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ABSTRACT

Access to finance is crucial for achieving sustainability goals, especially for poor and developing countries in the global south. However, traditional financial instruments often fall short to support the desired goals. This study explores the potential of a new modality of financing that integrates social, environmental, and economic criteria tailored to the sustainable supply chain finance. We illustrate the case of smallholder coffee farmers in Uganda with very limited collateral; to show how *sustainable supply chain financial instruments* can help to achieve sustainable goals whilst ensuring fair compensation for farmers and economically viable product for the money lender. Enhancing the welfare of smallholder coffee farmers can significantly strengthen their resilience, allow them to produce in a more environmentally sustainable way and contribute to their broader economic stability. In turn, it would reduce the financial risk to lenders and promote social equity to the benefit of the broader society. The study also explores the partnerships among government, NGOs, and private sector actors in creating supportive ecosystems for sustainable supply chain financing. The analysis underscores the importance of aligning financial incentives with long-term societal goals, advocating for a holistic approach that bridges the gap between profit and purpose.

Keywords: Sustainable Supply Chain Finance, financial innovation, coffee value chain, coffee farmers, farmers associations, small holder farmers

JEL Classification: Q14, O13, G23, L81, Q56.

1. Introduction

In the 2030 UN Agenda for Sustainable Development (UN, 2015), member States express their commitment to protect the planet from degradation and take urgent action on climate change. The agenda also identifies climate change as "one of the greatest challenges of our time" and its adverse impacts can undermine the ability of all countries to achieve sustainable development (Cho,R. ,2015). The poor and developing countries are among those most adversely affected and least able to cope with the anticipated shocks to their social, economic and environmental systems (Bizikova.L, et al, 2007).

Access to finance for all is one of the drivers to achieve the sustainability goals, especially for the poorest economies (Stern and Stiglits, 2023, Nordhaus, 2019, Stern et al 2022). However, in an era marked by economic volatility, environmental challenges, and social inequality, financial sources can be limited and traditional financial instruments often fall short in promoting sustainable growth and welfare (UN, 2022). Integrating environmental, social and governance (ESG) considerations into the finance decision induces greater longer-term investments into sustainable economic activities and projects. While supporting economic growth, they can reduce pressures on the environment by addressing social inequities and ensuring long-term sustainability (Bukreeva and Grishunin 2023, Huang, and Huang 2023, Ozili 2021, Popescu and Popescu 2019, Schoenmaker and Schramade 2019).

Sustainable financing represents a transformative shift in the way financial services are designed. Sustainable finance, is not merely an ethical choice; it's a pragmatic response to the global challenges posed by climate change, resource depletion and social disparities (Edmans and Kacperczyk 2022). The quest for sustainable growth and welfare in developing economies, necessitates not only of financial resources but also the creation of innovative sustainable financial instruments tailored to the unique challenges faced by the vulnerable sectors (Banerjee and Duflo, 2012).

Sustainable finance mechanisms tailored to smallholder farmers in developing countries is rather overlooked or underestimated as a key driver to spur economic and social growth in the agriculture supply chains. This

study contributes to the call for innovative financial tools by examining the case of smallholder farmers in the coffee supply chain in Uganda, the unique challenges they face and how financial institutions can mitigate those challenges by developing low risk sustainable supply chain finance tools (SSCF) to foster sustainable growth, resilience and promoting inclusive development in Uganda and similar contexts globally

By taking a bottom-up approach to the design of a new financial instrument, this study integrates sustainability into its core design to foster economic growth but also prioritises environmental stewardship, farmers' welfare and social equity. The design highlights how the novel structure of an ESG linked financial instrument can bridge the gap between traditional financing methods and sustainability while driving financial inclusion for the lesser supply chain players

The focus of this study is on Uganda's small holder coffee farmer. Uganda is Africa's second largest coffee producing country, after Ethiopia (Mwesigye and Nguyen, 2020) and coffee is a major contributor to its agricultural sector (Baffes 2006, NARO 2022, Jassogne et al. 2013). The annual production of coffee supports over 3.5 million families at all levels of the coffee value chain and contributes to between 20 – 30% of foreign exchange earnings. Its 1.7 million smallholder coffee farmers comprise 85 percent of Uganda's coffee industry, representing 10% of global coffee farms with a mean plot size of less than 1 acre (Bukomeko et al. 2017).

Smallholder farmers often struggle with access to capital, market volatility, and environmental pressures. Access to finance remains a major impediment to their productivity and the transformative potential of the sector (MoFPED, 2021). Because of their weak position in the supply chain, they tend to be cash-constrained or have problems obtaining loans from banks at affordable interest rates, which hampers their ability to enhance their operations to adopt sustainable operating methods (Tseng et al., 2021). The lower level of supplier sustainability engagement can severely affect the efficiency and sustainability of the entire supply chain, undermining its competitiveness.

Given the predominantly informal nature of smallholder farming and its heavy reliance on rudimentary agronomical practices, formal financial institutions are hesitant to advance credit to them (Karugonjo et al., 2024). The potential return on investment from smallholder farmers is very low,

considering the informal and small nature of their farm production units. Their production levels are highly unpredictable and susceptible to adverse weather patterns and fluctuating market prices. Combined, these factors make the financing of smallholder farmers risky for commercial banks and barely profitable.

Studies such as Baffes (2006) and Wang et al. (2015) have attributed the heightened credit risk profile of the smallholder farmers to the lack of incentives to improve the quality of their coffee. Additionally, Mwesigye and Nguyen (2020) emphasise that poverty and vulnerability to financial shocks create pressure to produce coffee as quickly as possible, including harvesting coffee cherries before they are ripe to access cash or pay back expensive loans. Therefore, smallholder farmers are faced with the dilemma of prioritising access to quick cash at unfavourable prices and poor farming methods over investing time and resources to produce high-quality coffee. In some cases, extremely limited access to affordable credit has led to smallholder farmers opting for faster and less capital-intensive farming methods with over-reliance on chemicals and cutting down shade trees to maximise arable land.

The unfavourable returns without access to credit ultimately culminate into stagnation and degrowth of the smallholder farmers who may become a threat to the sustainable economic growth of Uganda's economy and indeed the global coffee supplies as the farmers shift to other crops (NPA, 2021), not forgetting the looming risk of the smallholder farmers abandoning farming and seeking more promising livelihoods outside Agriculture and coffee farming all together (Giller et al., 2021).

In this paper, we first present an in depth analysis of the context in which farmers and financial institutions operate and we use it illustrate how sustainable (micro) finance can be developed to support smallholder producers with limited or no collateral to transition to sustainable farming practices, acting as a catalyst to accessing financing instruments modelled to leverage the credit worthiness of the other coffee supply chain players for whom the financial institutions have risk appetite. By examining this case study and emerging trends in sustainable finance, this study also investigates the potential of social impact investing, and blended finance mechanisms to support the local farmers within the supply chain ecosystem. By taking both the investor, the buyer and the farmer

perspective, we propose a new modality of designing finance that integrates social, environmental, and economic criteria, facilitating investment in sustainable farming practices while ensuring fair compensation and increased farm acreage for farmers. By leveraging mechanisms such as impact investments and microfinance, reverse factoring and risk distribution mechanisms (achieved in partnership with development finance organisation, export credit agencies and large corporate coffee exporting companies) to mitigate the credit risk impact on Commercial Finance institutions, the new model aims to enhance productivity, improve livelihoods, and foster resilience of the coffee sector against climate change.

This paper also discusses the role of partnerships among government, NGOs, and private sector actors in creating supportive ecosystems for sustainable supply chain financing. Ultimately, we argue that by investing in sustainable supply chain financial instruments, stakeholders can not only enhance the welfare of smallholder coffee farmers, but also strengthen their resilience, and contribute to broader economic stability and environmental sustainability in Uganda. These contributions are essential for fostering sustainable growth and resilience in commodity supply chains like coffee and promoting inclusive development in Uganda and similar contexts globally. We further offer recommendations for actions that Commercial banks and development financial institutions can take to facilitate this process with minimal risk to their portfolios while having a sustainable impact on the overall smallholder farmers.

Overall our analysis aims to deepen the understanding of sustainable supply chain financeand the opportunities that it creates sustainable supply chain and underscores the importance of aligning financial incentives with long-term societal goals. We advocate for a holistic approach to the design of sustainable finance tools that bridges the gap between profit and purpose, shining more light on the relationship between finance, equitable growth and the environment. Our ultimate aim is to provide policymakers, investors, and stakeholders with a roadmap to co-create financial solutions that ensure resilient economies while safeguarding our planet for future generations.

2. Relevance of Sustainable Finance to Smallholder farmers in the coffee sector in Uganda.

An estimated 1.7 million coffee smallholder farmers are at the forefront of Uganda's coffee production (Hoffman.V,2024). Supporting these farmers with the adoption of sustainable farming practices is critical for mitigating coffee production and safeguarding the entire supply chain from environmental degradation, and social vulnerabilities while promoting economic sustainability of the farmers (Salami et al. 2010). This requires both short and long-term finance tailored to the specificities of the business models behind these practices.

The coffee value chain, like other agricultural commodity value chains in Uganda, has limited access to finance. However, according to UCDA (2019), several attempts have been made to make financing available to the coffee value chain. Most of the funding to the coffee industry has majorly focused on productivity enhancement, quality improvement, establishment of value addition centres (Wang.N etal, 2015).

The annual Bank of Uganda report BOU (2024) confers that the uptake of credit by smallholder farmers is hampered by the high interest rates (20-26%) on credit offered by commercial banks to them, while Microfinance Deposit-taking Institutions (MDIs) charge in the region of 30 percent per annum. These rates compared to the 15%-18% charged to the larger enterprises are too high and make the farming venture to be unprofitable (BOU,2024).

According to Weber, R. & Musshoff, O. (2013) the high interest rates charged by the Financial institutions are mainly due to the risky profile of the smallholder farmers in general. For the case of the smallholder coffee farmers in Uganda, even when financing may be available, many of them are not able to qualify for the financing due to lack of adequate collateral, poor financial management methods and uncertainty of adequate cash flow among others (Wright, G. A.etal, 1999). Additionally, the lack financial and production data to analyse the credit worthiness of the coffee smallholder farmers has been a challenge for financial institutions to develop financial products suitable for the smallholder farmers.

Most organisations with supply chains (SC), encounter sustainability challenges in their SCs which can be considered as risks and potential

opportunities considering the incessant need to reduce scope 3 emissions within their supply chains. Therefore, developing and implementing a sustainability program within their SCs has become a common practice for organisations to manage the environmental, social, and economic issues within their SC (Carter, C.R., & Easton, P.L., (2011).

Although the research on sustainable SC has flourished over the past decades, environmental and social issues remain, and there is a call for innovative credit financing models in partnership with sustainability standards certification bodies like Fair Trade and Rain Forest Alliance with consideration of incentives for SC participants to promote sustainable SCs considering the financial barriers recognised as obstacles that hinder suppliers' willingness and enthusiasm to engage in sustainable methods of production (Zhan, J., Li, S., Chen, X.,2018).

This is particularly true for individual suppliers or small and medium enterprise (SME) suppliers and in the context of this study, the small holder coffee farmers in the wider coffee supply chain, because of their weak position in the SC, such suppliers tend to be cash constrained or have problems obtaining loans from banks at affordable interest rates which hampers their ability to enhance their operations to adopt sustainable operating methods. (Tseng et al,2021). From a buyer's perspective, a lower level of supplier sustainability engagement can severely affect the efficiency and sustainability of the entire SC.

Despite Uganda's undercapitalised smallholder financing, a growing number of collaborative partnerships between Commercial banks, development financiers and Micro Finance Institutions are testing new ways of catalysing capital flow to smallholders (BOU,2024). These partnerships, in combination with digital agricultural solutions, are unlocking new service delivery models, strengthening the business case for investments in sustainable agriculture, and providing an opportunity for innovative credit financing models aimed at achieving environmental, economic, and social goals tailored to the specific needs and context of the local stakeholders. This process requires financial institutions to take a design approach tailored not only to the instrument but also to the context in which the financial instrument is going to be used. Our design approach is based on three steps: i. **understand** the context; ii. **identify challenges and opportunities** based on current practices; iii. **propose financial**

solutions that address the weaknesses and embed the principle of environmental, economic and social sustainability principles. The next sections illustrate via an in-depth case study how the design approach was implemented by first gaining a nuance understanding of the operations and the needs of the small coffee farmers and the supply chain. Secondly, by exploring the challenges, opportunities of existing models of sustainable supply chain finance used by NUCAFE one of the main local farmers organizations. Thirdly, proposing solutions for enhancing the effectiveness of SSCF using principal agent modelling by assessing the extent to which it increases the Financial Institution's risk appetite for small holders and how that risk can be mitigated. Lastly, provide recommendations for effective SSCF that promote sustainable growth, positive environmental and social outcomes for the coffee smallholder farmers in Uganda further contributing to the body of knowledge in the area of SSCF for smallholder farmers in Agriculture value chains in emerging economies.

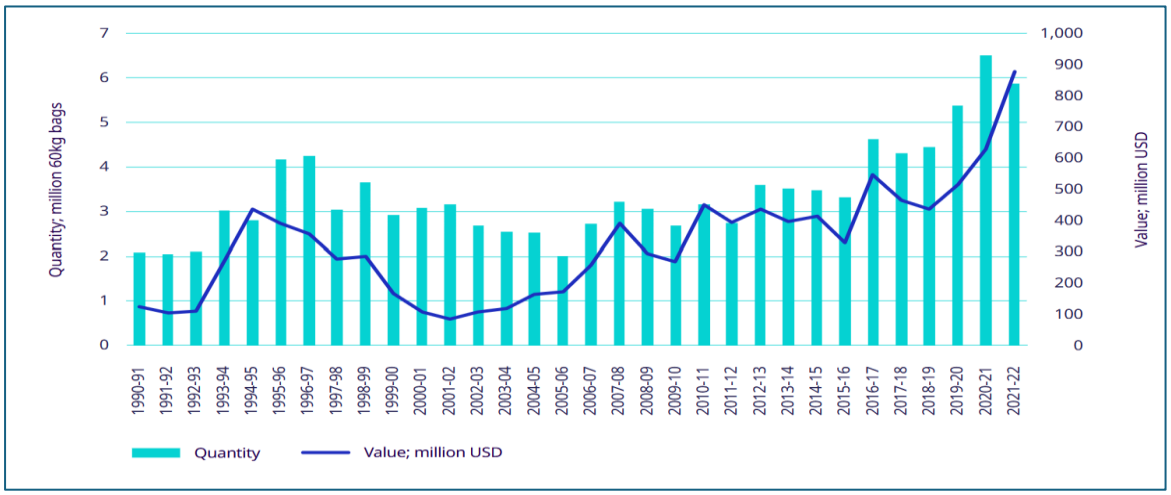
3. Understanding the context: coffee growing in Uganda

3.1. The coffee value chain

Uganda, the Pearl of Africa, has always been one of the most favourable countries for coffee cultivation. It has rich and fertile lands, volcanic soils in the east and west, mild temperatures between 20 °-30 ° and two rainy seasons that make coffee crops grow abundantly (Uganda, NDP 2020).

Uganda is the second coffee producer behind Ethiopia. As illustrated in Figure 1, the volume and the value of the coffee produced have been increasing steadily over time. A total of 743,517 60-kilo bags of coffee valued at US$ 121.64 million were exported in the year 2022-2023, the highest amount in 30 years.. According to the Uganda Coffee Development Authority (UCDA, 2023), the largest Ugandan coffee consuming country the period was Italy (30.27%) in second position was Sudan (22.11%) and German (11%). Thus, Europe is the main destination for Ugandan coffee with 41.27% of the production going to this continent.

Figure 1. ***Volume and value of coffee exports from Uganda 1990-2022***



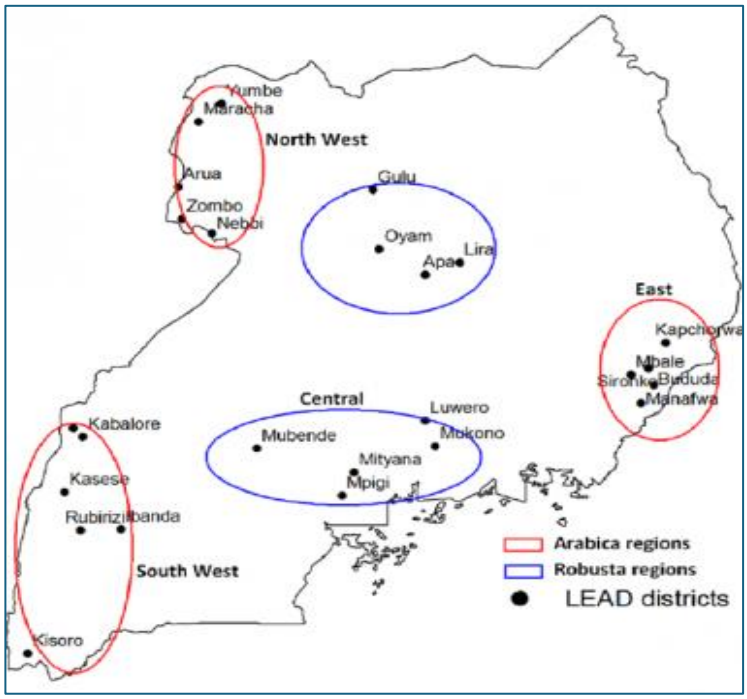
Source: UCDA (2023)

According to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF, 2023) the main challenges faced by Smallholder Coffee Farmers are threefold: access to finance, market power imbalances and limited knowledge and infrastructure. Many smallholder farmers in Uganda lack access to affordable credit and financing, which limits their ability to invest in better farming practices, inputs, or infrastructure. Traditional financing models are often inaccessible due to collateral requirements and high-interest rates. They also have little market power. Coffee buyers, often large exporters or multinational companies, hold significant leverage in determining prices. Smallholders are price takers with limited negotiation power. Lastly, farmers often have limited knowledge as they lack access to information on best farming practices, new market opportunities, and sustainable techniques that can enhance productivity and profitability.

Coffee is produced across most districts in Uganda, with 126 out of 135 districts producing coffee (UCDA,2023). Coffee production is concentrated in the Central, Western and Eastern regions, with minor production in the South-Western and Northern regions (see figure 2 below).

Robusta coffee, accounting for more than 80 per cent of Uganda's coffee crop, is grown in the low altitude areas of Central, Eastern, Western and South eastern Uganda up to 1,200 metres above sea level. Arabica coffee on the other hand is grown in the highland areas on the slopes of Mount Elgon, in the East and Mount Rwenzori and Mount Muhabura in the South-Western Region (1,500–2,300 m above sea level) (ICO,2019).

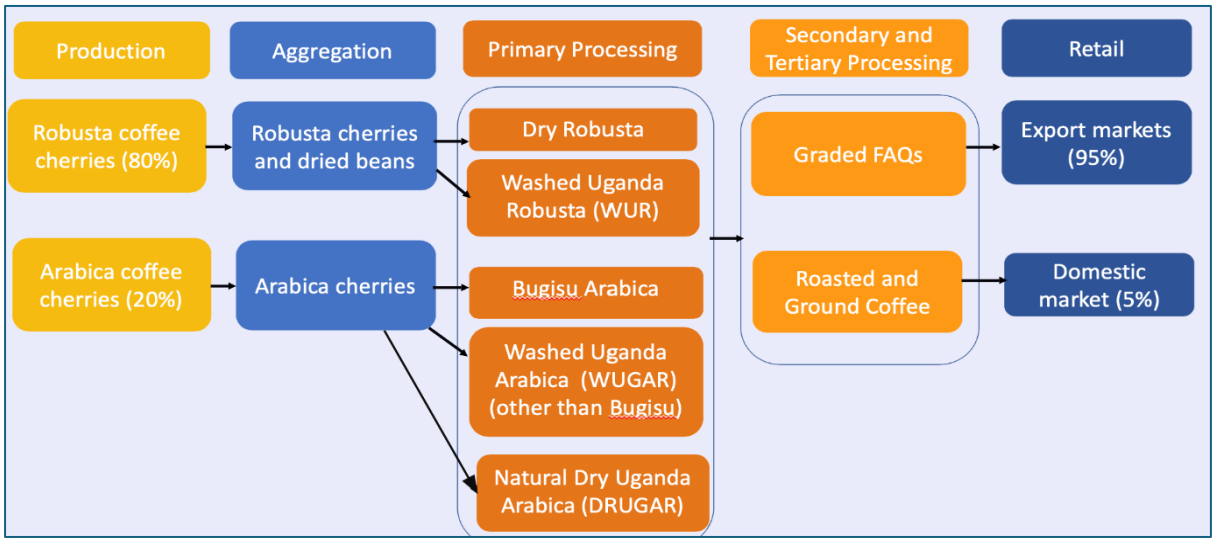
Figure 2: Map of coffee-growing regions



Source: ICO (2019)

Figure 3 below depicts the flow of coffee from production to consumption. It is estimated that about 85 percent of coffee producers in Uganda have intercropped small farms, ranging in size from well under 0.5 ha to 2 ha. These smallholder coffee growers normally use family labour, although hired labour is occasionally used for activities such as harvesting (Mugoya,T. ,2018).

Figure 3: Coffee Value chain map for Uganda.



Source : Mugoya (2018.)

Production

Most coffee is grown by the 1.7–1.8 million smallholder farmers cultivating on small plots usually less than one acre in size and the typical coffee farming household comprised of six to eight members, with four adults and three to four children and is a multi-generational family residing together in a single homestead which is owned or leased by a senior family member (Fairtrade International, 2022)

Mwesigye and Nguyen (2020) report that eighty percent (80%) of the coffee grown in Uganda is Robusta coffee and it is grown in the low altitude areas -of about 1,200 meters above sea level- of Central, Eastern, Western and South Eastern Uganda. Arabica coffee on the other hand is grown in the highland areas on the slopes of Mt. Elgon in the East and Mt. Rwenzori and Mt. Muhavuura in the South Western region, with Kapchorwa, Mbale and Nebbi districts being the major districts where Arabica is grown (ICO, 2019). The production of Robusta coffee generates high obtainable product per area compared to Arabica and the costs of harvesting the Robusta coffee beans are considerably lower than that for Arabica. Additionally, robusta coffee has a high resistance to wilts and plant diseases. However, due to its high bitterness, it is less popular on the global market in parallel to arabica (Jassogne et al., 2013).

Aggregation

The Aggregation level has many players including farmer groups, and traders who link coffee producers mainly the smallholder farmers to both primary and secondary processors (Salami, A.,2010). The value chain actors at this level mainly buy red cherries and sometimes dried beans and sell to processors and some representatives of organised farmers' groups who aggregate and find markets on behalf the farmers.

There are several arrangements under which aggregators buy coffee from farmers. Some aggregators buy coffee in advance when coffee trees are at the flowering stage. This practice is common among the agents of big processors who do this to ensure coffee quality (Bukomeko et al. 2017). Other aggregators buy red cherries either in the garden, or after harvest, but before drying. This is common in Arabica growing communities. Bukomeko et al. (2017) further identify the other category of aggregators as the one that buys dried beans from farmers, most commonly in Robusta

growing communities. Implying that farmers manage their gardens up to harvest and practice preliminary on-farm processing to transform cherries into dried beans, which are then sold to aggregators.

The last category of aggregators buys Fair Average Quality (FAQ) coffee from farmers. Under this arrangement, farmers harvest and pay for primary processing services, such as pulping for Arabica coffee or hulling for Robusta coffee. Of all these arrangements, aggregation of red cherries is the most common in Arabica growing communities, while aggregation of dried beans is the most common in Robusta growing communities.

Processing

At processing level, there are both primary and secondary/tertiary processors.

In primary processing, coffee is normally either pre-processed directly by producer groups or cooperatives, immediately upon harvest, or is outsourced by local traders to various processing units in the country. Sorting of coffee beans by quality (into different lots for marketing purposes) also occurs at this stage. There are two main ways in which coffee can be first processed: wet processing and dry processing. Wet processing is mainly used for Arabica coffee, but some washed Robusta varieties are also traded. These "washing stations" remove the outside pieces of the coffee cherry and wash the coffee to receive clean wet parchment. Subsequently the parchment coffee is dried and later hulled and sorted into different sizes (grading). Dry processing is commonly used for Robusta coffee. It involves drying and hulling which results in clean dry coffee beans referred to as fair average quality (FAQ). In the dry processing stations coffee cherries are spread out to dry and frequently stirred by attendants. Drying is complete when the dried cherries (kiboko) have attained moisture content of 13–14 per cent. After the coffee is dried, it is hulled, where all outer layers of the coffee bean are removed, leaving green FAQ coffee.

In 2023 Uganda had 537 dry processing stations, 912 hulling stations, 20 wet processing stations handling mostly Arabica and these were mainly operated by farmer groups along with 22 washing stations ie primary processing facilities (UCDA 2023). Moreover, there were 36 exporting

grading plants for secondary processing and 88 registered exporters and 17 roasters for tertiary processing (MAAIF, 2023).

Retailing

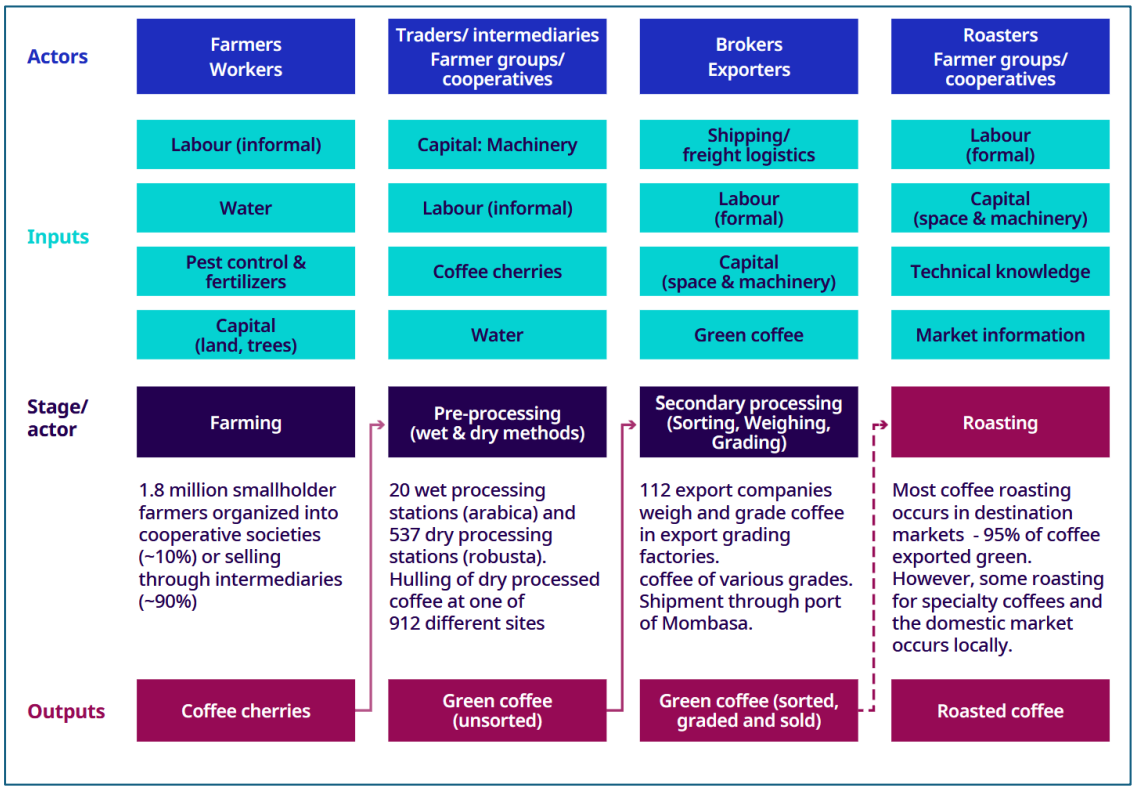
Only 5% of the domestic production is for the internal market. Exporting traders are in charge of retailing the remaining 95% of product for final consumption overseas.

Exporters buy green coffee from cooperatives and traders, inspect and sort coffee to ensure that requirements related to size/uniformity, quality (including moisture content, absence of defects, flavour and colour characteristics) are met to the standards of the buyers and import regulators. These sorting activities occur in warehouses located throughout the country. Additionally, exporters arrange the transportation of coffee from Uganda to the buyers' destination countries. This involves coordinating logistics, handling customs and regulatory requirements, and managing the shipping process to ensure that the product reaches its destinations on time and in good condition. For international destinations, shipping normally occurs by road to the port of Mombasa, Kenya and then to destination countries by sea freight.

3.2. The coffee supply chain key actors

Besides the farmers involved in the production various actors have an active role in the coffee supply chain. They are illustrated by stage of value creation in Figure 4. At the aggregation and processing level players such as farmer groups link the smallholder farmers to both primary and secondary processors (Salami, A.,2010) involved in rosting and exporting coffee. This is because secondary processors typically do not hold the required logistical capacity to source directly from farmers. This is where **cooperatives and farmer groups** play the critical role of intermediating between the producers, mainly the small holder farmers, the processors and the Exporters/Traders. They represent organised coffee farmers' groups who aggregate and find markets on behalf the farmers.

Figure 4: Mapping the coffee supply chain actors



Source: International Labour Organisation (ILO, 2024)

Farmers associations increase the capacity of small holder farmers to compete favourably with the larger coffee growers is very low considering the many hardships that they face. Their lack of bargaining power is reflected also in their lack of access to finance further impeding their ability to undertake key initiatives that would help them to compete favourably. These include the expansion of farm size which would in turn increase their coffee production. On their own, many small holder farmers don't have adequate access to markets, inputs, finance and information, but when they come together to form farmers organizations, that's when they find strength in numbers (IFAD, 2023). Schmidt (2017) describes farmer organisations as autonomous membership-based organizations of small holder rural producers, including cooperatives and unions. From grassroots to global movements, they all share one common goal which is to further their members' interests by giving them a voice. Crucially, as part of a collective, smallholder farmers can do things that would otherwise be prohibitively expensive, laborious or time-consuming. Access to financing being the biggest benefit.

4. The paradigm shift of Agricultural Financing in Uganda

A variety of sustainable agricultural financial instruments support farming in Uganda. One of them is the Impact Investments Fund, where investors including international development organizations, NGOs, and private investors, have increasingly shown interest in investing in sustainable agricultural practices. These funds typically focus on long-term social and environmental impact, alongside financial returns. For coffee smallholders in Uganda, these investments often focus on *Capacity Building* directing Funding towards training farmers in sustainable farming practices and business skills, or for '*Infrastructure Development*' whereby the Investments are used for establishing rural infrastructure like warehouses, roads, or processing facilities that are crucial for accessing markets or '*financing for inputs'* where funds provide smallholders with access to low-interest loans or grants for inputs such as fertilizers, seeds, or equipment. An alternative are blended finance mechanisms that combine concessional finance (typically from development finance institutions or philanthropies) with private capital. The concessional capital absorbs some of the risks for private investors, which helps attract more private financing. This mechanism is particularly useful in agriculture where the risk is high, and financing costs are often prohibitive. An alternative model is the Cooperative Financing Model. In Uganda, farmer cooperatives play a crucial role in facilitating access to financing for smallholders. Cooperatives aggregate smallholder outputs, which makes it easier to access finance and negotiate better terms with buyers. Funding for cooperatives might come from Social Impact Bonds or Revolving funds from Rural Development banks like Post Bank Uganda and Centenary Rural Development bank. Development Financial Institutions like Agriculture Business Initiative (ABI Finance). According to the former, private investors fund social programs with returns tied to measurable outcomes (e.g., improvements in farmer yields or incomes). If these outcomes are achieved, the investors receive a return; Revolving Funds, on the other hand are created from initial investments and replenished through loans and repayments. This model enables ongoing financing for farmers without requiring constant capital infusion.

The above models although valid in their own right, tend to focus on the farmer or the cooperative. However, the landscape of financing Agriculture

in Uganda is undergoing a paradigm shift, driven by the evolving supply chain pressures that require financiers to innovate beyond traditional lending models that viewed each actor of the value chain as a standalone, whether a farmer of a cooperative.

At the heart of this transformation is the understanding that financing agriculture is about creating a holistic ecosystem of **financial support, risk management, and sustainable development** for all the value chain participants including input suppliers, producers, aggregators, traders, processors, distribution and marketing (Hoffman, V. ,2024). This mechanism ensures continuous financial support throughout the agricultural cycle, dramatically reducing supply chain shocks, risks and increasing potential for sustainability of the value chain and sustainable growth for all the value chain actors.

Risk management is the bedrock of the new financing paradigm in the Agriculture value chain in Uganda. According to Karugonjo et al. (2024) the agricultural sector in Uganda is inherently unpredictable, burdened with weather uncertainties, market fluctuations, and production challenges.

The solution lies in strategic partnerships that distribute and mitigate these risks including Export Credit Agencies (ECAs) like UKEF, Development Finance Institutions (DFIs) like African Development Bank (ADB)Insurance companies, government programs like the Agricultural Credit Finance (ACF) program under the Central Bank of Uganda, and specialized agricultural support organizations that cushion the credit risk for commercial banks to extend debt to the value chain actors.

Furthermore, **sustainability** has evolved to become a fundamental principle of modern agricultural financing. While the notion sustainable finance is still nascent in Uganda, Commercial lenders are now evaluating loans not just on financial metrics, but on their broader impact with environmental, social and governance considerations. Edmans, A. and Kacperczyk, M. (2022) asserts that job creation, and community development are now integral to lending decisions by most commercial lenders in Uganda. This approach recognizes that agricultural development is not just about financial returns, but about creating long-term, sustainable economic ecosystems and, crucially involving the main actors in the entire value chain, known as Sustainable supply chain financing.

Supply Chain Financing (SCF) or '*supplier finance' or 'reverse factoring'* is a financing solution in which suppliers can receive early payment on their invoices. Supply chain finance helps to optimize cash flows for both buyers and suppliers, creating more resilient supply chains, supporting business continuity, and fostering stronger supplier relationships. Additionally, SCF reduces the risk of supply chain disruption and enables both buyers and suppliers to optimize their working capital (Pfohl and Gomm, 2009).

Sustainable Supply Chain Financing (SSCF), is a financial tool facilitating transactions among interconnected entities within the supply chain, SSCF plays a pivotal role in advancing sustainability objectives with in supply chains by integrating financial institutions into these models, organisations can leverage financial expertise, resources, and networks to bolster sustainable practices throughout the supply chain (Bals, 2019, Klapper 2006).

Sustainable Supply Chain Finance represents a transformative shift in how financial services contribute to a greener, more equitable, and sustainable future of supply chains (Edmans and Kacperczyk, 2022). Unlike traditional supply chain finance, which often overlooks environmental and social impacts, sustainable supply chain finance integrates these considerations into financial decision-making. This approach emphasizes the need to support economic growth while reducing pressures on the environment, addressing social inequities, and ensuring long-term economic sustainability (Grishunin, et al 2023, Huang, Yu and Huang 2023, Ozili 2021, Raluca, Popescu, & Popescu. 2019 and Schoenmaker, and Schramade 2019). Schoenmaker, & Schramade (2018) further refer to Sustainable Supply Chain Finance as an overarching term referring to the investment process accounting for and promoting environmental, economic, social factors and crucially governance factors, hereafter referred to as ESEG, essential for aligning corporate behavior with long-term societal goals.

5. Identification of challenges and opportunities based on current practices

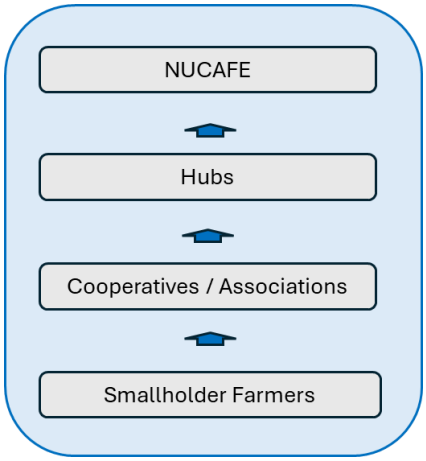
5.1. Sustainable Financing models: the case of NUCAFE

The primary objective of the study is to contribute to the call for innovative financial tools by examining the case of sustainable finance for smallholder coffee farmers in Uganda based on the Cooperative Financing Model and extend it to sustainable supply chain finance that embraces the broader value chain.

To gain a deeper understanding of the challenges and opportunities of sustainable supply chain finance we use grounded theory to carry out an in-depth exploration from multiple stakeholders perspectives based on current practices of sustainable supply chain finance in Uganda. To this purpose we focus on the National Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE). NUCAFE was founded in Uganda in 2003 whose members include 237 cooperatives representing over 250000 households and 1.5 million coffee farmers (NUCAFE, 2025). NUCAFE is a farmer-owned social enterprise that has empowers and organizes smallholder coffee farmers through the *Farmer Ownership Model* to assume more roles and functions within the coffee value chain for enhanced productivity, value addition, profitability and policy advocacy. With the Farmer Ownership Model, the farmers do not sell their product to the cooperative like is the case with other farmer group models (NUCAFE,2003). The farmers are therefore able to sell their product at higher stages of the value chain and subsequently receive higher prices. Farmers also benefit from fully transparent, well documented processes agreed upon prices.

On a structural level, the Farmer Ownership Model requires farmers to be organized in groups. At a village level, 20-35 farmers on average, 10-15 farmer groups form an association at the sub-county level and about 10-20 sub-counties in a district form a “hub” (see Figure 7 below)

Figure 5: Representation of the Farmer Ownership Model structure

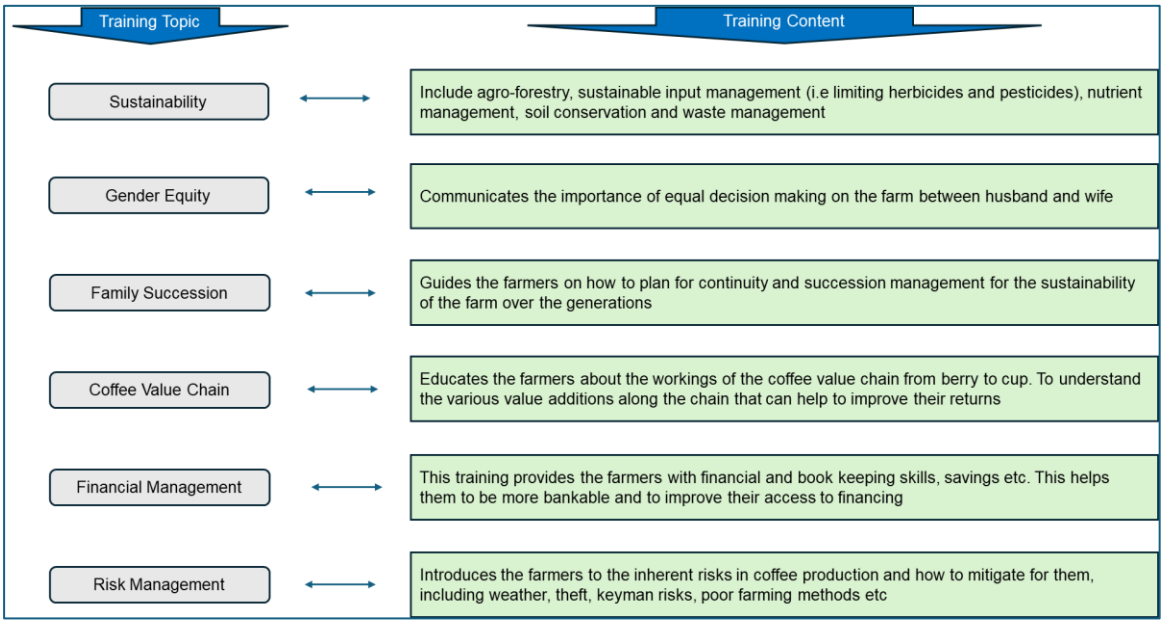


Source: NUCAFE (2003)

Individually, coffee farmers dry their coffee cherries, bulk their product with other farmers in the region, and deliver it to their cooperative. Some cooperatives have the capacity to conduct further processing such as milling, sorting, grading and even roasting at their hubs. Other cooperatives deliver the coffee to NUCAFE's centralized processing facility for secondary processing and exportation (UNDP 2024). While most of the coffee is sold at the stage before roasting, NUCAFE has options for roasting (see figure 5), adding value and selling under the NUCAFE and Omukago brand for the highest value. Along the process, coffee farmers maintain ownership of their product. They pay a monthly subscription fee to the cooperative for its services and transportation of coffee, and the cooperative pays an annual subscription fee to NUCAFE.

The Farmer Ownership Model seeks to transform the way coffee farmers approach coffee production creating opportunities for them to add value to their coffee and get a good price for their coffee without relinquishing ownership of the coffee to other value chain actors. Furthermore, through the Farmer Ownership Model NUCAFE can disseminate knowledge and skills to the farmers via ad hoc training which help farmers implement the key elements of sustainability. In doing so the farmer's production becomes sustainable and more credit worthy for commercial banking financing as illustrated in Figure 6.

Figure 6: The Farmer Ownership Model structure



Source: NUCAFE (2025)

To gain a deeper insight onto the challenges and limitations of the models of sustainable supply chain finance employed by NUCAFE a multiple stakeholders study has been conducted based a survey (questionnaire in the appendix), face to face interviews and focus groups with smallholder farmers members of NUCAFE, bank loan officers, senior management of NUCAFE, coffee exporters from Kyagalanyi Coffee (Volcafe) and field officers of Fairtade International and Rainforest sustainability standards schemes (more details are available upon request).

Based on our respondents from NUCAFE, we find that household income on farming homesteads is highly diversified owing to small plots of land and large family sizes. Most families have adopted mixed farming (cash and subsistence crops) and seek alternative income sources from employment like boda boda (motor cycle) riding to sustain the household. The average coffee plot size is 0.23ha indicating a very weak bargaining power and extremely limited ability to access credit to implement sustainable farming methods including Agro-forestry, use of organic fertilisers, acquisition of value addition equipment like hullers, cherry washing machines among other equipment, and skilling on general management of the farms to optimise their returns and financial management. Furthermore, feedback from the smallholder farmers that were interviewed in this study pointed to the fact that they are forced to

partition their already small plot plots further to create room for food crops for home consumption which further decreases their coffee production and in turn the return from the coffee business.

The limited access to credit of small farmers in the NUCAFE is in line with the findings of the Consultative Group to Assist the Poor national survey indicating that only 10% of smallholder farmers in Uganda have bank accounts implying that only 10% of the smallholder farmers can access formal lending (CGAP,2016; FSDU,2020). Commercial lenders, such as Regional and Global banks typically find it difficult to invest in the agricultural sector. Only around 2% to 7% of total bank credit in Sub-Saharan Africa is allocated to agriculture (FSDU,2020). Hence, only less than 10% of small-scale agribusiness companies have access to Agricultural SMEs that as a result lack access to the capital needed to grow and reach their full potential. loan or line of credit. Our study also indicates that that 40% of the smallholder farmers access financing through middlemen and greater than 35% from Village Savings and Loan Associations and Cooperative groups. Various reasons have been proposed in the literature for lack of access (see Weber, R. & Musshoff, O. 2013, Butler, A. W. & Cornaggia, J. 2011, Beck, T. & Demirguc-Kunt, A. 2006). In the case of the NUCAFE cooperative of farmers in the districts of Busoga, Elgon and Rwenzori, we find that the main barriers to accessing financing by the coffee smallholder farmers are:

i. *the lack of suitable collateral*, the biggest barrier, as most of the land that they grow the coffee on is highly fragmented and without land titles, making it unsuitable for banks to use as collateral;

ii. *lack of Bankable Projects* as many smallholder farming operations are too small to meet the appropriate hurdles for the effective returns required for the bank to advance credit;

iii. *High Default Risk* of small farmers compared to the larger enterprise farmers owing to their low competitiveness within the coffee value chain and their vulnerability to price and market fluctuations, coupled with the weather-related losses;

iv. *Limited financial management skills* not being equipped with the financial management knowledge including book keeping, saving culture,

and prudent financial managements tools, making their financial data not apt for banks;

v. *lack of sustainable farming methods* that can guarantee longevity of the farms and quality of the coffee.

Overall, the evidence gathered points to three key aspects of the coffee supply chain that future innovations aimed at driving sustainable growth of the coffee value chain and its actors, especially at the production stage (Upstream), need to take into consideration. These considerations include;

The futility of making the smallholder farmers creditworthy: Getting the smallholder farmers to be credit worthy for banks to advance loans to them will be an uphill task due to the informal nature of their setups, the informal land tenure systems, the cultural norms and illiteracy levels. Even with the farmer group models and grass root government interventions, creating bankable projects for the small holders continues will take a while to achieve.

Information asymmetry between the smallholder farmers and the other supply chain actors is an ever-present problem. Even with the digital advancement through mobile money (>80% mobile money penetration) right to the grass roots, the high levels of illiteracy continue to impede adoption and effective use of technology. The absence of information on both sides of the divide (the smallholders not having access to market knowledge, new farming methods, financial management etc, and the Banks not having access to accurate financial information of the smallholder farmers to use for credit analysis) means that the banks will not comfortably advance credit to the farmers for fear of loan default.

Sustainability pressures: The demand for coffee continues to grow, and in turn the pressure on the upstream to produce more is growing as such unsustainable coffee production methods are being deployed by the coffee producers the biggest sited in the interviews being the use of harmful pesticides and fertilizers which have affected the quality of the beans, and also destroyed the plantation. The interviewees also mentioned the fact that the increased deforestation by the farmers in a bid to increase the farming land has affected the coffee plantations and the weather patterns. This coupled with the impact of climate change on the coffee plantations is

creating pressure for the coffee exporters who are struggling to meet the global demand for coffee.

6. Designing an inclusive financial instrument

In recent years, the emergence of **upstreaming** has seen the incorporation of local actors (smallholder farmers, farmer cooperatives, local financial institutions) into the broader decision-making process of a supply chain (ICO, 2019). In the case of coffee production in Uganda, **upstreaming** has seen the farmers' participation in key decisions about financing, agricultural practices with sustainable farming starting to take center stage especially with the new requirement to comply to European Union Deforestation Regulation (EUDR), and market access (Emong and Bakema, 2024). This process often involves strengthening endogenous capabilities within the local communities and addressing the power asymmetries between smallholder farmers and large coffee buyers or export firms. Leveraging the power asymmetries in the supply chain involves recommending a sustainable supply finance framework where the financiers take risk on the buyers to extend financing to the smallholder farmers. Recourse would, of course, be on the coffee buyers who would affect the embedding of sustainable practices by the smallholder farmers.

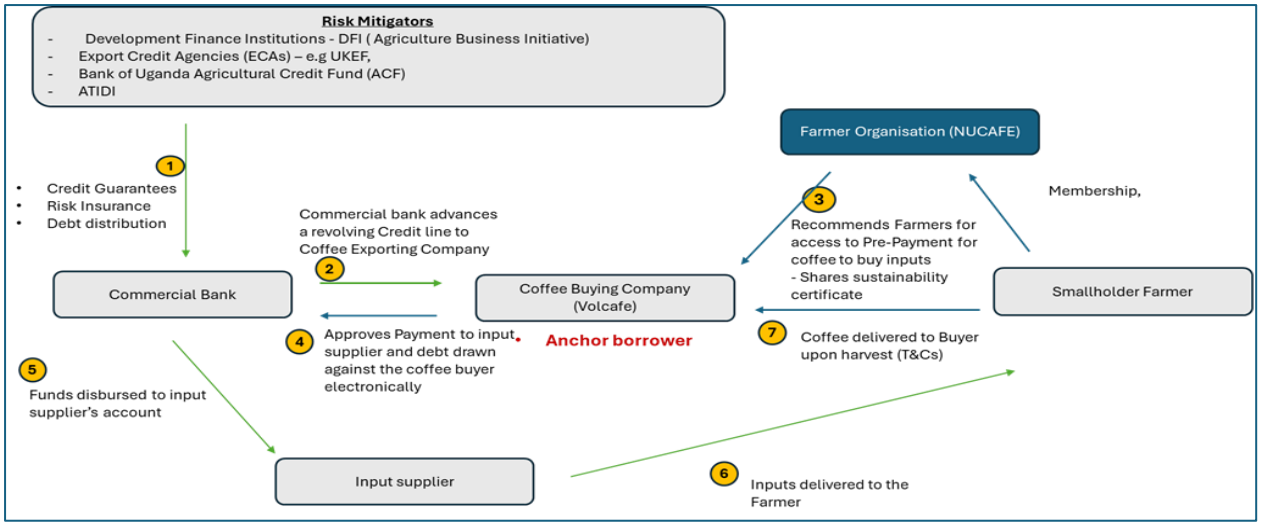
Besides power asymmetries and risk management, financiers can leverage farmer groups in supply chain financing models to embed sustainability elements of environment, social, economic and governance (ESEG) in the lending models. In embedding the ESEG elements in their operations, the risk profiles of the smallholder farmers are greatly improved making them credit worthy for the banks to extend financing to them.

Building on the identified weaknesses and strengths of the farmers needs and existing financial instruments we proceed to designing a new financing model premised on sustainability in the supply chain and upstreaming. The power of the model lies in the three key tenets of sustainability which include i. *economic sustainability* of the value chain players, ii. *environmental sustainability via* sustainable farming methods to cover the environmental conservation and, ultimately, iii *social sustainability* of the most vulnerable actors in the supply chain facilitating their access to finance and hence health, sanitation and education.

Economic sustainability

The model we propose is illustrated in Figure 7. It applies to a supply chain by leveraging the Principal-Agent Theory with the principal being the anchor supply chain actor on whom the financial institutions take risk. The Principal is usually at the apex of the supply chain. In the case of commodity supply chains like coffee, the principal is the coffee exporter who in this case would be a large multi-national corporation (e.g Nestle, Starbucks) whom Financial Institutions are usual comfortable to lend to. While the Agents are usually the producers/ suppliers at the bottom of the pyramid. The credit financing risk is taken on the Principal in the supply chain, and recourse in the event of non-repayment of the loan by the Agent will be taken on the principal. The financier credits the loan proceeds directly to the input provider who provides the services or goods to the Agent in the supply chain, and not directly to the agent. The Financing is repaid by the anchor using part of the proceeds meant for payment for the goods supplied by the Agent. For smallholder coffee farmers, this instance of the proposed financing model specifically drives sustainable economic growth of the smallholder farmers as they get to access financing towards increase of their production through access to inputs including seedlings, equipment, organic manure etc. and farm expansion through access to additional land. The loan is underwritten against the coffee buyer, usually a large multi-National Organisation (Anchor) on whom the bank takes recourse. The farmer commits their coffee to the coffee buyer (Anchor / Principal) through a tri-partite agreement signed by the Financial Institution, the Farmer and the Anchor committing that the coffee harvest, equivalent to the debt to be advanced to the farmer, will be committed to the coffee buyer (Anchor) and not sold to any other buyer. The Financial Institution underwrites the debt against the Anchor (Using the anchor's Credit rating), but disburses the funds to the input supplier directly (To avoid diversion of the funds by the farmer).

Figure 7: A new sustainable supply chain financing model (Purchase of inputs for the smallholder farmer – Financing proceeds going direct to the input service provider and debt marked against)



Risk Mitigation

The proposed model leverages the farmer group to mitigate risks for the financiers, the coffee buyers and the farmers. The coffee buyers approach the farmer group with their need. The farmer group mobilises the member farmers for the coffee. Evidence has shown that during peak seasons the coffee buyers need up to 10 million dollars to meet their demand. They access this financing through banks, which give them a revolving line of credit to be paid back once they have exported the coffee (Usually 90 days). With this financing structure, the farmers are paid once they deliver the coffee and the coffee buyers don't have to use their operating capital to finance the purchased.

The farmer groups would recommend the certified farmers to the coffee buyers, and the coffee buyers would in in turn pass on the mobile money wallet details of the farmers to the bank for them to get paid directly. In doing so the bank mitigates against the risk of the coffee buyers diverting the funds away from coffee purchasing which could lead to defaulting.

The upstreaming supplier finance model is premised on commercial institutions lending to the coffee buyers who are usually global organisations with good credit grades for example Volcafe. In this model, the recourse in the event of default will be on the coffee buyer who is the anchor borrower whom the bank would underwrite for the loan.

Sustainable farming

To drive sustainability of the coffee supply chain, the model recommends that the financial Institutions embed aspects of environmental, social and

governance in their underwriting criteria. Partnership with sustainability certificate bodies would play a crucial role in ensuring that the coffee is grown sustainably and that there is no greenwashing. In the case of coffee farmers, the model recommends that the farmer organisation partner with the likes of FairTrade, Rainforest Alliance or Government in the case of EUDR compliance to make sure that all the farmers who are members of the farmer group are certified as sustainable before they buy their coffee. The compliance to sustainability in coffee production is pivotal to the effectiveness of the model since the bank's terms for sustainable finance on pricing and tenor provide incentives for sustainability and emissions reduction in the supply chain. In the case of NUCAFE we find highly promising that that the farmer group is a member of the Rainforest alliance and is in the process of complying with the EUDR.

7. Conclusion

Access to Finance is a key impediment to the sustainable growth of the coffee smallholder farmers in Uganda, that are responsible for 90% of the coffee in the supply chain. The inherent risks posed by the smallholder farmers make it hard for the commercial banks to extend financing to them. Traditional sustainable finance models partly address those issues but tend to focus exclusively on the producers, whether farmers or farmers' associations. Building on their limitations and challenges, a new financing framework is designed that involves multi-stakeholders in the value chain. The resulting upstreaming *supply chain sustainable finance model* is tailored to farmers' needs and broadens the design of traditional sustainable financial instruments to include the buyers in the supply chain using principal-agent theory, where loans are underwritten against large coffee buyers. The proposed model aligns finance with long-term societal goals to foster inclusive development by embedding into the financial instrument economic, environmental, and social sustainability principles for inclusive finance that can improve productivity, resilience, and environmental outcomes. The model also highlights that partnerships with certification bodies and financial institutions are key to success.

While this study aimed to source for enough data points so to contribute to the body of knowledge of innovative sustainable financing models in the coffee supply chain with the aim of proposing a financing framework for coffee smallholder farmers in Uganda, we faced some challenges when

carrying out the study which could limit the study. These include the timeframe of the study, which may not capture long-term trends or the full impact of recent policy changes is sustainable coffee production and sustainable financing frameworks, such as the European Union's deforestation regulation, and the Central bank's climate financing policies that are still under review both of which could affect the access to Finance by the smallholder farmers and indeed the production of coffee in Uganda. Also, the research focuses primarily on Uganda's coffee sector, which may limit the applicability of the findings to other regions with different agricultural practices, economic conditions, or trade policies.

Despite these limitations, we believe the study provides valuable insights into the role of trade finance instruments in enhancing supply chain farming offering recommendations for sustainable finance framework developers, financial institutions, and Development Financing Institutions (DFIs) to address existing challenges and leverage opportunities for growth and sustainability, not only in the coffee supply chain but also for other agriculture supply chains like cocoa, palm oil and maize among others in the global south.

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