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Climate-smart coffee production in the East African Community and export opportunities to the EU

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Shade grown Arabica Coffee (Coffea arabica) plants in Arusha, Tanzania © indigojt / Getty Images [url: https://www.gettyimages.com/license/492642524]

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Key messages:

- **Climate-smart agriculture (CSA) practices for coffee in the East African Community (EAC) such as mulching and agroforestry can increase yields and export opportunities, while also responding to climate change risks.**
- **Coffee exports to the EU from EAC countries, including Ethiopia, Kenya and Uganda, have grown by around 60% over the past decade, and business models differ by country, with auctions being most prevalent.**
- **Local growers need to scale up CSA practices in order to meet sustainability certification and other requirements for the growing EU market, which include quality, traceability, biodiversity conservation, social responsibility, packaging and labelling compliance, and adherence to phytosanitary measures.**

Introduction

This fact sheet provides coffee farmers and farmers' representatives in the East African Community (EAC) with an overview of research findings on alternative climate-smart cropping systems and best practices that can increase coffee productivity and export opportunities while responding to climate change risks. This is based upon a literature and data review on coffee export opportunities from the EAC to the EU, as well as a meta-analysis that integrates findings from a large body of academic and grey literature.

Climate-smart agriculture (CSA) is an approach to farming that aims to address the challenges induced by climate change and is based on three key principles: (a) increased productivity; (b) resilience to climatic stressors; and (c) reduction of greenhouse gas emissions (FAO, 2014).

CSA practices are highly relevant to the EAC, given the region's vulnerability to climate change risks and the importance of coffee production as a livelihood source for many people in the region (Shinyekwa et al., 2017). Effective implementation of these practices in the region has shown the potential to simultaneously reduce greenhouse gas emissions and enhance agricultural productivity and resilience of farming systems in the region in the face of a changing climate (Nyasimi et al., 2014).

The significance of coffee production in the EAC cannot be overstated due to its social, economic and cultural implications (Nzeyimana et al., 2020). However, the production of this crucial commodity faces a myriad of climate variability and change-related impacts such as rising temperatures, erratic rainfall patterns, drought, and proliferation of pests and diseases, all of which negatively impact coffee's quality and yields (Nsabimana & Tirkaso, 2020). In recent years, coffee export from the EAC to the EU has experienced significant growth and plays a key role in the region's economy. Countries such as Uganda, Ethiopia, Kenya, Tanzania, Rwanda and Burundi have experienced a steady growth in their coffee exports, with the EU accounting for 69% of EAC coffee exports in 2021 (FAOSTAT, 2023). This growth has quickly revealed that

existing coffee management practices are unsustainable. In Kenya, for example, coffee exports are associated with 50 hectares per year of deforestation over the period from 2015 to 2018 (Dummett & Tenorio, 2023).

With this context in mind, it is imperative to understand current management systems and how the widespread usage of CSA practices can both tackle environmental concerns and take advantage of the potential for greater export of coffee to growing markets like the EU.

Characteristics of conventional coffee farming systems in the East African Community (EAC)

Conventional coffee farming systems in the EAC fall into one of two categories. The first is smallholder systems, which make up the majority and are mainly characterized by soils with low nutrients and organic matter levels, prevalence of coffee pests and diseases such as coffee berry and stem borer, coffee leaf rust and bacterial blight, use of indigenous varieties and low-quality inputs, low-shade tree density, intensive intercropping with other crops, and little access to extension services (Otieno et al., 2019; Canwat, 2023). The second is commercially managed coffee plantations that are export-oriented and mainly characterized by high inorganic fertilizer consumption, higher yielding varieties, and use of herbicides and pesticides that increase their carbon footprints (AFDB, 2019).

Figure 1: Examples of CSA coffee practices (a) shade trees, (b) intercropping, and (c) irrigation

[Figure 1: (b) intercropping]

[Figure 1: (c) irrigation]

Source
1a: https://www.gettyimages.com/license/492642524
1b: https://upload.wikimedia.org/wikipedia/commons/8/8f/Intercropping_coffee_tomatoes.jpg
1c: https://www.gettyimages.com/license/688726370

Co-benefits of climate-smart agriculture (CSA)

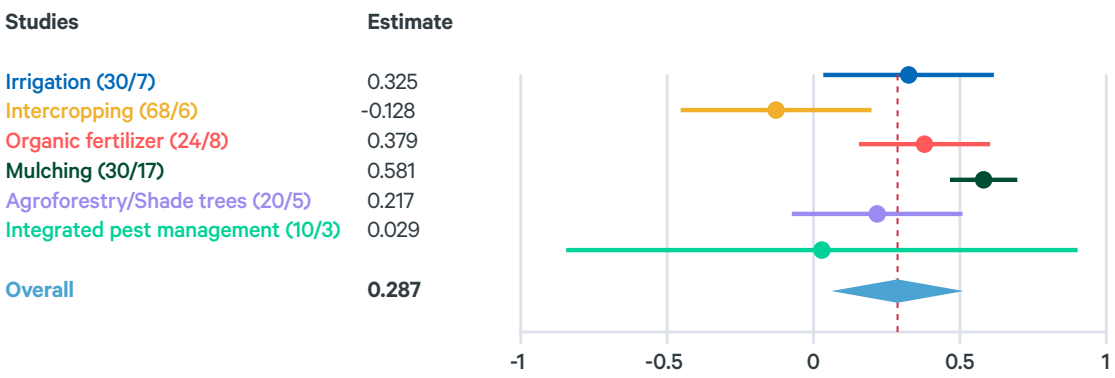
According to FAO's State of Food and Agriculture report (The State of Food and Agriculture, 2023) current agrifood systems cost society, the environment and our health enormous amounts of hidden money—at least 12 percent of GDP in middle-income nations. Additionally, environmental factors—including greenhouse gas and nitrogen emissions, land use change and water consumption—account for one-fifth of total agrifood costs. Restructuring these agrifood systems to improve their effectiveness, inclusivity, resilience and sustainability is necessary to minimize these costs.

CSA provides an opportunity to restructure agrifood systems with multiple co-benefits such as enhanced food security, improved livelihoods, carbon sequestration, resilience to climate change, soil and biodiversity improvement, and social equity and inclusivity (FAO, 2014).

CSA and coffee productivity

Our review of the literature and meta-analysis revealed that CSA practices offer positive effects on coffee yields and productivity, carbon sequestration, and adaptation to environmental changes including climate change impacts. The effects on coffee yields differed between the climate-smart practices identified (see Figure 2).

Figure 2: Mean coffee yields comparing CSA practices and conventional coffee farming



Number in parenthesis denote the number of observations and studies. A value of zero means that there is no difference in yields between CSA practices and conventional coffee.

Source: Authors' own

Our analysis demonstrates that mulching has a significant positive and consistent effect with an overall effect size of 0.581, leading to increases in coffee yields of 58% compared to a control treatment with no mulch. Organic/green manure increases coffee yields by 37.9%. According to Scherr et al. (2012), mulching and green manure/organic fertilizers have the potential to enhance crop productivity by suppressing weeds, thereby decreasing manual weed control or use of herbicides, while simultaneously reducing fertilizer production costs and production-related greenhouse gas emissions.

In terms of irrigation, our analysis indicated an overall effect size of 0.325, indicating a moderate increase in coffee yields of 33%. Despite having small negative effects of 12.6% on overall coffee yields compared to mono-cropped control, intercropping was reported by Nyasimi et al. (2014) to improve soil fertility and income for smallholder farmers.

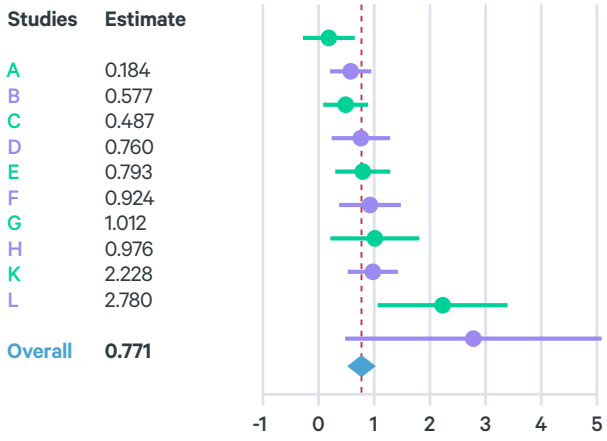
A small positive effect of 22% increase in coffee yields was observed under shade/agroforestry systems. Besides the small effect size on overall coffee yields, nitrogen-fixing shade-fruit trees have been reported to: (i) increase the size and quality of coffee beans; (ii) increase income for farmers from other sources such as fruits, fuel wood and timber produced within the agroforestry system; and (iii) reduce fertilizer production costs that ultimately reduces production-related greenhouse gas emissions (Bote & Struik, 2011).

Our review only focused on experimental studies comparing CSA with a control (with no CSA). Notwithstanding, other CSA practices are also vital for ensuring resilience, including practices such as climate-resilient varieties, cover cropping and conservation tillage.

Agroforestry/shade trees: climate change benefits through carbon sequestration

We evaluated the effects of agroforestry/shade trees on carbon sequestration, and our analysis indicated that coffee-based agroforestry/shaded coffee, on average, has significant and consistent positive effect on total carbon stock with an overall effect size of 0.771 (77% increase in carbon stock) (see Figure 3).

Figure 3: Total carbon storage/sequestration potential comparing coffee-based agroforestry and sole coffee systems.

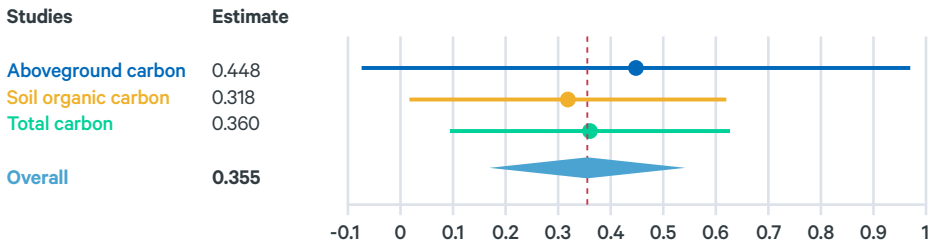


Positive effect size denotes higher carbon storage/ sequestration under coffee-based agroforestry systems, while negative effect size denotes higher carbon storage/sequestration under sole-coffee systems.

Source: authors' own

Figure 4 shows a comparison of aboveground carbon stock, soil organic carbon stock and total carbon stock in organic versus conventional coffee systems. Overall, organic coffee farming systems have a small positive effect on total carbon stock with an overall effect size of 0.355 (36% increase in carbon stock). Additionally, organic coffee systems are found to increase aboveground and soil organic carbon stock by 45% and 32% respectively.

Figure 4: Aboveground carbon, soil organic carbon and total carbon sequestration comparing organic coffee systems and conventional coffee systems.



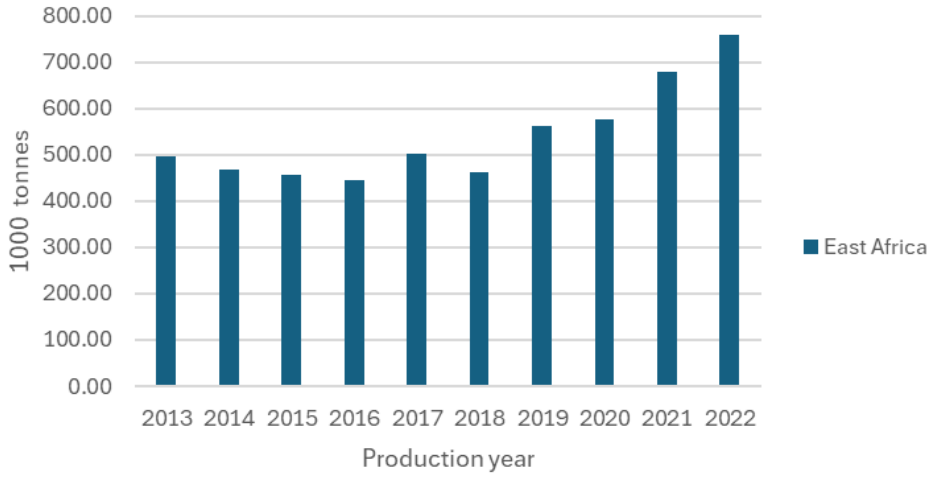
Positive effect size denotes higher carbon storage/sequestration under organic coffee systems, while negative effect size denotes higher carbon storage/sequestration under conventional coffee systems.

Source: authors' own

Coffee production and exports from the EAC to the EU

The EAC has established itself as a significant coffee exporter to various global markets with the EU being one of its major export destinations, accounting for 58% of the total production of 461 746 metric tonnes in 2018 as depicted in Figure 6 (FAOSTAT, 2023; EAC, 2024). Total coffee production in the EAC, including Ethiopia, decreased from 501 582 tonnes in 2017 to about 460 000 in 2018, before increasing to 678 812 tonnes in 2021 (see Figure 5).

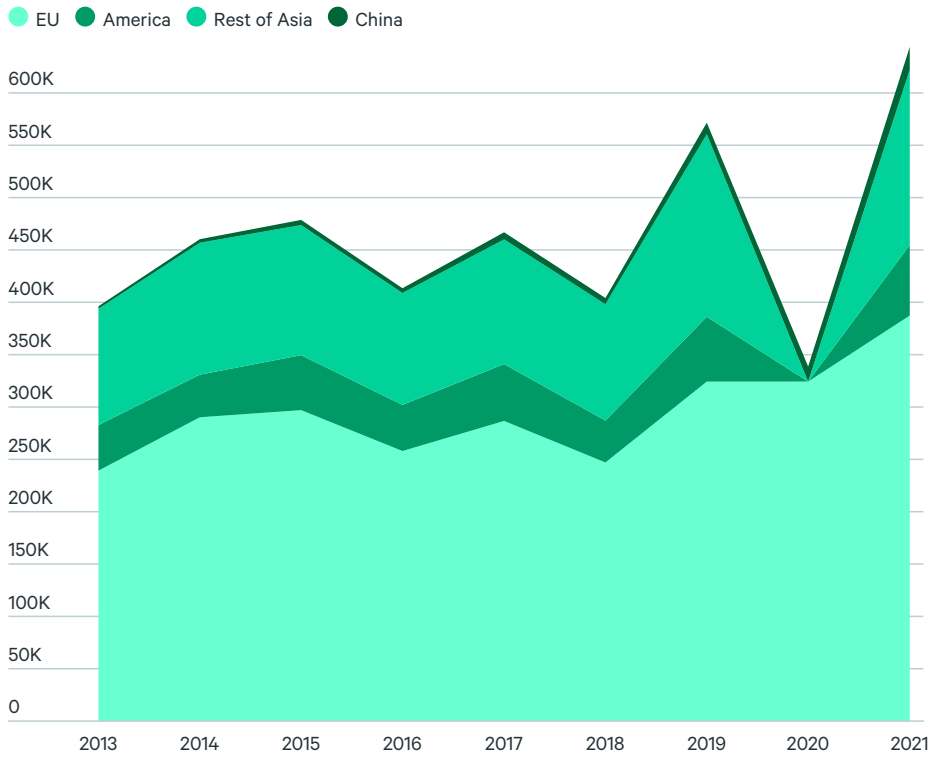
Figure 5: Total coffee production in the EAC 2013-2022



Source (FAOSTAT, 2023; EAC, 2024)

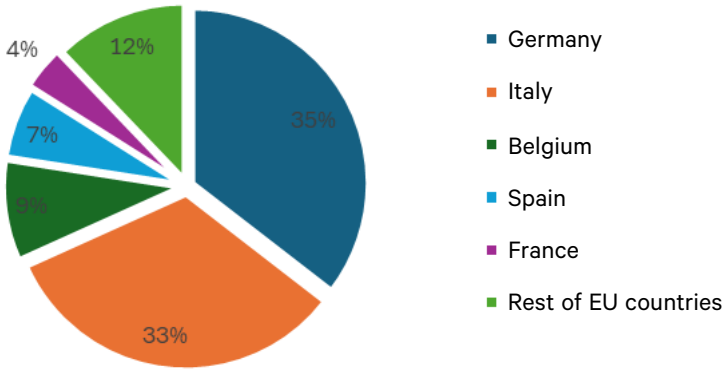
In 2021, the EU accounted for 60.1% of the EAC's total export, followed by Asia and the Americas at 20.4% and 10.5% , respectively (see Figure 6). Germany (35%) and Italy (33%) were the major importers within the EU, followed by Belgium (9%), Spain (7%) and France (4%) (FAOSTAT, 2023) (see Figure 7). As for export volumes, Uganda and Ethiopia top the list, followed by Tanzania, Kenya, Rwanda and Burundi (see Figure 8).

Figure 6. Major importers of EAC coffee from 2013-2021



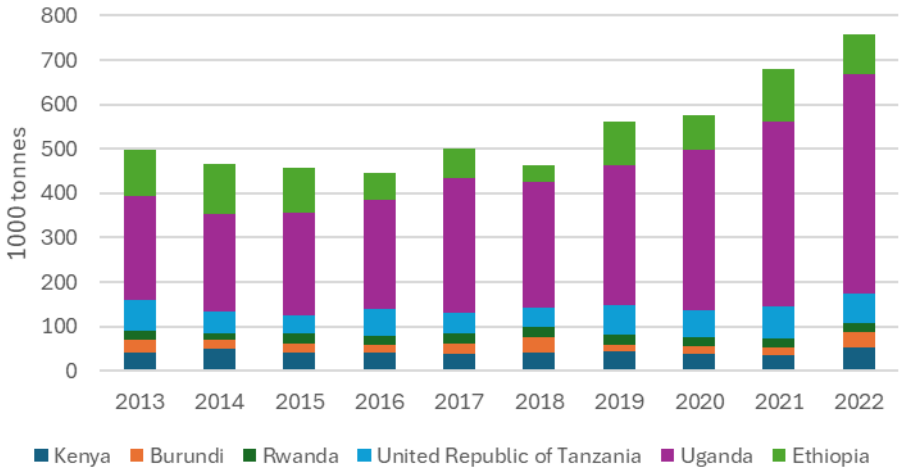
Source: Based on FAOSTATS (2023)

Figure 7. Top five EU countries importing EAC-produced coffee, 2021



Source: FAOSTATS, 2024

Figure 8: Total green coffee production for export from EAC to the EU from 2013–2021

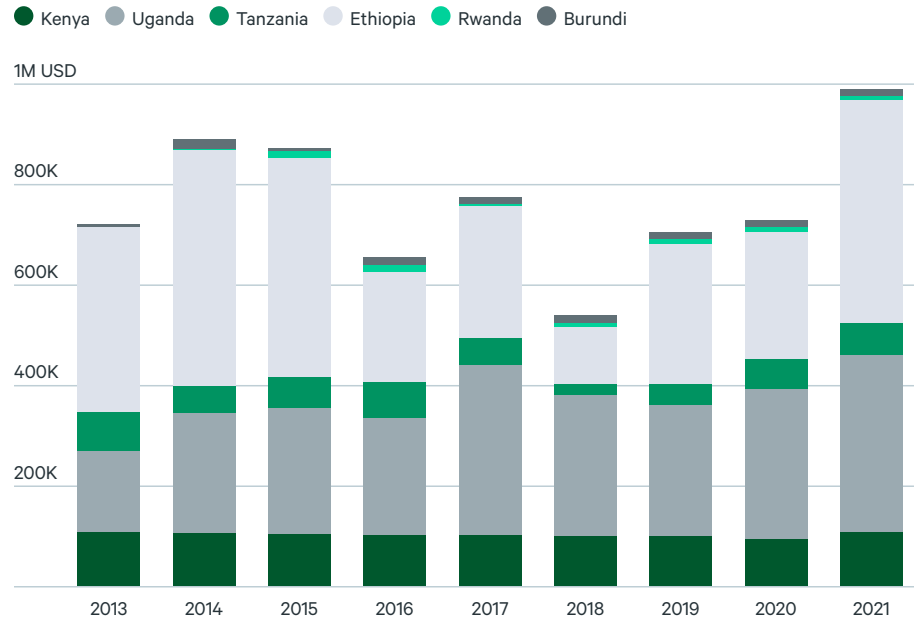


Source: Based on FAOSTAT (2023) and EAC (2024)

EAC green coffee export value to the EU

The value of coffee exports from the EAC to the EU is also noteworthy; ;in 2022, the total value of these exports was estimated at around EUR 1.1 billion (The Citizen, 2023). Similar to production, the total value of coffee export from the EAC to the EU decreased from USD 775 125 in 2017 to about USD 540 849 in 2018 before increasing to USD 988 683 in 2021; with Ethiopia and Uganda dominating the market share (see Figure 9).

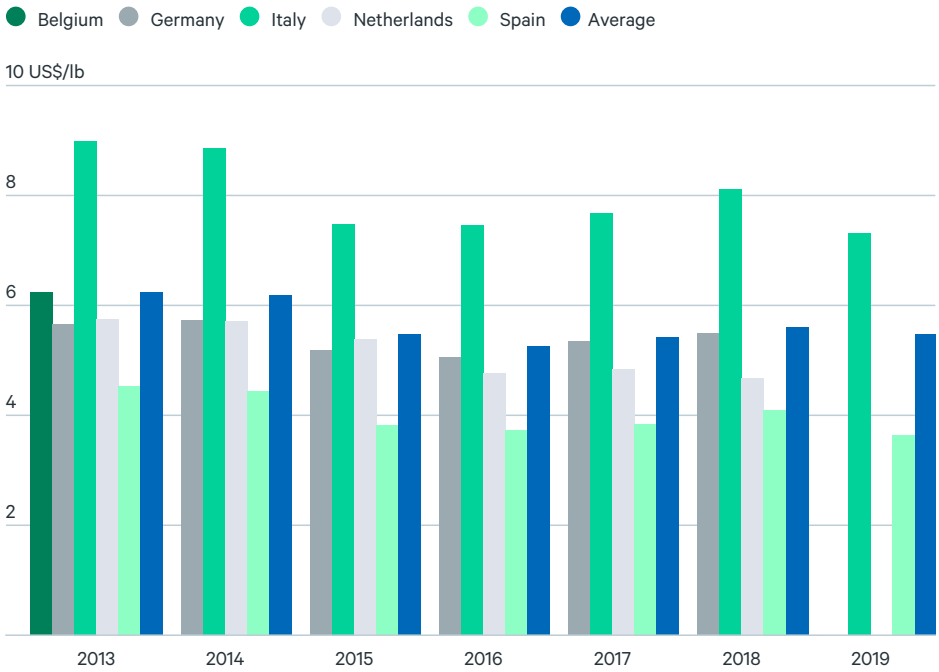
Figure 9: Green coffee export value from the EAC to the EU from 2013–2021



Source: Based on FAOSTAT (2023)

The average retail prices of roasted coffee in the EU decreased from USD 6.2 per pound (lb) in 2014 to about USD 5.3/lb in 2016 before increasing to USD 5.6/lb in 2018 (see Figure 10).

Figure 10. Retail prices of roasted coffee in selected EU countries from 2013-2019

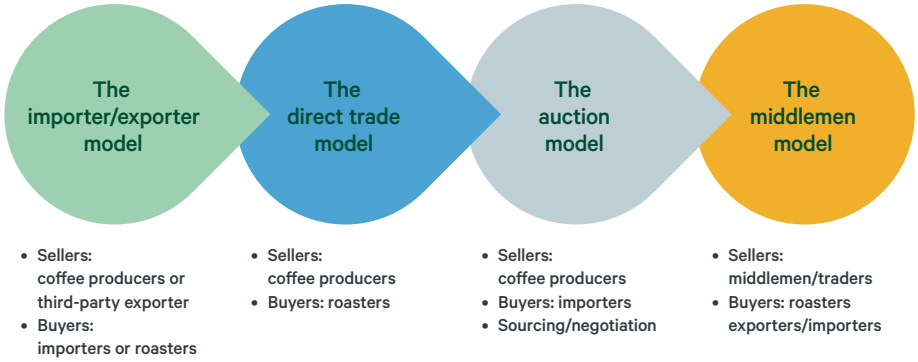


Source: Based on ICO (2023)

East Africa coffee business models and EU market access requirements

Coffee trading in East Africa is broad and complex, and business models generally vary from country to country (see Figure 11). The direct trade model is more prevalent than the other trading systems. Centralized auctions are the primary trading models for East African coffee in Kenya, Burundi, and Tanzania. Uganda is the only East African country where all sales are undertaken directly between individuals or cooperatives and the buyers at negotiated prices.

Figure 11: Different business models practiced in the EAC within the coffee market



Source: (Sitati, 2024)

Access to the EU market requires coffee producers and exporters to comply with EU regulations, social responsibility certifications and phytosanitary requirements (see Table). These requirements are captured in EU legislation as well as trade and customs policies.

Among the recent EU regulations and policies that are relevant to EU market access for EAC coffee are:

1. The Deforestation Regulation, which requires importers of cattle, cocoa, coffee, oil palm, rubber, soya and wood to ensure that the supply chain does not contribute to deforestation or forest degradation (Regulation (EU) 2023/1115, 2023).

2. The Corporate Sustainability Due Diligence Directive, which requires large companies operating in the EU (that meet certain conditions related to numbers of employees and turnover) to identify, prevent, mitigate and account for their adverse human rights and environmental impacts (Procedure 2022/0051/COD, 2022). This proposed directive received provisional agreement of EU institutions on 14 December 2023 but is still the subject of negotiation. The Corporate Sustainability Due Diligence Directive, which requires large companies operating in the EU (that meet certain conditions related to numbers of employees and turnover) to identify, prevent, mitigate and account for their adverse human rights and environmental impacts (Procedure 2022/0051/COD, 2022). This proposed directive received provisional agreement of EU institutions on 14 December 2023 but is still the subject of negotiation.

3. The EU-Kenya Economic Partnership Agreement, signed by the parties on 18 December 2023, which is among a new generation of EU free trade agreements with trade and sustainability chapters that include specific requirements on climate change and agriculture, as well as the elimination of forced and child labour.

Table: Coffee market access requirements into the EU

Market access requirements	Description
Quality	Value specialty and high-quality coffee beans with unique characteristics
Traceability	Important; often seek traceability and transparency in the coffee value chain
Packaging and branding	Prefer clear and informative labelling that includes relevant product information
Certification	Very important; demonstrate adherence to ethical and environmental standards
Market trends	Closely follow market trends, including preferences for single-origin coffees, specialty blends, and ethical sourcing
Social responsibility	Address human rights and environmental standards within coffee value chains and sustainability certifications such as Fairtrade, Organic, Rainforest Alliance/UTZ and 4C.
Sustainable	Prevent global biodiversity loss (EU Regulation on deforestation-free products)
Packaging	Use high-barrier packaging and vacuum-packing for exclusive specialty coffees to preserve the green coffee quality.
Labelling	Label coffee to ensure product identification and traceability.
Phytosanitary requirements	**Description**
Pesticides	Maximum residue levels (MRLs) Zero (Regulation EC 396/2005)
Mycotoxins/mold	No specific limit for Ochratoxin A (OTA) for green coffee beans. The maximum OTA level for roasted and ground coffee is lowered to 3 µg/kg, and for instant coffee, it is 5 µg/kg (Regulation (EU) 2022/1370)
Pathogens: Salmonella	No microbiological standards are prescribed as coffee beans are at low risk for salmonella infection because roasting kills germs
Extraction solvents	Restrictions on maximum residue limits for extraction solvents, including methyl acetate (with a limit of 20 mg/kg in coffee), dichloromethane (with a limit of 2 mg/kg in roasted coffee), and methylethylketone (with a limit of 20 mg/kg in coffee) (European Union Directive 2009/32/EC)
Hydrocarbons	No official maximum levels for Mineral Oil Aromatic Hydrocarbons (MOAHs)
Acrylamide	The benchmark level for roasted coffee is 400 µg/kg (Commission Regulation (EU) 2017/2158)
Sensory requirement	Rating of 50 to 100 for flavour, fragrance/aroma, aftertaste, acidity, body, uniformity, balance, cleanliness, sweetness, and off-notes
Other safety requirements	Some coffee buyers require exporters to comply with ISO 9001 or ISO 22000 or hazard analysis and critical control points (HACCP) principles

Source: CBI (2022)

Constraints and enablers for implementation of climate-smart production

Despite the benefits of CSA such as improved coffee yields, mitigation of greenhouse gases, adaptation and resilience to climatic stressors, implementation of these practices in the EAC has been limited. The slow uptake is due to a variety of factors including, land tenure issues; inadequate knowledge and capacity; fragmented croplands; high CSA implementation costs; limited access to finance; slow return on investments; inadequate extension support to smallholder farmers; lack of access to climate information services; as well as insufficient policy and institutional support (Zerssa et al., 2021).

Increased access to finance and insurance from the financial sector, government extension support and secure land tenure, research and development partners' technological innovation, and new ways of organizing labour are critical for scaling up CSA practices in the region (Diro et al., 2022).

Market opportunities for sustainably produced coffee from EAC

In the European coffee market, consumers and industry participants are placing a growing emphasis on sustainability and demand certification from importers, roasters and merchants as a measure of sustainability adherence (CBI, 2021). Notably, countries such as Germany, France, the UK, the Netherlands, Switzerland, Denmark and Sweden emerge as focal points for certified coffee consumption, reflecting a growing appetite for sustainably sourced products among discerning European consumers (CBI, 2021).

Within this context, CSA emerges as a pivotal enabler of sustainability, offering a multifaceted approach that not only enhances product quality but also aligns with prevailing sustainability standards. By implementing CSA principles, coffee producers can improve soil health, optimize water management and reduce reliance on chemical inputs, resulting in higher-quality coffee beans with minimal environmental impact and increased access to export markets.

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