean are washed off with clean water. The coffee beans are put into the grading channels where they are washed clean with the purest water. This process both cleans the beans and also as the flow of water carries the beans along the slight incline of the grading channels the coffee is separated with the densest and best quality at the high end of the channel and the smaller lighter and defective beans flowing down channel where they are separated.
- **Soaking-**After washing the coffee beans are soaked overnight. Soaking of the seeds is meant to encourage the coffee bean to germinate, which contributes to extra sweetness and complexity.
- **Parchment drying:** Finally, the beans are slowly sun dried over raised tables over 1-3 weeks under supervision. Once the optimal moisture levels for export (11.5 – 12%) is attained. The coffee beans are turned regularly to ensure that it dries evenly. During the rainy seasons and “winter months” when it is not possible to sun-dry the coffee parchment, the coffee is dried mechanically with fans in special drying rooms.
- **Parchment conditioning**  
It is also called resting, curing or storage. The coffee is stored in silos for 15-16 days. The goal is to homogenize moisture, enhance quality attributes and ensure better ageing. Coffee is hygroscopic and exchanges moisture with its surrounding environment, it is therefore generally recommended that it be stored at a relative humidity of 60%–65%.

## ii) **Dry Processing**

Before the parchment coffee can be turned into a coffee blend it must first go through a milling process to remove the endocarp. The parchment is weighed and stored in 60-70 kg bags while it is bulked awaiting a date with the millers.

Special permits are required to move or transfer coffee and once the required weights are met the parchment is sent off to the millers.

- **Hulling-** The dried parchment is then hulled, polished and graded. Hulling removes the endocarp and the test or silver-skin. Hulling away the parchment is optional because some coffee beans are sold with the parchment. The final traces of the silver-skin are removed in polishing. Defective beans are sorted out by hand. Hulling removes a leathery covering (parchment) from the coffee beans, which includes the husk and the mucilage as well as other plant material. Regardless of how many layers are being removed during hulling, it is all taken care of in one step. A machine called a "huller" is used to remove the coffee parchment. Hullers range from simple millstones to sophisticated machines that tap away at the coffee to remove the hulls. No matter how simple or complex the huller, the basic operation is that they abrade the hull until it crumbles away.

- **Grading-** Once the dried coffee has attained the required moisture content it is rigorously sorted by size and density and graded a Parchment 1-4 (P1-P4) with parchment 1 being the best quality (densest) and 4 being the least (lightest). The coffee is graded by colour flaws, imperfections and damage that could have been incurred while drying.

#### **1.4. Support services in the extended value chain**

##### **2.4.1 Suppliers of physical inputs**

KALRO's, Coffee Research Institute, as the only authorized source of Certified Coffee seeds in Kenya, produces certified coffee seeds. The institute has enough quantities of seeds of traditional coffee varieties such as SL28, SL34 and K7. Ruiru-11 seeds are produced through manual pollination, a labour intensive and delicate process hence the supply of seeds has not been able to meet the high demand. The institute also raises coffee seedlings.

and supplies the seedlings to farmers on a first come first served basis. Seedlings are raised in the nursery from seeds or vegetative propagation. They also do testing and evaluation of newly released chemicals for use in coffee such as pesticides, fungicides, herbicides, fertilizers etc. to determine their suitability and make recommendations to growers

Coffee Cooperative Societies (CCS) are about 525 and each serves about 2000 coffee growers. CCSs provide equipment to coffee growers, such as plant sprayers and pruning materials, and sell to farmers at lower prices than elsewhere on the market. Co-operatives also offer chemicals such as fertilisers and pesticides at subsidised rates. They also provide lime to farmers every two years to neutralise acidity levels in soil, and sometimes it is provided for free.

Private suppliers have ready market to supply inputs such as; coffee seedlings, fertilizer, and financing to coffee growers. Coffee seedlings are grown in local nurseries and are purchased directly by coffee estates and growing cooperatives. Fertilizers are imported and sold either directly to cooperatives or through wholesalers and retailers. Where the cooperative has contracted suppliers for various equipment, and the beans fetch fair prices in the auction, suppliers receive their payments on time.

Coffee equipment suppliers include companies who provide necessary coffee processing equipment and machinery.

## 2.4.2 Support services provided to actors along the VC

### County Governments

Following the promulgation of the Kenya Constitution 2010 provision of agricultural extension services were devolved to the county governments.

The county government extension staff promote the coffee sector by providing access to good practices in coffee production. Moreover, the Coffee Directorate in collaboration with other relevant stakeholders provide capacity building to the counties' agricultural staff and other coffee value chain players. The collaborating private agencies include Technoserve, Solidaridad, certification bodies (UTZ, 4C, Fairtrade) and management services providers. Kenya's coffee sector is funded by the national and counties government, banks, SACCOs and development partners. Commodities Fund (ComFund) – ComFund was established under Crops Act 2013. The Fund is the successor of Coffee Development Fund and Sugar Development Fund which was part of Kenya Sugar Board. ComFund mandate is to provide sustainable and affordable credit and advances to agricultural sector for farm improvement, farm inputs, farming operations, agricultural infrastructural development, value addition initiatives, price stabilization and facilitating capacity building related to credit absorption. The facility is a short term working capital advance offered to registered coffee farmers, co-operatives societies, coffee associations and estates growers to enhance their primary processing (pulping) capacities<sup>52</sup>.

### Coffee Cooperative Societies

They can host seminars and workshops to educate their members on ways to upgrade their coffee farms, through digitalization and more modern mechanization. They link farmers to coffee traders. They facilitate the sale of green coffee at weekly auctions at Nairobi Coffee Exchange. Through their connections, sometimes higher-quality coffee is sold before it gets to auction, but this must be approved by co-op members. It is the cooperatives that decide the price that farmer members receive, which is paid per kilogram of coffee leaves delivered. Through the cooperatives, farmers receive their money from marketing agents after their coffee has been purchased<sup>53</sup>.

### Coffee Research Institute (CRI)

CRI falls under the Kenya Agriculture Research and Livestock Organization and is responsible for carrying out coffee related research. The institute conducted major research to ensure sustainability of production through an efficient value chain and climate mitigation measures. In addition, it develops technologies coffee varieties and carries out research on disease and pest management. Moreover, CRI developed two improved varieties of coffee namely Ruiru11 and Batian, which are resistant to Coffee Berry Disease and Leaf Rust Disease, thus lowering the cost incurred in the control by fungicides. It provides recommendations regarding good agricultural and manufacturing practices.

CRI serves the coffee industry through conducting research in all coffee production, processing and marketing aspects. The institute also provides routine soil and leaf analysis. Soil and leaf samples are analyzed and farmers given advice on the best fertilizer to use, the rates and time of application. CRI also does chemical analysis and evaluation to test newly released chemicals for use in coffee such as pesticides, fungicides, herbicides, fertilizers etc., to establish their suitability and make recommendations to coffee growers. Samples of chemicals are also analyzed to confirm their active ingredients.

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<sup>52</sup> ComFund. (2022, November 16). Commodities Funds, Financing crops for prosperity. Retrieved from Who we are: <https://www.comfund.co.ke/who-we-are/>

<sup>53</sup> Muthoni, M. P. (2014). Coffee Value Chain Analysis in Kenya (A case of Kenya Planters Cooperative Union). *Journal of Business and Management*, 6(5), 207-215.

CRI also provides advisory services to farmers through publications to farmers such as the Coffee Production Recommendation Handbook, The Coffee Growers Handbook, The Mapendekezo ya Ukuzaji wa Kahawa among others. It also organizes Field Days, Field Visits, Open Days, Agricultural Shows, Radio Programmes and Use of Demonstration Plots. They have a residential training at the Kenya Coffee College where they offer short courses on coffee production, processing and marketing to farm, Factory and Nursery Managers, Coffee Extension officers and ordinary farmers <sup>54</sup>.

The CRI as well does weather monitoring and forecasting where quarterly weather bulletins are released to coffee growers with advise on the husbandry and processing practices to be carried out in line with the expected weather conditions. It also does routine recording and analyzing of meteorological data such as rainfall, temperature and other weather parameters for Coffee Research Stations and substations. In addition, CRI links the coffee industry with the coffee farming community, research Centers and institutions dealing with coffee in and outside Kenya, though information and material exchange<sup>55</sup>.

### **Kenya Coffee Traders Association (KCTA)**

KCTA is a non – political, non – profit membership umbrella organization of coffee farmers in Kenya. Currently it represents approximately 343,536 smallholders of coffee farmers spread out in all the coffee growing counties. Their mandate is to represent the economic and social interests of coffee farmers through active participation in policy issues impacting on coffee sub-sector in Kenya and enhance the capacity of members to address issues related to coffee production, processing and marketing for improved livelihoods of coffee producers. Their membership includes coffee exporters/dealers, millers, marketing agents, warehousemen, and coffee equipment suppliers.

## **1.5. Societal enabling environment.**

### **2.5.1 Societal environment**

<b>Institution</b>	<b>Role</b>
Ministry of Agriculture	The government through the Ministry of Agriculture, is the main body in charge of controlling the policy and regulatory environment of the coffee Industry. It achieves this through the Agriculture and Food Authority's, Coffee Directorate.
The Coffee Directorate	The Coffee Directorate is in charge of regulation and compliance enforcement, market research and product development and technical and advisory services in the Coffee industry. The directorate is the registering and licensing body of all the coffee commercial marketing agents, exporters/dealers, grower marketers, millers, warehousemen, and management agents.
Nairobi Coffee Exchange	The Nairobi Coffee Exchange is the manager of the coffee trading floor in Kenya. It is mandated to manage the coffee central auction in the country. The NCE is managed by a management committee of 9 members comprised of 5 Producers, 2 Traders, 1 Representative of Commercial Millers & Marketing Agents and 1 from the Directorate. Ownership of the NCE is vested

<sup>54</sup> KALRO. (2022, November 23). Coffee Research Institute. Retrieved from Kenya Agricultural and Livestock Research Institute: <https://www.kalro.org/coffee/?q=homepage>

<sup>55</sup> KALRO. (2022, November 23). Coffee Research Institute. Retrieved from Kenya Agricultural and Livestock Research Institute: <https://www.kalro.org/coffee/?q=homepage>

	in the Directorate in trust for the coffee industry with an overall oversight over its operations. The operations of the NCE are financed by the participants: traders and producers through their respective marketing agents, an auction levy fee as determined by the NCE committee from time to time is charged <sup>56</sup> .
Kenya Coffee Traders Association	KCTA is a body of coffee traders with membership from Exporters, Roasters, Millers, Marketing Agents, Warehousemen, Shipping lines and Coffee Equipment suppliers. Its main objectives include: representing and furthering interests of member companies in the Kenya Coffee Industry, promoting Kenyan Coffee and its industry in the international market, acting as a forum for discussion and exchange, disseminating coffee industry information to the members, promoting better trade practices and business efficiency for the Kenya Coffee Industry, engaging in dialogue with the statutory bodies in Kenya to advice on policy reforms and collaborating with industry actors for strengthening best practices and a sustainable future for the Kenya Coffee Industry <sup>57</sup> .
Kenya Coffee Producers Association (KCPA)	KCPA is a lobby and advocacy association. Its member are coffee producers. It provides the following services to its members: policy dialogue, capacity building in coffee production, processing and marketing for improved livelihoods of coffee producers and collection and dissemination of knowledge and information about coffee production, processing and marketing. It also engages in financial resource mobilization and sustainability and internal institutional capacity building and strengthening. It works in partnership industry actors and development organizations such as Agriterria, Hivos, Solidarid, We effect, Rainforest Alliance <sup>58</sup> .
Kenya Agriculture Livestock Research Organization – Coffee Research Institute (KALRO-CRI)	The Institute conducts coffee research in all areas of production, processing and marketing. It organizes, designs and conducts on-station and on-farm research for coffee. It identifies production, policy, market, processing and utilization constraints in the coffee sub sector. It identifies and disseminates, in collaboration with partner organizations, knowledge, information and options to improve coffee production and provide answers to foreseeable problems in the sub sector. It also collaborates with the extension and education services and other organizations, agencies. CRI also establishes and maintains regular contact with regional and international agricultural research centers to ensure the rapid introduction, evaluation and use of coffee improved technology. In association with the secretariat, CRI conducts annual reviews of research results, promotes demand-driven participatory research, planning and priority setting.
Coffee Cooperative Societies (CCS)	The coffee cooperative societies have membership of all coffee producers. They provide collective marketing of coffee. The individual farmers harvest their coffee and deliver to the factories owned by their respective cooperative societies. The CCS do primary processing of coffee at their factories before transportation to coffee millers for secondary processing. It is the CCS that

<sup>56</sup> <https://nairobicoffeeexchange.co.ke/>

<sup>57</sup> <https://www.kenyacoffee.co.ke/whoweare-about-us.html>

<sup>58</sup> [http://kcpa.co.ke/?page\\_id=156](http://kcpa.co.ke/?page_id=156)

	engage services of commercial coffee marketing agents to market the coffee deliveries at the NCE auction. The marketing agents pay the CCS who in-turn pay the coffee producers.
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### **Business Environment**

The cooperatives need to embrace or diversify coffee value addition practices to increase their economic growth. Value addition would transform the current trend where the bulk of exported coffee is simply to provide raw materials for more developed countries who use it to manufacture specialty coffees. Most coffee growers get discouraged from coffee growing due to minimal incomes or even delayed payments of their daily coffee deliveries. Value addition would give more bargaining power for better profits which would reflect in increased farmer profit margins. Value addition at the cooperative level would also create competitiveness therefore contributing to the sustainability of the coffee industry in Kenya. This would curb extortionist who make exorbitant profits from the coffee produce than what the smallholder producer actually earns per kilo gram of coffee delivered at the collection centers.

Still at the cooperative level, it has been reported before <sup>59</sup> that due to corruption farmers have no say on the appointment of cooperative board. As some boards want to serve beyond their term. As well farmers have minimal bargaining power over the price per kg of coffee delivered as they are not involved in appoint of commercial marketing agents. Some agents have bribed cooperative boards to be the sole agents in marketing their coffee. Farmers in most cases are not aware of how much their coffee fetched at the NCE auction as this information is never relayed to them the cooperatives.

Coffee co-operative societies have been mismanaged leading to embezzlement of funds. This has led to low income for the farmers.

### **Cooperation with government and donor projects**

All the value chain actors work under the regulation of the Government through the Ministry of Agriculture, The Agriculture and food Authority's Coffee Directorate. KALRO's CRI works in partnership with the Ministry of Agriculture, other research institutes and the Universities to deliver coffee research for the benefit of the coffee industry. The government as well partners with donar agencies to deliver programs that will benefit the industry.

For instance, KCPA in collaboration with the relevant industry stakeholders and development partners has currently and in the past continued to aggressively develop and implement initiatives in form of projects aimed at addressing the issues affecting the coffee farmers. The following are some of the projects:

- Computerized management information system project by Agriterria
- Coffee reference point project by Hivos
- Strengthening smallholder farmer participation in the coffee value chain project by WE EFFECT
- Coffee tree shade project by WE EFFECT
- Building the lobby and advocacy capacity of KCPA to represent the interests of farmers in the National Coffee Platforms project by Rainforest Alliance,

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<sup>59</sup> Muthoni, M. P. (2014). Coffee Value Chain Analysis in Kenya (A case of Kenya Planters Cooperative Union). *Journal of Business and Management*, 6(5), 207-215.

### **State infrastructural elements**

The growing areas have good roads which has enabled the crop to be transported to the buying centers and factories. This has also helped in marketing of the processed berries. Though, some of the feeder roads in the growing areas are poorly maintained and impassable during the rainy season. This has made it difficult for the farmers to deliver their produce on time to the processing factories in the rainy season.

### **Socio-cultural elements**

Kenyan coffee is greatly recognized around the globe for its superior quality and unique characteristics such as full body, balanced acidity, and distinctive fruity taste. As a result, it keeps bagging international awards among the top choices for roasters and baristas globally. Locally, coffee consumption is low due to the fact that Kenyans are predominantly lovers of tea. Local coffee consumers have little information on how Kenyan coffee is a global 'gold' that is heavily regulated. Lower quality instant coffee is what is dominantly available in the local market. A huge number of Kenyans have never seen coffee in its green bean form.

Kenyan coffee is considered a social drink for the rich and the middle class as they spend several hours in coffee shops socializing and enjoying their coffee drink. In fact, majority of coffee consumers actually consume the beverage in classy coffee houses and restaurants in urban areas. Since there are very few tea houses for comparison, most Kenyans tend to believe that coffee drinking is an expensive affair reserved for the rich. It is the growing middle class populations in urban areas who are driving coffee consumption owing to their higher disposable incomes. On the shelf price of coffee compared to other known beverages tend to suggest that coffee is far more expensive commodity in local stores.

Kenyans make their coffee, by boiling simultaneously with milk and coffee until boiling point which end up ruining its taste and flavors instead of brewing coffee. This is attributed to a lack of coffee making equipment which are out of reach to many. Majority of Kenyans believe that making coffee is difficult and time-consuming and so tea is always a readily available option.

Coffee is considered by some Kenyans not healthy due to its caffeine content. Coffee has more caffeine content than tea<sup>60</sup>.

Recently, young coffee consumers consider visiting coffee shops as something trendy contributing to significant increase in consumption of instant coffee<sup>61</sup>.

Coffee growing makes a positive contribution on the social environment by maintaining substantial rural employment and stable communities. It improves the living standards of coffee producers, especially smallholders.

### **2.5.2 Natural environment**

Coffee growing and trading has contributed positively to environmental issues. Coffee plant is an evergreen shrub, thus it contributes to carbon sequestration, and is effective in stabilizing soils. It permits the conservation of much of the original bio-diversity in planted areas.

However, climate change, has caused changes in rainfall and temperature regimes negatively impacting the health and productivity of Kenya's coffee. It is projected that climate change will worsen and areas suitable for coffee growing will reduce drastically if suitable measures are not taken. Climate change poses great risk to all coffee

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<sup>60</sup> Majani, D. (2019, September 6). Kenyan Coffee: The Myths and Facts in your Cup. Retrieved from Agro foodious: <https://agrofoodious.com/kenyan-coffee-the-myths-and-facts-in-your-cup/>

<sup>61</sup> Nicholas, C. (2022, May 3). Exploring coffee consumption in Kenya. Retrieved from Perfect Daily Grind: <https://perfectdailygrind.com/2022/05/coffee-consumption-in-kenya/>



value chain actors, but especially to coffee growers at the estates and smallholder level. Majority of farmers are not enlightened about climate-smart agriculture, sustainable environmental practices and mitigation & adaptation measures towards climate change.

### **Production**

- Many smallholders carry on with environmentally harmful practices like cutting down trees, slashing and burning plant biomass, poor tillage practices, poor management of coffee processing by-products and the degradation of forests and riparian areas. There is an increase in the prevalence of pests and diseases and natural calamities such as landslides and drought<sup>62</sup>.
- Prolonged drought has led to decline in coffee production. Low returns from coffee due to price volatility and significant fluctuations have deterred Kenyan coffee growers and other value chain actors from making the necessary investments for increasing competitiveness, productivity, and production. This has led to diversification from coffee to other more profitable value chains leading to a significant reduction of land suitable for coffee production (Golinucci, Tahavori, & Sulliman Hussain, 2022)
- Higher temperatures than the threshold hastens the development and ripening of the cherry, affecting quantity and quality of yields, particularly of Arabica beans. Due to projected increasing temperatures, suitable areas for coffee growing are projected to shift from 1600m to 1700m of altitude as well as to shrink from 50-70% of the areas to 30-50% by 2050, particularly due to coffee berry borer outbreaks. The suitability of coffee growing areas will significantly reduce by 2050 due to projected increasing temperatures by 2°C.
- Changing temperature and rainfall patterns, including higher temperatures, shorter and delayed rainy seasons, increase the probability of pest and disease attacks (e.g., coffee berry disease and leaf rust) as well as negatively affect coffee pollinators, thus undermining flowering and berry growth stages as well as the effectiveness of pest and disease management (due to uncertainty in the timing of fertilizer and fungicide application and the drying of parchment), as well as coffee harvesting due to ineffectiveness of cherry ripening and drying, and overall reduced quality and quantity of yields.
- Extreme rainfall events cause soil erosion, nutrient leaching, and soil infertility.
- Decrease of precipitation of driest month and increase of minimum temperature of the coldest month are main negative factors affecting suitability together with increasing precipitation of the coldest quarter.

### **Milling**

- Overall, the milling process has high negative environmental impacts due to the release of high volumes of pulp waste in the environment which releases mycotoxins directly into the soils<sup>63</sup>.
- Wet processing of coffee on the other hand causes water pollution. While at the processing and factory level, the current traditional pulping method commonly used in Kenya requires a large amount of water – up to 20 litres of water per kilogram of coffee cherries, the fruit that encases the seeds or beans<sup>64</sup>.

### **Storage**

- Ochratoxin A (OTA) contamination is a key risk for coffee during storage and is driven by unsuitable temperature and relative humidity conditions.

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<sup>62</sup> EANH. (2020, May 6). Climate Smart Agriculture for Kenya's Coffee Sector. Retrieved from Nature Kenya: <https://naturekenya.org/2020/05/06/climate-smart-agriculture-for-kenyas-coffee-sector/>

<sup>63</sup> <https://feem-media.s3.eu-central-1.amazonaws.com/wp-content/uploads/968-rpt-supplychainanalysis-coffee-kenya.pdf>

<sup>64</sup> Stockholm Environment Institute. (2022). Improving Kenya's coffee value chain, Integration of sustainable consumption and production practices.

- Pests and diseases-related damages from coffee production, as well as presence of insects within the storage facility may increase relative humidity and thus mould growth and mycotoxins through insect respiration.
- High relative humidity in the storage facility contributes to coffee moisture content growth due to exchange of moisture between the air and the product to re-establish the equilibrium.
- Heavy rainfall and flooding events may induce water entrance in storage facilities and re-wetting of coffee is not adequately stored on raised shelves.

### **Impact of the value chain operations in terms of competitive advantages or weaknesses**

Coffee berry disease and leaf rust remain a major factor affecting production costs and coffee yields for most varieties of coffee grown in Kenya.

There exists a large age gap in coffee production, since most of the coffee farmers are elders, with more than 50% of the farmers above the age of 60. This compromises the future of Kenya's coffee production. Coffee farmers are reluctant to adopt new technologies such the climate smart agricultural practices, thus resulting in a reduced production and land deterioration.

High risk for smallholder coffee growers due non-inclusive Kenya's policies and legal framework where a batch of coffee belongs to the farmer up to the point of sale. The smallholder growers or estates without a marketing license must contract and authorize marketing agents to sell their coffee through the NCE. The growers only get paid after exporters purchase the coffee which may take up to 5-6 months. Therefore, the growers are forced to take the risks at all stages of marketing including quality deterioration, theft and exchange rate instability. Their coffee incomes are cut by marketers and millers during marketing. This has discouraged some farmers who are abandoning coffee production to more profitable value chains.

Only 5% of Kenya's exported coffee is roasted locally. The remaining 95% is exported as raw material to destination markets. Therefore, coffee growers miss out on the added value from the sales of roasted and packaged coffee while at the same time they silently incur the costs related to transport, trade and conversion of coffee beans into the final product by exporters mostly in Europe and America.

Coffee production in Kenya is expected to significantly drop due to effects of prolonged drought. Adverse climatic conditions such as unreliable and erratic rains with shorter seasons are expected to reduce production. High erosion levels due to heavy rains have caused loss of soils and leaching of nutrients, leading consequently to soil infertility. Unpredictable rainfall patterns are also posing challenges to patterns of cherry ripening and parchment drying<sup>65</sup>. Coffee prices in the world markets have been declining due to high yields in Brazil and Vietnam, creating a huge surplus of coffee in the market, especially Arabica and lowering prices. Other factors include political ongoing conflict between Russia and Ukraine that has led to inflation and increased costs of inputs such as fertilizer and consequential high cost of living in many countries. In Kenya, cost of production of coffee has increased due to high costs of fertilizers, spraying chemicals, labour, irrigation water and Electricity. Driven by low prices and climate changes farmers are shifting towards producing other products instead of coffee.

Farmers in Siboti cooperative in Transnzoia reported that the rising cost of inputs has seen many farmers stop application of fertilizer and other inputs thus reducing the quality of coffee. Use of organic manure from their

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<sup>65</sup> International Coffee Organization. (2019). Country Coffee Profile: Kenya. Nairobi: International Coffee Council.

livestock farms as an alternative is not practiced by many farmers. The farmers mentioned that use of organic manure from the farms would improve coffee production and reduce the cost of inputs especially fertilizers.

Another challenge mentioned by the farmers and government officials in Transnzoia and Nandi was access to planting material especially for the preferred Ruiru 11. Farmers make orders and have to wait for up to three months to get coffee seedlings for planting.

The farmers mentioned coffee theft both on farms and during transportation as a major challenge. The coffee factories incur high costs to hire police escort for their coffee to the millers.

The Kenya government's Coffee Revitalization Program seeks to address these challenges and aims at increasing Kenya's coffee production to 100,000 MT of clean coffee in five years. This is by providing farmers with subsidized fertilizers, affordable farm inputs, training on best agricultural practices and adoption of improved coffee varieties. The aim is to help farmers reduce their production costs and increase their production volumes, thus increasing their earnings and promoting more farmers to produce coffee.

The program also seeks facilitate the modernization of the primary processing equipment and automation of co-operatives systems to enhance increase in efficiency and quality, consequently lowering processing costs and increase farmers share of export price. The project as well is keen to enhance availability of affordable credit to coffee growers to promote the production of coffee.

Kenyan's have also started to adapt a culture for coffee drinking due to the emerging urbanized middle class as reflected by the increase in the number of roasters and coffee shops in major towns. This is likely to stimulate demand for coffee.

Efforts to promote local coffee consumption by farmers' co-operatives and county governments are scaling up as they are setting up small scale roasting plants and coffee houses in rural areas and multitasking machines that mill, roast and brew ready to drink coffee are being introduced into counties by their governments. Also, the coffee directorate conducts several coffee promotions and campaigns to target youth in universities. The target is to stimulate an increase in the local consumption of coffee, creating an opportunity for local roasters to increase their production and generating more value along the supply chain and increasing earnings for coffee farmers.

### **Climate Rationale**

Coffee is considered a climate smart crop due to its diverse attributes. Coffee is a tree crop and with regard to climate, it provides ground cover, thus promoting soil and water conservation. Worldwide coffee coverage is estimated to be over 10 million hectares while in Kenya the total coffee plantation covers 114,500 hectares. Coffee is a perennial crop therefore it sequesters carbon contributing to mitigation of global warming. Coffee is adaptable to diverse growing environments. It be grown in three Agro-ecological zones in Kenya. It can be intercropped with other tree species and other crops <sup>66</sup>.

Climate smart agriculture is composed of three main pillars. The first one is adaptation, which refers to sustainably and efficiently increasing agricultural productivity and incomes. Secondly, poverty reduction, which refers to enhancing the achievement of national food security and development goals (resilience, synergies and trade-offs; poverty reduction). And lastly, mitigation, reducing and/or removing greenhouse gas emissions where possible

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<sup>66</sup> KALRO. (2022). Climate Smart Agricultural Technologies, Innovations and Management Practices for Coffee Value Chain. Kenya: Kenya Agricultural and Livestock Research Organization.

(FAO 2010, 2013). Climate smart agriculture is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. CSA efforts revolve around weather, soil, tillage, water, pest/ vector, crop/ livestock, biodiversity, harvest and post-harvest interventions. CSA main goal is to conserve and produce suitable varieties and breeds; to adopt an ecosystem approach and to work at landscape scale. CSA provides a framework for discussing tradeoffs between productivity, resilience building and greenhouse gas mitigation development and for bringing the issues to the forefront of agricultural planning decisions<sup>67</sup>.

## 2. Sustainability Assessment

### 2.1. Economic Analysis

#### 3.1.1 Profitability

Kenyan coffee industry contributes about 2% to the national GDP and about 8% of the total agricultural export earnings. It earns the country about KES. 20 billion annually in foreign exchange<sup>68</sup>. It provides up to 30% of the total labour force in agriculture. It is the primary source of income of around 800,000 households who are basically smallholder farmers. It is therefore an important contributor to economic growth and poverty alleviation.

Well managed coffee farms are profitable as was confirmed in discussions with farmers and government officials during field data collection. Tables 11-13 below show gross margins for different coffee varieties grown in Kenya.

Table 12: Gross Margins for Traditional Coffee (old coffee trees)<sup>69</sup>

GROSSMARGIN ANALYSIS				
<b>Enterprise: Coffee (1 ACRE), 555 trees</b>	<b>Variety: Traditional Varieties (SL28, K7 and SL34)</b>		Management Level:	Medium
<b>VARIABLE COSTS:</b>		No. of Units	Unit Cost (Kshs)	Cost
Weed Control (Manual)-4 times/year	Labour	4	3,000	12,000
Manures (3kg/tree) -1.7 tons	Manure	1.7	1,000	1,700
	Transport (2 Trailer loads)	2.0	2,000	4,000
	Labour (MDs)	5	200	1,000
Fertilizers	CAN (200g/tree) -50kg bags	2	5,500	11,000
	Labour (MDs)	2	200	400
	Transport	2	100	200
	NPK 17:17:17 (250g/tree) - 50kg bags	3	5,800	17,400
	Transport	3	100	300
	Labour (MDs)	3	200	600
Disease control (CBD, Leaf rust)	Fungicides (Copper-based)-Kg	1	2,000	2,000
	Spraying Labour (MDs)-2 times/year	10	300	3,000
Canopy Management	Main Pruning (Ksh.8/tree)	555	8	4,440

<sup>67</sup> FAO. (2015). Scoping study on climate-smart agriculture in Kenya, Smallholder integrated crop-livestock farming systems. Kenya: Food and Agriculture Organization.

<sup>68</sup> KALRO. (2022). Climate Smart Agricultural Technologies, Innovations and Management Practices for Coffee Value Chain. Kenya: Kenya Agricultural and Livestock Research Organization.

<sup>69</sup> From Field data collection (information provided by Tinderet Agriculture officer and farmers from Siboti Coffee)

	De-Suckering (Ksh. 4/ tree)-2 times/year	555	8	4,440
Harvesting	Cherry picking (Labour Ksh. 7.5/kg)	2775	7.50	20,813
	Transport (Trips)	24	200	4,800
Miscellaneous expenses (10% of TVC)				8,810
<b>Total Variable Costs</b>				<b>96,903</b>
Gross Output (Average 5kg cherry/tree/year @ksh.80)		2,775	80	<b>222,000</b>
Gross Margin/Acre/Year				<b>125,098</b>

Table 13: Gross Margins for Ruiru 11 Variety<sup>70</sup>

GROSSMARGIN ANALYSIS				
<b>Enterprise: Coffee (1 ACRE), 1012 trees</b>	<b>Variety: Ruiru 11</b>			
<b>VARIABLE COSTS:</b>		No. of Units	Unit Cost (Kshs)	Cost
<b>Weed Control (Manual)-4 times/year</b>	Labour	4	3,000	12,000
<b>Manures (3kg/tree) -3 tons</b>	Manure	3	1,000	3,000
	Transport	3	2,000	6,000
	Labour (MDs)	10	200	2,000
<b>Fertilizers</b>	CAN (50kg)	4	5,500	22,000
	Transport	4	100	400
	Labour (MDs)	4	200	800
	NPK 17:17:17 (50kg)	4	6,000	24,000
	Transport	4	100	400
	Labour (MDs)	4	200	800
<b>Disease control (CBD, Leaf rust)</b>	Fungicides (Copper-based)	0	0	0
	Spraying Labour (MDs)	0	0	0
<b>Canopy Management</b>	Main Pruning (Ksh.6/tree)	1012	6	6,072
	De-Suckering (Ksh. 3/ tree)	1012	3	3,036
<b>Harvesting</b>	Cherry picking (Labour Ksh. 7.5/kg)	6072	7.50	45,540
	Transport (24 times)	24	400	9,600
<b>Miscellaneous Expenses (10% of TVC)</b>				13,565
<b>Total Variable Costs</b>				<b>149,213</b>
<b>Gross Output (6kg cherry per tree @kshs.80)</b>		6,072	80	<b>485,760</b>
<b>Gross Margin/Acre/Year</b>				<b>336,547</b>

Table 14: Gross Margins for Batian Variety<sup>71</sup>

GROSSMARGIN ANALYSIS				
<b>Enterprise: Coffee (1 ACRE), 800 trees</b>	<b>Variety: Batian</b>			

<sup>70</sup> From Field data collection (information provided by Tinderet Agriculture officer and farmers from Siboti Coffee)

<sup>71</sup> Ibid

<b>VARIABLE COSTS:</b>		No. of Units	Unit Cost (Kshs)	Cost
<b>Weed Control (Manual)-4 times/year</b>	Labour	4	3,000	12,000
<b>Manures (3kg/tree) -2.4 tons</b>	Manure	2.4	1,000	2,400
	Transport (2 Trailer loads)	2.0	2,000	4,000
	Labour (MDs)	8	200	1,600
<b>Fertilizers</b>	CAN (50kg)	4	5,500	22,000
	Transport	4	100	400
	Labour (MDs)	4	200	800
	NPK 17:17:17 (50kg)	4	6,000	24,000
	Transport	4	100	400
	Labour (MDs)	4	200	800
<b>Disease control (CBD, Leaf rust)</b>	Fungicides (Copper-based)	0	0	0
	Spraying Labour (MDs)	0	0	0
<b>Canopy Management</b>	Main Pruning (Ksh.8/tree)	800	8	6,400
	De-Suckering (Ksh. 4/ tree)	800	4	3,200
<b>Harvesting</b>	Cherry picking (Labour Ksh. 7.5/kg)	5600	7.50	42,000
	Transport (Times)	24	400	9,600
<b>Miscellaneous Expenses (10% of TVC)</b>				12,960
<b>Total Variable Costs</b>				<b>142,560</b>
<b>Gross Output (7kg cherry per tree @kshs.80)</b>		5,600	80	<b>448,000</b>
<b>Gross Margin/Acre/Year</b>				<b>305,440</b>

### 3.1.2 Employment

Kenyan coffee is grown by both smallholder and estate farmers. The smallholders account for approximately 65% of the total production. The smallholder farmers are organized into about 500 cooperatives, while the estates number is approximately 3000. Coffee is grown in 32 counties with a total area of about 114,500 hectares. Annual coffee production is estimated to be 42,000 metric tons per year. It is therefore one of the most strategic cash crops contributing to Kenya's economic growth <sup>72</sup>.

The coffee sector employs about 30% (approximately 5,000,000 people) of the labour force in the agriculture sector, directly and indirectly. Out of which an estimated 800,000 growers, mainly smallholder farmers in rural Kenya, are involved in coffee growing<sup>73</sup>. Culturally land is owned and dominated by men. Women who own farms are largely those who have been widowed. The rural youth prefer migrating to urban centers to pursue careers and in search of employment. As such, the coffee business is dominated by the elderly. Over 60% of the workforce is provided by women in coffee farms and coffee factories. The coffee industry is labor intensive. The industry has employed workers who carry out activities such as weeding, spraying, harvesting sorting, and transporting coffee to the factories. Other workers work in the coffee factories, milling, marketing and allied activities.

<sup>72</sup> KALRO. (2022). Climate Smart Agricultural Technologies, Innovations and Management Practices for Coffee Value Chain. Kenya: Kenya Agricultural and Livestock Research Organization.

<sup>73</sup> Coffee Directorate. (2022). COFFEE PRODUCTION, MARKETING AND EXPORTS STATUS REPORT-MARCH 2022. Kenya: Agriculture and Food Authority.

There is a widening generational gap in coffee farming. As with a number of other African coffee origins, the average age of Kenyan coffee farmers continues to rise. Eventually, this will mean producers could become less physically able to carry out labour on coffee farms in the long term, and also means that the industry is at risk of losing hard-earned expertise without a clear succession plan. Many younger people in Kenya are migrating to urban areas in search of different lines of work. In many cases, younger generations aren't as interested in coffee production, largely because it isn't viewed as financially stable or viable.

### **3.1.3 Potential for Value Addition**

Stockholm Environment institutes (SEI), 2022<sup>74</sup>, suggests various ways to add value to coffee production in Kenya at different levels of the value chain. At the farm level SEI suggest adoption of climate smart practices such as integrated coffee and livestock farming and animal manure composting to generate organic fertilizers. Also replacing synthetic fertilizers with organic fertilizers to reduce the agriculture sector's greenhouse emissions while also producing healthier coffee crops with lower costs. SEI also suggests using shade trees, single-stem farming, block and labelling or precision farming to help farmers provide an ideal microclimate for the growth and production of coffee, especially in poor soil. Planting lemongrass between crops or natural plant pesticides (using dried leaves of pest-resistant plants diluted in water) serve as natural pest repellents that replace synthetic ones. This practice will enhance yield and quality by protecting soil and water quality, improving farmers' health by reducing direct contact with synthetic pesticide poisons, and lowering carbon emissions. Implementing climate smart practices will help build resilience through the dry season, reduce carbon footprints and increase qualifications for sustainability certifications, which could lead to higher and competitive coffee prices in national and international markets.

Cooperatives have the potential to improve on most of their processing practices and operations by automating some of their processes. They could invest in automated weighing scales which can significantly improve the quality of records in factory journals, prevent long queues at delivery points and reduce factory labour overheads synonymous to manual systems. They could also adopt electronic moisture meters to accurately monitor the moisture content during drying of coffee which will help the factory to maintain quality of parchment. (Mwangi, 2018)

At the mills, there should be careful labelling and recording to help the coffee farmer to control quality and use traceability for the coffee quality and characteristics in marketing. This help farmer obtain better prices and sales compared to selling raw green beans. The mills should use sustainable energy and materials in the roasting and packaging process to increase the product's attractiveness and ensure that the coffee retains product value for a longer time. This will in turn improve farmers' livelihoods and creates incentives to produce a more sustainable product<sup>75</sup>.

To increase local consumption of Kenyan coffee especially among the youths, the government should promote a coffee-drinking culture. This could be through local channels such as cooperative members and networks, posters and local vending.

To boost farmers' morale, the Ministry of agriculture at the county level could create institutional platforms for farmers to explore both local and international coffee markets, by allowing them to gain access to information on the market conditions and bargaining powers on the pricing and product marketing. Framers will better

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<sup>74</sup> SEI. (2022). Improving Kenya's coffee value chain Integration of sustainable consumption and production practices. Kenya: Stockholm Environment Institute.

<sup>75</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

understand the market demands and produce quality coffee that fits the market with the potential to sell at a higher price.

### 3.1.4 Effects in the county and national economy

Kenyan coffee farming has many economic benefits. Coffee earns Coffee is the fourth largest foreign exchange earner, the coffee sector is important to the national and the county economy. It provides employment opportunities improving living standards of about 5 million who directly or indirectly work in the coffee value chain. Coffee sales generate income/revenue hence earn farmers a living improving rural economy.

At the county level the coffee sector is a source of livelihood for many people through its linkages in production, processing, milling, marketing and consumption.

### 3.1.5 International competitiveness

Belgium is the top destination for Kenyan coffee for the last two coffee years with 64,529-60 kg bags in 2020/21 and 52,771-60 kg bags in 2021/22. Germany is the second top destination followed by USA and Korea Republic in that order. Germany has been the leading destination often in position one or two in the past seven coffee years. The increase in Korea Republic could be due to promotional efforts made to the Guest Portrait country effect. Kenya participated in the Korea Republic Expo as Guest portrait country during the 2021 COEX from 14th to 17th July 2021.

The country has lost Syria, Oman and Malaysia as well as Thailand, Qatar and Nigeria which are seasonal destinations. The new destinations in the present season include Bahrain, Burundi, Egypt, Greece, Guatemala, Kuwait and Tunisia. Tunisia is especially one of the emerging markets for Kenya coffee.

In the second quarter of the crop year 2021/2022, the Coffee Directorate has participated in three Expos namely; Gulfood Festivals Exhibition in Dubai, United Arab Emirates (UAE) from 13th to 17th February, 2022, Kenyan Drink and Food Event organized by Montgomery East Africa from 23rd to 25th March, 2022 at the New Sarit Centre- Westlands, Nairobi and the Specialty Coffee Expo event held in Boston, United State of America on 7th -10th April, 2022 hosted by Specialty Coffee Association (SCA)<sup>76</sup> (Coffee Directorate, 2022). Table 14 below shows the top 5 international markets for Kenyan Coffee.

Table 15: Top 5 International Markets for Kenyan Coffee 2018/2019-20/2021<sup>77</sup>

Year	2018/2019		2019/2020		2020/2021	
Rank	Country	%age	Country	%age	Country	%age
1	Germany	20	USA	20	Belgium	21
2	Belgium	18	Germany	19	USA	15
3	USA	13	Belgium	16	Germany	13
4	Korea	9	Korea	9	Korea	10
5	Sweden	6	Sweden	6	Sweden	7

<sup>76</sup> Directorate, C. (2022). COFFEE PRODUCTION, MARKETING AND EXPORTS STATUS REPORT-MARCH 2022. Nairobi: Agriculture and Food Authority.

<sup>77</sup> Coffee Directorate. (2021). Coffee Year Book 2020/21. Nairobi: Agriculture and Food Authority, Coffee Directorate.



### 3.1.6 Value for end-consumers

Coffee is popular due its taste and the stimulating effect of caffeine to its customers. Coffee is also associated with social interaction.

With regard to food security, it has been reported that regions that primarily produce cash crops such as coffee are among the ones that experience the worst undernutrition in developing countries, resulting in poor productivity levels, low school performance of children, and a poor health situation in farming families. Moreover, of all the 34 countries listed as in food crisis or at risk due to high food prices, over one-third (38.2%) are coffee-producing countries of which Kenya is one of them<sup>78</sup>.

This has seen multiple donor-sponsored initiatives being undertaken to foster food and nutrition-sensitive agriculture in the developing world through various mechanisms which include nutritive food production, income, and gender impact pathways. Hence the increased adoption of climate smart agriculture interventions. The isolated rural areas where the world's best coffee is grown are exposed to multiple food insecurity risk factors, including: depletion of natural resources from which the population makes its living; environmental degradation; shocks such as natural disasters and conflict; and seasonal changes in food production and food prices.

To cushion coffee farmers from nutritional and food insecurity several studies have suggested increasing production of food crops in coffee growing areas, promoting livelihoods diversification model through basic cropping, animal husbandry and/or temporary off-farm wage work, among other activities so as coffee growers may have multiple sources of income and food other than just coffee and also developing multi-stakeholder, long-term interventions<sup>79</sup>.

## 2.2. Social Analysis

### 3.2.1 Inclusiveness

#### Income and employment distribution

The coffee sub-sector is estimated to employ 30% (about 6 million people) of the labour force in the agriculture sector<sup>80</sup>. The Kenyan coffee sector employs about 6,000,000 people directly and indirectly. An estimated 800,000 growers, mainly smallholder farmers, are involved in coffee growing<sup>81</sup>. Since majority of coffee growers are in rural Kenya, the sector is a significant contributor to poverty eradication as it contributes to increased rural economy. In the 2018/2019 coffee production year, farmer earnings from coffee production in Kenya amounted to an approximate total of 159 million U.S. dollars, with Kiambu County accumulating the highest income, upto 28.3 million U.S. dollars through estate growers and 5.8 million U.S. dollars through co-operatives<sup>82</sup>.

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<sup>78</sup> Shumeta, Z., & D'Haese, M. (2018). Do coffee farmers benefit in food security from participating in coffee cooperatives? Evidence from Southwest Ethiopia coffee cooperatives. *Food and nutrition bulletin*, 39(2), 266-280.

<sup>79</sup> Caswell, M., Méndez, V. E., & Bacon, C. M. (2012). Food security and smallholder coffee production: current issues and future directions.

<sup>80</sup> International Coffee Organization. (2019). Country Coffee Profile: Kenya. Nairobi: International Coffee Council.

<sup>81</sup> <https://www.solidaridadnetwork.org/story/a-bright-future-for-kenyan-coffee/>

<sup>82</sup> <https://www.statista.com/statistics/1154640/county-earnings-from-coffee-in-kenya-by-sector/>

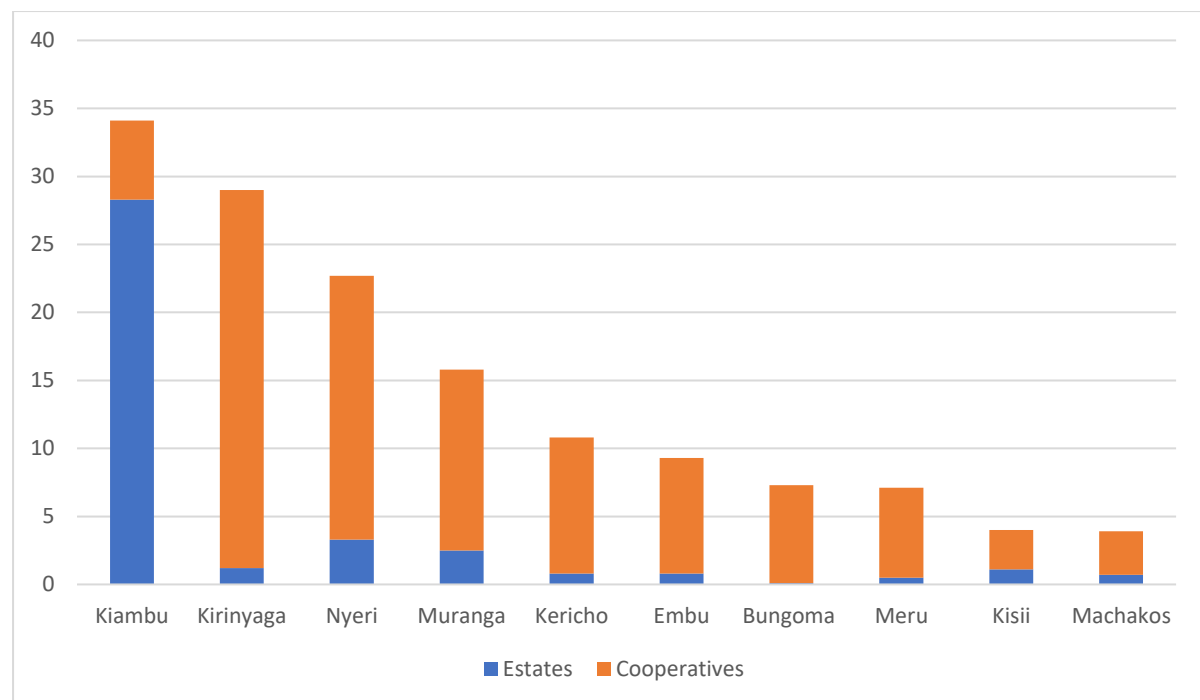


Figure 3: County earnings from coffee production in Kenya in the 2018/2019 season, by sector (in million U.S. dollars) County<sup>83</sup> earnings from coffee production in Kenya in the 2018/2019 season, by sector (in million U.S. dollars)

### Poverty

Countless Kenyan coffee farmers make less than 42 US Dollars per month, about KShs 5,000 from coffee production. As such, many Kenyan coffee farmers, are fighting poverty daily and struggling to provide more income for themselves, their families, and their farmworkers or communities.

Climate change, poor management of the intermediaries/cooperative societies responsible for tracking, managing and marketing the coffee farmers' produce and fluctuating and unpredictable global coffee prices, are the primary factors challenging coffee farmers' earnings. Kenya's coffee farmers are limited to influence the worldwide coffee prices or the climate.

Coffee farmers with less than 300 coffee trees remained amongst the poorest in the world due to limited potential output and produce for a harvest from them. Until now, most coffee farmers have to rely on outside help from the buyers' intermediaries to organize workers who would mill and ship the coffee. The middleman more often takes away jobs that the coffee farmers could easily find new farmworkers to fill, increasing the local economic flow. Majority of coffee farmers have no direct market access. Direct market access offers farmers maximum income from coffee produce and the chance to escape poverty while contributing to the country's third-largest<sup>84</sup>.

Currently, smallholder coffee farmers in Kenya cannot depend on coffee farming alone to pay their bills. They have to engage in diversified farming practices in order to earn a living. This is a result of the very complex international coffee market set-ups. The prevailing market price for coffee at any given time is determined at New York and London International Coffee Exchange markets. This price does not factor in the cost of production for the commodity. The sole purpose of the prevailing market price is to generate profits for coffee dealers in those markets working at the order of global investment banks. In this case, the control of a coffee farmer over his coffee produce stops immediately coffee leaves their farm. The prevailing market price does

<sup>83</sup> <https://www.statista.com/statistics/1154640/county-earnings-from-coffee-in-kenya-by-sector/>

<sup>84</sup> <https://www.borgenmagazine.com/kenyan-coffee-farmers/>

not factor in the coffee production costs by the farmer or the predicted price of future coffee based on a myriad of financial derivatives instead it is majorly influenced by the worldwide coffee supply and demand.

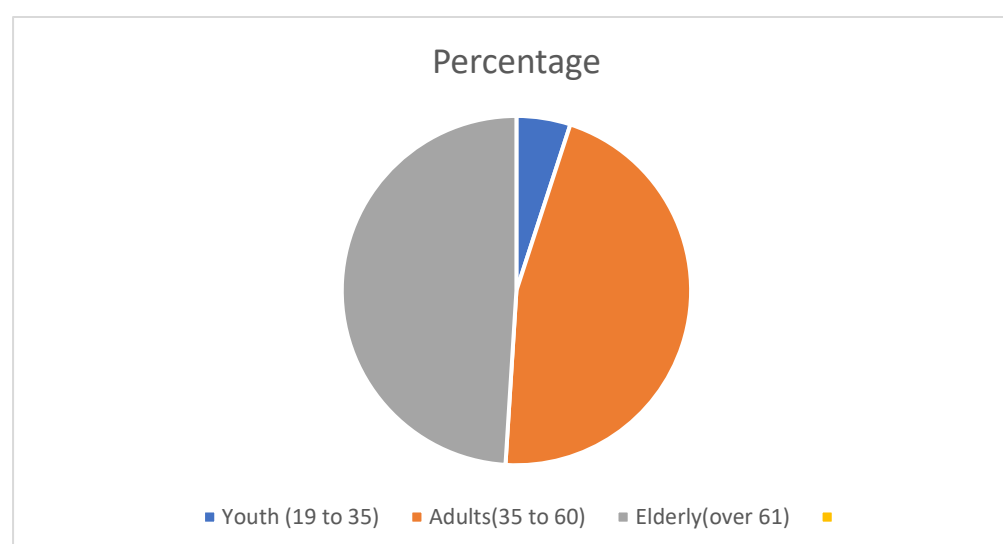
The break-even point for small-scale coffee farming is 3kgs/tree (dependent on the number of trees per hectare) whereas most farmers' production is below this in some instances being as little as 0.13kg/tree. Unfortunately, most farmers have 200 to 300 coffee bushes cultivated on 0.1 to 0.3 hectares of land. It is for this reason that such farmers earn a miserable Kshs 10,000 per year against their living income of Kshs 150,000 and ultimately, poverty becomes a norm. The government's Kshs 1.5 billion coffee revitalization fund from World Bank in should be utilized to realization of an equitable coffee sector where farmers can earn a living income as opposed just to poverty alleviation.

### **Vulnerability and discrimination**

A study by Kenya Coffee platform (Coffee revitalization study report), revealed that the coffee cooperative societies' membership data had an average of 70% men and 30% women. This is a significant effort on the membership registration end to include women. Also, it is an indication of gains on policy as per the constitution (2010) which has the 1/3 gender rule. This is not so for smallholder farmers, as the study revealed that for the smallholder farmers, 83% of the farmers are men and only 17% are women.

The study also revealed that about 49% of the smallholder farmers are above 60 years which is the Kenyan government's retirement age. Very few youths at 5% are involved in coffee growing as they consider coffee as an old man's crop. Measures need to be put in place to foster youth engagement and integration interventions to generate interest in coffee and more importantly to get them engaged in active coffee growing. The poor involvement of youth in coffee farming could be as a result of urban migration such as in Kiambu County which is closer to the capital city of Nairobi and so most of their youth have migrated there in search of jobs hence not involved in coffee growing. More profitable enterprises including horticulture, dairy, and business could be more attractive for the youth compared to coffee farming. The average age of the coffee growers across all counties that were surveyed was 62 years<sup>85</sup>.

*Figure 4: Age Distribution of Coffee Growers Surveyed by Percentage<sup>86</sup>*



<sup>85</sup> <https://www.globalcoffeeplatform.org/wp-content/uploads/2021/03/Kenya-Coffee-Platform-Coffee-Economic-Viability-Study-Report-F.pdf>

<sup>86</sup> <https://www.globalcoffeeplatform.org/wp-content/uploads/2021/03/Kenya-Coffee-Platform-Coffee-Economic-Viability-Study-Report-F.pdf>

### 3.2.2 Gender equality

Traditionally, coffee in Kenya is considered to be a 'man's crop'. Women and youth participation is limited to the supply of unpaid labour. Their involvement in the decision-making on growing coffee, and how returns from the crop are used is thus insignificant. Around 2011, over 95% of coffee farms are owned by men, and women and youth were found to provide the bulk of labour used in coffee production. Women and youth are involved in cultivating, picking, sorting at home and at the factory and transporting to the factory for processing. But men play a large part in collecting money from coffee sales and owning of the coffee farms. Generally, the groups who have the role of coffee production in Kenya have little or no access to the income from the commodity. This has created apathy among women and youth in respect to active and voluntary engagement in coffee production. Women have minimal access to the income from coffee sales, a situation aggravated by a number of historical socio-cultural norms in smallholder communities, where men, except in cases where the male head of the household dies, historically own land. Women are less involved in decision making in coffee growing <sup>87</sup>.

### 3.2.3 Food and nutrition security.

Food insecurity in Kenya is aggravated by factors such as low agricultural technological, inefficient production systems, inconsistent economic growth, increasing population and climate variability. Climate change is the agenda on the table all over the world with devastating effects especially on agriculture leading to food insecurity especially in less developed countries. Donors and development agents are advocating for adversely affected communities to adopt climate smart agricultural practices in order to combat the effects of climate change.

They consider coffee as a climate smart crop with potential to influence food security. This is because coffee production can be integrated with livestock production (such as poultry, dairy, shoats etc.) and also allows intercropping with other food crops such as beans, maize, sweet potatoes etc. Coffee planting also allows for Shade trees which help to regulate soil temperature and water levels. These shade trees could be fruit trees like avocados, mangoes among others which can fetch good prices on the market besides promoting nutrition of the smallholder households<sup>88</sup>.

Proceeds from coffee sales are used to purchase inputs for coffee production and pay labour costs and the profits are utilized in providing food items for the smallholder households besides other family needs. Coffee potential to positively impact food and nutrition security are threatened by low world prices for coffee, high export taxes, delayed farmer payments, lack of transparency, vulnerable coffee markets and higher value from competing commodities (tea and horticulture) which makes smallholder farmers opt out of the sector to more promising value chains like the hass avocado<sup>89</sup>.

The agriculture sector is fully devolved with the function of service provision mandated to the county governments. The decentralization of resources and governance to the counties and the coffee revitalization project gives the coffee sector a potential to positively contribute to food and nutrition security if well managed.

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<sup>87</sup> Morris, A., Douglas, B., & Charles, A. (2015). Mainstreaming gender and youth in smallholder sustainable coffee supply chain in Kenya. *Journal of Economics and Sustainable Development*, 6(18), 76-86.

<sup>88</sup> SEI. (2022). Improving Kenya's coffee value chain Integration of sustainable consumption and production practices. Kenya: Stockholm Environment Institute.

<sup>89</sup> Michael N. I. L. (2021). An Overview of Food and Nutrition Security Situation of Kenya. *Food and Nutritional Sciences Research (JFNSR)*, 112-129.

### **3.2.4 Decent employment**

Smallholder coffee production is traditionally owned by men since it is the men who inherit land. Women and youth have little or no access to land ownership in the traditional rural set up. Women and youth are the main suppliers of labour which is unpaid for the reason being they are part of the family where the men are the heads. Also they have little or no say at all in decision-making about growing coffee, and how returns from the coffee sales are utilized. They have no access to coffee proceeds. As a result, women and youth have little interest in active and voluntary engagement in coffee production.

Advocacy campaigns on gender mainstreaming by development partners such as Solidaridad in the producers' groups at the cooperative level are positively reversing the traditional norm and some men are involving their women in full participation in coffee production.

It is the elderly men, about 60 years and above, who dominate the coffee sector in Kenya, with very minimal involvement of the youth. Also youth farmer groups are less common since majority of the youth are less interested in physical labour and instead prefer to work in offices. This implies that the coffee sector is at risk for the lack of active involvement of the youth.

Child labour in the coffee sector was rampant by 2003 where upto 30% of labour was provided by young girls under 14 years old especially on the largest coffee and tea plantations in the Rift valley. They would work on hungry stomachs and the girls fell victims in the hands of men. Children worked as hand pickers of coffee berries on commercial coffee plantation. Through the efforts of trade unions and child labor committees, child labour in coffee sector has been successfully eliminated<sup>90</sup>. Many coffee growers have policies against child labour, such as the requirement of a national identity card as proof of age at the time of recruitment. They also post notices at convenient points to deter underage. Also most parents are enlightened about the importance of education and they send their children to school especially the free primary education programme by the government<sup>91</sup>.

Cooperative societies are mismanaged providing poor quality service and management. Management committees are corrupt, poorly skilled especially in financial management, and they are mostly selected based on family lines. The managers are easily influenced by marketing agents through bribes. This has negative influence on farmers who receive little payments from their coffee deliveries and in the end lose interest in coffee production.

### **3.2.5 Social and cultural capital**

Social capital leveraged through coffee producer cooperatives. Cooperatives under strong social bond and having better governance and leadership are in better positions to manage social capital. Cooperatives with low trust from farmers influenced by corrupt management and lack of transparency have very limited impacts on their economic status of their farmers. Some cooperatives have enrolled into fair trade programs where the farmers access regulated and better trading terms for their coffee deliveries as opposed to conventional trade in which coffee sales consist of inspected samples sold by importers/ brokers – with very little profit going back

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<sup>90</sup> MVC. (2022, May 21). Kenya: Coffee Farms. Retrieved from Media Voices for Children: <https://www.mediavoicesforchildren.org/coffee-farmers>

<sup>91</sup> Mureithi, L. (2008). Coffee in Kenya: Some challenges for decent work. Kenya: International Labour Office.

to the farmer<sup>92</sup>. Fair trade programs help to reduce poverty in developing countries. Fair trade products have a fair trade mark which indicates that international fairtrade social, economic and environmental standards have been met. It satisfies items traded and not companies. Fair trade price set is usually ahead of market minimums and also eliminates the need for corrupt grower marketers/marketing agents. It gives farmers access to information on pricing and market performance. Fair trade premiums are incentives enough for farmers to upgrade their farm machinery and processes to achieve improved quality and yields<sup>93</sup>.

### **3.2.6 Institutional strength**

Devolution of agricultural services to the county governments gives farmers access to the latest, knowledge, skills and technologies in coffee production. The county governments have a role in the issuance of distinguishing marks and grower codes to promote the coffee quality and standards compliance and growers coding and registration for branding and effective produce traceability and also in the registration of miller-marketers at the county level for approval of miller licence applications before issuance by the Coffee Regulatory Authority.

The national coffee revitalization project by the Ministry of Agriculture that aims to increase coffee production, improve efficiency of farmer cooperatives, support research development and technology as well as development of alternative coffee markets<sup>94</sup>. The fair trade programs where consumers are willing to pay for quality and farmers are cushioned against price volatility. The programme is an organized social movement and market-based approach with the aim to help coffee producers in developing countries to make better trading conditions and promote sustainability<sup>95</sup>.

## **2.3. Environmental Analysis**

### **3.3.1 Climate change**

The negative impacts of climate change, such as rising temperatures, increased pests and diseases, erratic weather events like droughts and floods, pose major threats to the coffee value chain, and majorly affects smallholder farmers. The long term effects of climate change such as rising temperatures and decreasing rainfall, have also been linked to a significant reduction of land suitable for coffee production in Kenya. In addition, knowledge gaps and low access to finance, continue to hinder uptake of, and investments in climate-smart agricultural practices, sustainable land management, and climate adaptation practices. As a result, practices such as deforestation caused by land clearing, burning plant biomass, farm establishment in high conservation value areas and riparian land, as well as poor tillage practices and management of waste from coffee processing, are still rampant among smallholder farmers and processors. In 2020, unsustainable production practices led to Kenyan coffee being flagged in Japanese and South Korean markets due to high levels of chemical contamination. Climate change has led to unpredictable weather patterns hence reduced production. Climate change is likely to impact the global area suitable for coffee significantly in the long-term. Options to shift production exist but

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<sup>92</sup> Buliro, A. (2013). AN EVALUATION OF THE BENEFITS OF FAIRTRADE TO THE KENYAN COFFEE COMMUNITY. Kenya: UNITED STATES INTERNATIONAL UNIVERSITY.

<sup>93</sup> Buliro, A. (2013). AN EVALUATION OF THE BENEFITS OF FAIRTRADE TO THE KENYAN COFFEE COMMUNITY. Kenya: UNITED STATES INTERNATIONAL UNIVERSITY.

<sup>94</sup> Wangari, N. (2022, April 20). Government Launches Coffee Revitalization Project. Retrieved from Kenya News Agency: <https://www.kenyanews.go.ke/government-launches-coffee-revitalization-project/>

<sup>95</sup> Buliro, A. (2013). AN EVALUATION OF THE BENEFITS OF FAIRTRADE TO THE KENYAN COFFEE COMMUNITY. Kenya: UNITED STATES INTERNATIONAL UNIVERSITY.

smallholder farmers do not have the resources, ability and flexibility to relocate and may be forced to abandon coffee production. Farmers can be cushioned against climate change through access to information, technologies, financial support, and research and development for climate smart agricultural practices and climate-resistant coffee varieties.

It is the low productivity level in the smallholder agricultural practices that is today globally responsible for over a quarter of greenhouse gas emissions. It is estimated that in the next 30 years 75% of available, unforested land suitable for Arabica farming will be lost due to climate change<sup>96</sup>. Therefore, the land currently being used by coffee farmers in many regions will become unsuitable economically. Smallholder coffee farmers will be forced to abandon coffee production due to its unproductivity.

About 90% of Carbon dioxide emissions are linked to deforestation when forests and woodlands are cleared to make room for fields and pastures. Whereas 80% of Nitrous oxide are emitted from fertilizer applications<sup>97</sup>.

It is expected that higher temperatures will reduce yields of Arabica coffee as coffee ripens more quickly with increase in temperature leading poor quality. Arabica coffee thrives at a temperature range of 15°C – 24°C. Temperatures over 25°C reduce photosynthesis. Temperatures above 30°C lead to leaf damage. In addition, high soil temperatures increase the rate of evaporation and organic matter breakdown which lead to poor soil structure and increased susceptibility to erosion. High temperatures are associated with coffee leaf rust heavy insect parasites.

High rainfall amount influence drying and processing of coffee berries reducing coffee quality and affecting its marketability. High rainfall is also associated with the coffee berry disease. While erratic rainfall results in random flowering, with flowers and berries at different stages of growth being on the same primary branch.

Most factories cut down trees used for firewood to provide fuel for coffee processing in attempt to reduce electricity bills. In current coffee processing processes, plastic waste generated from packaging is another problem creating a hazardous environment and putting the health of humans and livestock at risk<sup>98</sup>.

Table 16: Climate hazards, impacts, and resilient practices along the Coffee value chain<sup>99</sup>

VALUE CHAIN STEP	CLIMATE HAZARD	CLIMATE IMPACTS	IMPLEMENTED PRACTICES	ADAPTATION RECOMMENDATIONS
Production	High temperature and relative humidity	Significant reduction of suitability of coffee growing areas by 2050. Rapid ripening of cherries; shifted production to higher altitudes. Pests and diseases attacks	Limited use of fertilizers, herbicides, and pesticides	Integrated soil, water, and pest management practices. Balanced application of fertilizers, establishment of cover crops, optimization of crop calendars. Agroforestry practices (plant shade trees to regulate temperature, wind protection, and water use). Shift to pest and disease-resistant varieties.
	Heavy rainfall and hailstorms	Ineffectiveness of cherry ripening and drying	Approximate drying methods right after harvesting	Selective picking techniques. Appropriate timing for drying according to suitable weather conditions. Agroforestry practices. Balanced application of fertilizers, herbicides and fungicides, and pesticides according to forecasted weather conditions.

<sup>96</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

<sup>97</sup> Hussain, L. A. S., Inzoli, F., Golinucci, N., Stevanato, N., Rocco, M. V., & Colombo, E. (2020). FEEM Approach to Supply Chain Analysis The coffee sector in Kenya.

<sup>98</sup> SEI. (2022). Improving Kenya's coffee value chain Integration of sustainable consumption and production practices. Kenya: Stockholm Environment Institute.

<sup>99</sup> Transforming Livelihoods through Climate Resilient, Low Carbon, Sustainable Agricultural Value Chains in the Lake Region Economic Bloc, Kenya (CRLCSA), *Climate Impact Potential Assessment 2022*

<b>Harvesting, storage, and processing</b>	<b>High temperature and relative humidity</b>	Mold and mycotoxins spread (e.g., ochratoxin A - OTA contamination)	Use of poor storage infrastructure	Use appropriate moisture-measuring equipment, temperature and relative humidity forecasts tailored to VC actors; Reduce time of storage; Facilitate ventilation through fans and use of jute bags; Pests control and infrastructure inspections.
	<b>Heavy rains, hailstorms, and flooding</b>	Disruption of storage infrastructure, coffee beans re-wetting, stagnant humidity	Use of communal storage facilities; store on wooden pallets above the ground; use of poor storage infrastructure	Adequate ventilation, relative humidity control, rainwater drainage systems;  Access to cooperative storage structures; Pile bags on pallets or similar structures and away from walls to prevent re-wetting; Use real-time weather forecasts, extreme rainfall and flooding advisory tailored to VC actors.
<b>Transportation and markets</b>	<b>High temperature and relative humidity</b>	Reduced quantity and quality of coffee beans available at markets. Increased costs and reduced final prices.	Price setting and logistics primarily managed by cooperatives	Development of sustainable certifications that include climate adaptation standards; Ensure equitable access to information to value chain actors; Monitor activities to improve performance of cooperatives; Promote coffee processing and market opportunities, organization through cooperatives
	<b>Heavy rains and flooding</b>	Reduced quantity and quality of coffee beans available at markets. Increased costs and reduced final prices.	Price setting and logistics primarily managed by cooperatives	Development of sustainable certifications that include climate adaptation standards; Ensure equitable access to information to value chain actors; Monitor activities to improve performance of cooperatives; Promote coffee processing and market opportunities, organization through cooperatives

County-level climate risk assessments and climate resilient recommendations tailored to selected agrifood commodities as part of the Kenya Climate Smart Agriculture Project (KCSAP) were performed by the Ministry of Agriculture, Livestock, and Fisheries of Kenya (MoALF) in collaboration with the International Center for Tropical Agriculture (CIAT) and the CGIAR Research Programme on Climate Change, Agriculture, and Food Security (CCAFS), and supported by the World Bank. The results of this work for each key VC as selected by the counties involved in the project are further analysed below.

*Table 17: County-level climate risk and value chain mapping*

Prioritized value chains	Agro-climatic indices					
	Minimum temperatures	Mean temperatures	Maximum temperature	Rainfall	Altitude	Relative humidity
Coffee	0°C	18-23°C	40°C	1500-2000mm	1,400 and 2,200 m asl	11-12.5% mc (storage)



### 3.3.2 Water foot print

Coffee production and processing in relation to coffee, consumes relatively low amount of water compared to other agricultural commodities. This is attributed to the fact that coffee beans are exported from often water scarce producing countries to be then roasted, served and consumed mainly in water abundant countries like Europe. It is estimated that water needed to produce 1 ton of raw coffee cherry ranges between 1 and 15 cubic meters<sup>100</sup>. In producing countries, it is the wet processing of coffee that consumes a lot of water up to 20 litres of water per kilogram of coffee cherries<sup>101</sup>. This represents a risk for the sustainability of the process as well as for the communities living in the surroundings. And this water is normally wasted instead of recycling. Many smallholder coffee farmers rely heavily on rainwater and river to cover all their primary and secondary water consumption<sup>102</sup>. Smallholder agricultural producers are characterized by a low level of productivity. It is the low productivity level that is today globally responsible for about 70% of freshwater consumption. To reduce impacts on water sources, an eco-pulper machinery (an innovative water-saving pulping machinery) for the wet milling process which uses petroleum for fuel. It minimizes water consumption and wastewater production. It can process up to one ton of coffee berries per hour. It is therefore more economical as it reduces the processing time and can serve several farms which can share the financial risk associated with the investment. It saves water by heavily reducing the amount of water required per unit of processed coffee. Use of eco-pulpers is able to save up to 1.46 M cubic meters of water per year<sup>103</sup>.

### 3.3.3 Biodiversity and ecosystems

All the areas that favour coffee growing have been described as being biodiversity 'hotspot' because of its location in the rich volcanic soils, high annual rainfall amounts and conducive temperatures. The local coffee agroforest systems are capable of ensuring habitat for wildlife while simultaneously providing a means of livelihood for local communities. Most coffee growing zones have diverse tree species, as shade trees with the main tree being *Grevillea robusta*, ever since coffee was introduced in Kenya. Shade trees and other food crops are intercropped in coffee plantation as sources of food and timber/fuelwood for home use or cash income. Some agroforestry trees can help against soil erosion and weathering which benefits the environment. Agroforestry services the global purpose of greenhouse gas regulation, climate regulation, biodiversity and rural poverty alleviation.

Shade trees crops in coffee plantation can serve as emergency crops to compensate for situations of some crops failing or bad prices<sup>104</sup>.

Majority of coffee farms are crop based with a mixture of cereals, vegetables, fruits, grasses, and trees for firewood and timber. Also, majority of farms have at least one cow to produce milk for home consumption and

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<sup>100</sup> Coffeelands. (2016, May 27). The water footprint of coffee. Retrieved from Wocat pedia: [https://wocatpedia.net/wiki/The\\_water\\_footprint\\_of\\_coffee](https://wocatpedia.net/wiki/The_water_footprint_of_coffee)

<sup>101</sup> SEI. (2022). Improving Kenya's coffee value chain Integration of sustainable consumption and production practices. Kenya: Stockholm Environment Institute.

<sup>102</sup> Coffeelands. (2016, May 27). The water footprint of coffee. Retrieved from Wocat pedia: [https://wocatpedia.net/wiki/The\\_water\\_footprint\\_of\\_coffee](https://wocatpedia.net/wiki/The_water_footprint_of_coffee)

<sup>103</sup> Golinucci, N. S., Tahavori, M. A., & Sulliman Hussain, L. A. (2022). Comprehensive and Integrated Impact Assessment Framework for Development Policies Evaluation: Definition and Application to Kenyan Coffee Sector. *Energies*, 3071.

<sup>104</sup> Lamond, G. (2007). Local knowledge of biodiversity and ecosystem services in smallholder coffee farms in Central Province, Kenya (Doctoral dissertation, Master Thesis, Bangor. School of the Environment and Natural Resources, University of Wales, Bangor).

manure for the crops, some chickens and occasionally a few goats. Smallholder farms have various crop plots inside the coffee plantation for subsistence purposes and for selling at the marketplace. Most commonly grown crops include bananas, maize, napier grass, beans, kales, cabbages, arrowroot, sugarcane, sweet potatoes, cassava, passion fruit, yams, chilli peppers, tomatoes, pumpkins, and pineapples. The most common agroforestry trees are avocado, macadamia and bananas<sup>105</sup>.

Shifts in coffee production have the potential to alter diversity by affecting niches available for indigenous trees on farms<sup>106</sup>. Coffee trees grown beneath shade trees can provide some habitat for birds' species associated with trees and more forested habitats. Shade trees can provide insect resources and microhabitats that are suitable food source for some forest-associated birds. They also serve as migratory corridors of migratory birds. Coffee farms with rich ground cover offers suitable breeding sites and hiding places for skulking birds and foraging habitats for birds. The individual coffee trees produce flowers that attract insect eating bird species<sup>107</sup>. Being an evergreen shrub, coffee contributes to carbon sequestration, soil quality, and biodiversity conservation.

### 3.3.4 Toxicity/ pollution

High level of fertilizer and chemical consumption has been a major threat to marketability of Kenyan coffee on the international markets. For instance, Kenyan coffee was flagged off in Japanese and South Korean markets due to high levels of Ochratoxin that exceeded the allowable minimum chemical content<sup>108</sup>. At the production level, there is soil pollution due to copper-based agrochemicals and water pollution from agro-chemicals carried in sediment. At the factory level there is odour from accumulating coffee pulp and husk; and water pollution from disposed waste water. The millers lack financial capacity for technological solutions to treat waste water as well and solid biomass waste into other products such as fertilizer<sup>109</sup>. Majority of smallholder households rely of firewood for fuel and warming their homesteads leading to pollution and public health hazard. It is reported that cooking smoke from traditional firewood fuels contributes to 21,500 deaths every year according to Kenya government data. It is also a cause of a range of chronic and acute illnesses that mostly affecting women and children<sup>110</sup>.

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<sup>105</sup> Lamond, G. (2007). Local knowledge of biodiversity and ecosystem services in smallholder coffee farms in Central Province, Kenya (Doctoral dissertation, Master Thesis, Bangor. School of the Environment and Natural Resources, University of Wales, Bangor).

<sup>106</sup> Carsan, S., Stroebel, A., Dawson, I., Kindt, R., Swanepoel, F., & Jamnadass, R. (2013). Implications of shifts in coffee production on tree species richness, composition and structure on small farms around Mount Kenya. *Biodiversity and conservation*, 22(12), 2919-2936.

<sup>107</sup> Ong'ondo, F. J., Fogarty III, F. A., Njoroge, P., & Johnson, M. D. (2022). Bird abundance and diversity in shade coffee and natural forest in Kenya. *Global Ecology and Conservation*, 39, e02296.

<sup>108</sup> Solidaridad. (2022, September 30). COFFEE SUSTAINABILITY: KENYA'S LOOMING CRISIS AMIDST THE SOARING COST OF PRODUCTION. Retrieved from Solidaridad Network: <https://www.solidaridadnetwork.org/news/coffee-sustainability-kenyas-looming-crisis-amidst-the-soaring-cost-of-production/>

<sup>109</sup> Gituma, K., & Fuchaka, W. (2017). Enhancing benefits from biomass wastes within small-medium scale coffee processing factories in Kiambu County, Kenya. *African Journal of Environmental Science and Technology*, 11(4), 198-206.

<sup>110</sup> Orang'i, M. (2022, April 22). Project Profile: Project Profile: Clean Household Energy Solutions for Mount Kenya's Coffee Farmers. Retrieved from Rainforest alliance: <https://www.rainforest-alliance.org/in-the-field/clean-household-energy-solutions-for-mount-kenya-coffee-farmers/>

### 3.3.5 Food loss and waste

On the farm, un-pulped coffee berries that are under-ripe, over-ripe or diseased, drop off the ground before harvesting and are not fit for wet processing, are gathered by farmers and processed as ‘Mbuni’ low grade coffee<sup>111</sup>. Mbuni coffee constitutes 10% of all the coffee produced in the country. They are considered naturally processed. They do not undergo the wet processing.

The processing of coffee in Kenya has remained to be a weak link in the value chain and is responsible for the high losses experienced both in quality and quantities. Also processing of coffee has been responsible for the high charges that coffee growers have to meet for processing services and processors’ dishonesty. Coffee millers have not been accountable to their clients on their produce and growers have no role in the processing of their coffee. The Ministry of Agriculture, through the Agriculture and Food Authority’s Coffee Directorate, has proposed new regulations with the aim to give the coffee growers a voice on the appointment and overseeing of the millers. The contracts signed with millers will cap the allowable milling losses to 19% of parchment coffee milled and the cost of coffee milling and related activities (handling, sorting, grading, packaging, warehousing charges) will not to exceed Kshs. 4,000.00/ton of coffee delivered. This is meant to protect growers from excessive charges for services rendered by millers and ensure processing efficiency thus enabling better returns for growers<sup>112</sup>.

## 2.4. SWOT Analysis

<b>Strengths</b> <ul style="list-style-type: none"> <li>Increasing domestic consumption</li> <li>Recognized quality</li> <li>Global market</li> <li>Two options for sale (Direct sale or NCE)</li> <li>Ideal climatic conditions</li> <li>Pool of coffee knowledge</li> <li>Renowned coffee variety - Blue Mountain</li> <li>Availability of Renown coffee research facility</li> <li>Availability of superior coffee varieties (New / Improved)</li> <li>Devolution of functions</li> <li>Good will from the County government</li> <li>A good asset base at the union</li> </ul>	<b>Weakness</b> <ul style="list-style-type: none"> <li>Ageing farmers and old technologies</li> <li>High risk for farmers</li> <li>Low domestic value addition</li> <li>Low yields due to low use of inputs and droughts</li> <li>Small and Uneconomical units at the farm and society levels</li> <li>Old and obsolete processing technologies</li> <li>Capacity bottlenecks and mismatch especially at processing, warehousing and level.</li> <li>Poor keeping and management of records</li> <li>Limited value addition of coffee</li> <li>Inappropriate policy framework - There is a conflict in the line ministries that deal with coffee and other related bodies</li> <li>Weak regulatory framework leading to weak regulation- the activities of CBK are not visible on the ground</li> <li>Multiplicity of players leading to duplication and poor coordination</li> <li>Lack of brand identity</li> </ul>
<b>Opportunities</b> <ul style="list-style-type: none"> <li>Government recognition</li> <li>Rising domestic consumption</li> <li>Exporting roasted coffee</li> <li>Generating revenue from coffee pulp</li> <li>Liberalization of sector allowing farmers to market their coffee directly</li> <li>Value addition</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>Environmental challenges</li> <li>Coffee sector is losing competitiveness</li> <li>Drop in international prices</li> <li>Pest and disease Climate change effects</li> <li>Competition from other enterprises</li> <li>Changing consumer preferences</li> </ul>

<sup>111</sup> Mwangi, R. W., Mwenda, L. K. M., Wachira, A. W., & Kiarie, D. M. (2017). Effect of Primary Processing Practices Carried out by the Coffee Cooperative Societies on the Sustainability of the Coffee Industry in Kenya.

<sup>112</sup> Coffee Directorate. (2022). THE CROPS (COFFEE)(GENERAL)(AMENDMENT) REGULATIONS, 2022. Kenya: Agriculture and Food Authority.

<ul style="list-style-type: none"> <li>• Penetration of niche markets – emerging markets, specialty markets, consumer preferences, youth and local consumption</li> <li>• Certification for sustainability</li> <li>• Adoption of modern technology and ICT</li> <li>• Use of devolution platform to revitalize the sector</li> <li>• Reorganization of the regulatory function following the consolidation of agricultural parastatals</li> <li>• Optimal utilization of the large asset base</li> <li>• Possibility for Private public partnerships especially in value addition of coffee</li> <li>• Organized and aggregated marketing</li> </ul>	<ul style="list-style-type: none"> <li>• Price volatility – leading to a very unstable farming system</li> <li>• Illegal coffee deals / hawking</li> <li>• Age profile of farmers –most farmers are old and young people not willing to go into farming</li> <li>• Climate change</li> <li>• Rising Consumer concerns about food safety and health issues associated with coffee</li> </ul>
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### 3. Recommendations

#### 3.1. Key recommendation for value chain improvement

##### Farm

- There is need for coffee growers to integrate coffee and livestock farming and practice animal manure composting to generate organic fertilizers. Manure from livestock will provide natural fertilizer source for the coffee crops limiting use of fertilizers. Also composting of manure will reduce waste. Replacing synthetic fertilizers with organic fertilizers will reduce the agriculture sector's greenhouse gas emissions while also producing healthier crops with lower costs.
- In order to control the micro-climate temperature and stability of the soil moisture it is recommended that farmers should intercrop shade trees, practice single-stem farming, block and labelling, or precision farming where coffee trees are planted in blocks and labelled. In single-stem farming farmers are able to increase crop yield up to four times from average while producing higher quality berries. Block and labelling will help farmers improve traceability by keeping track of information such as growth and fertilizer application. Also use of natural pest control methods such as intercropping with other crops and plant-based pest repellents such as lemon grass and mulching are safer alternatives to chemical pesticides. In single-stem technique the farmer deliberately thins the coffee crop leaving only one or two coffee stems per plant with single-sided branches to maximize yield and ensure optimum primary branches with few secondary and no tertiary branches<sup>113</sup>
- Promote the use of Ruiru 11 variety which is resistant to pests and diseases, although with lower quality of coffee berries, or the Batian variety which also has higher yields in all agro-ecological zones, lower costs of fungicide application and higher income opportunities due to its resistance to coffee berry disease and leaf rust, its early maturity and ripening timing, while providing high yields and quality.
- Shift to selective picking methods to ensure high quality of cherries already at harvest.
- Use adequate trees for agroforestry practices, and appropriate organic materials for mulching. Shaded coffee production compared to monoculture helps remove pests, maintains soil fertility, provides farmers with diversified income, and reduces impacts from extreme weather events such as hailstorms, as well as from dry spells impacts on reduced soil water content, and solar radiation impacts on sun scorching.
- Increase use and improve timing of organic fertilizers, pesticides, and herbicides application based on forecasted extreme weather events and pest and diseases attacks.

##### Factory

- Factories are advised to use eco-pulper machine technology that mechanically separates the beans from the cherry without the need for water or sun-drying the coffee cherries. It allows natural separation of

<sup>113</sup> <https://www.ico.org/documents/cy2018-19/icc-124-7e-profile-kenya.pdf>

beans from the dried fruit husk. This will reduce water usage by 90–100% compared to the current traditional pulping (wet processing) method that uses up 20 litres of water per kilogram of coffee cherries. An eco-pulper is less labour-intensive, which in turn increases the efficiency of pulping.

- During coffee packaging, plastic waste generated is an environmental hazard in current coffee production practices. It also puts the health of humans and livestock at risk. Plastic waste can be managed by creating a systematic process of collecting plastic containers for recycling and re-use.
- Factories should enhance their record keeping efficiency. They should carefully weigh, label and record coffee deliveries by farmers to make it easier for the coffee farmer to control. In turn the factory should use traceability for the coffee quality and characteristics in marketing to gain better market prices. In this way they will be adding value to the coffee value chain.

### Millers

- Utilization of renewable energy resources such as biogas, solar and wind across the coffee value chain could help build resiliency within the industry. Solar photovoltaic conserves energy. Wind pumps enhance productivity by pumping water without fuel required. Biomass (coffee pellets and husks) eliminates pollution by turning coffee byproduct waste into energy. Biogas generates renewable energy from livestock manure and reduces farm emissions.
- Increase processing and packaging activities after milling to increase processed, high-value coffee domestic and exportation marketing<sup>114</sup>.
- Promote the processing and use of by-products such as coffee pulp through drying and recycling for application as manure to reduce use of chemical fertilizers and costs for farmers, as well as biomass to produce bioethanol, or as coffee flour, which has high nutritional and gluten-free values, thus generating income for farmers and millers<sup>115</sup>.
- Increase automatization of coffee processing using electronic weighing machines and electronic moisture control systems to increase time- and cost-effectiveness of sorting and grading<sup>116</sup>.

### Storage

- Ensure correct moisture levels during storage through appropriate drying<sup>117</sup>.
- Support collaboration between actors along the value chain from farmers to traders to optimize the use of coffee storage facilities and safe coffee handling.
- Ensure sanitation and hygiene within storage units such as adequate levels of relative humidity in the ambient, pests monitoring, consistent cleaning and maintenance of the facility (including walls and roof).
- Ensure adequate levels acceptance of dried coffee beans at 11-12.5% of moisture content, using appropriate electronic moisture control devices such as hygrometers (both for the product and the surrounding environment), affordable ventilation (e.g., fans), and technical support. Select acceptance levels of husk material which is a source of OTA contamination.
- Integrate rainwater harvesting and drainage systems to prevent water entry.
- Reduce timing of coffee storage according to extreme weather advisories.
- Store green beans, dry cherries, and parchment separately.

<sup>114</sup>[https://journals.sagepub.com/doi/pdf/10.1177/0030727018766956?casa\\_token=yQ0u3llmyMwAAAAA:EOpxUeC4zkszSOKGeTrKju77kMmaQY5Q7XMwWUJCV0TbOy8TqT-MhSRNDnaksAA7PCJS9X1HE0](https://journals.sagepub.com/doi/pdf/10.1177/0030727018766956?casa_token=yQ0u3llmyMwAAAAA:EOpxUeC4zkszSOKGeTrKju77kMmaQY5Q7XMwWUJCV0TbOy8TqT-MhSRNDnaksAA7PCJS9X1HE0)

<sup>115</sup> <https://feem-media.s3.eu-central-1.amazonaws.com/wp-content/uploads/968-rpt-supplychainanalysis-coffee-kenya.pdf>

<sup>116</sup> <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.821.6464&rep=rep1&type=pdf>

<sup>117</sup> <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.821.6464&rep=rep1&type=pdf>

- Use jute bags instead of plastic bags to favour ventilation and water vapour transmission. At the same time, ensure that bags previously containing other contaminants such as fertilizers, feeds, and other chemicals are not re-used for coffee transportation and storage.
- Store coffee bags on pallets on raised shelves to allow air circulation and avoid re-wetting from water entrance. Ensure that coffee is not stored close to other potentially contaminating materials, as well as to operations which could heat up the ambient (e.g., hot air dryers) and consequently warm up and humidify the product. Consider storing coffee in silos with ventilation systems (e.g., fans) and proper insulation to prevent water entrance and temperature variations.

### **Marketing**

- The farmer cooperatives should be facilitated for value addition of coffee through coffee roasting and packaging. Roasting the coffee before selling will fetch higher market prices and enhance the income of coffee growers.
- Farmer cooperatives should be sensitized and facilitated to adopt Fairtrade market based approach in order to provide coffee farmers with better trading conditions and promote coffee production sustainability. Farmers will gain free access to the world marketplace and consumers. For this to be achieved cooperatives must improve on certifying and labeling initiatives. This will fetch farmers better market prices of their produces and discourage diversification from coffee production to other value chains as is the trend currently. This will consequently improve coffee production in terms of quality and quantity.
- Directorate of Kenya should allow for direct local sales that foster engagement between the grower-marketer and consumers which would benefit coffee producers economically and help them to hedge against risks inherent in the global market.
- There should be sustainable coffee certifications to increase the purchase and consumption of Kenyan coffee both locally and globally. Coffee farmers and cooperatives should be supported to access these certifications and to meet the costly processes of certification and high fees levied by certification bodies.
- Coffee farmers should be involved throughout the value chain from the input stage/distribution systems, to the farm level and then to processing and marketing/distribution systems.

### **Consumption**

- The government and other industry players should promote local coffee consumption by creating a stronger domestic market for coffee especially among the youth. This can be done through local communication channels and networks such as cooperative members, posters, local vending and local TV and radio stations.
- Also more young people should be enrolled into the value chain to ensure its sustainability as the majority of coffee producers are elderly people over 60 years and above.

## **3.2. Key recommendations for value chain development actors**

### **Farmers**

- The farmers are advised to optimize costs and application of inputs by reducing excessive use and application of fertilizer. This will contribute to reduced disease management, weeding and labour costs.
- Farmers should embrace improved agricultural practices and cultivars to improve farm level productivity. This is only possible when farmers have access to improved extension services.
- Enhance farmers' participation in the value chain to increase knowledge sharing and farmers' capacity building to negotiate prices and contracts with middlemen, as well as requests for improved technologies and practices tailored to farmers' needs. Increase income opportunities for farmers taking up adding-value activities such as collection, grading, bulking, and transportation.

## **Kenya Planters Cooperative Union's**

- Improve Kenya Planters Cooperative Union's (KPCU) support towards cooperatives and members in accessing climate- and market-based information as well as subsidies to enable more informed decisions at the production site and improve the quality and quantity of coffee production.

### **Cooperatives**

- Cooperatives should ensure that the premium coffee receives on the international market trickles down to the smallholder farmers. This could be achieved through eliminating payment delays and high interests' rates payments on production loans.
- Reforming governance of smallholder cooperatives will improve transparency, accountability and governance. This will solve problems related to cooperative societies offering high interest loans, high processing losses and some evidence of embezzlement/corruption.
- Cooperative ownership should remain with farmers but management should be hired on performance basis.
- Cooperatives could lower their operational costs and production efficiency through upgrading their machinery.

### **Coffee Directorate**

- There is need for regulation reforms in the coffee value chain to increase private participation in coffee processing and marketing. Individual farmers should be allowed to sell their coffee directly to consumer markets.

### **The Ministry of Agriculture**

- The government through the Ministry of agriculture should incorporate sustainable coffee production practices in the current coffee sector reforms focused on the revival, strengthening and adequate funding of the coffee sector.
- The national and county Ministries of agriculture should allocate resources to support capacity-building activities for all actors along the coffee value chain. The extension officers should be more available and effective to provide knowledge and training on the sustainable coffee productions practices to coffee producers to be able to implement the practices on their farms.
- Through the already launched coffee revitalization project, the county government should make available financial resources to support coffee producers by providing subsidy programs for sustainable technology improvements and incentive programs for integration of sustainable agricultural practices. The aim should be to encourage more farmers to improve their current practices and switch to sustainable practices and motivate more farmers and youth to stick with coffee production.
- The government should create institutional platforms for farmers to explore both local and international coffee markets and allow them to gain access to information on the market conditions and bargaining powers on the pricing and product marketing. Farmers who are informed about market demands will produce quality coffee that fits the market with the potential to sell at a higher price.
- The government should restructure the subsidy program such that besides availing fertilizer at a fair and affordable cost, farmers are also educated to ensure that they optimally use the subsidized fertilizer.
- The government should introduce and scale up coffee branding through the geographical indication for single origin coffee. It should consider offering incentives to farmers to enroll into this type of marketing as it will help widen the coffee market.
- The government should also aggressively market Kenyan coffee and offer incentives to encourage foreign investors to engage into contract partnership with coffee farmers to minimize spreading price between producer and the consumers.

**Coffee Research Institute**

- The CRI together with the county governments should develop an extension outreach program for coffee farmers to equip them with the right knowledge and skills to produce and manage coffee.
- Also CRI through research should continuously provide farmers access to new coffee varieties in order to facilitate higher yields in the longer term. Awareness about new coffee varieties should be made for farmers to be aware of their existence and potential benefits and recommendations.