Impact of Cooperative Membership on Tea Marketing Strategies and Farmers' Income in Kericho, Kenya: Use of Endogenous Switching Approach

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ABSTRACT

Although cooperatives play a crucial role in reducing transaction costs and promoting better farming practices, the effects of cooperative membership on tea marketing strategies and farmers' Income still need to be explored. This study investigates the impact of cooperative membership on tea marketing strategies and farmers' Income. Using household-level data from tea farmers, the study used an endogenous switching regression model; the results indicate that factors such as age, land size, market access, tea plucking standards, distance, and neighbors in cooperatives significantly influence farmers' decisions to join cooperatives. Moreover, the Average Treatment Effect on the Treated (ATT) indicates that households with cooperative membership experience a statistically significant income increase, with a treatment effect of 0.858, reflecting an 8% income rise. Similarly, the Average Treatment Effect on the Untreated (ATU) shows a 4.34% income increase for non-member households, highlighting the broader economic benefits of cooperative participation. These results underscore the empirical strategy's robustness and affirm the cooperative membership's positive influence on marketing strategies and household income. Consequently, the study concludes that cooperatives provide a platform for farmers to share resources, knowledge, and best practices, leading to improved agricultural techniques, increased productivity, marketing and higher incomes for members.

Keywords: Cooperative membership, Tea marketing strategies, Tea Farmers, Endogenous Switching Regression, Kenya

INTRODUCTION

Globally, cooperatives have significantly impacted economic development, with over 8 billion cooperative members contributing to various sectors relating to agriculture domains(Birchall, 2004, Duguma, 2016). They promote production modernization, specialization, the formation of specialized farming areas, market linkages, and the elimination of practices that hinder self-sufficiency(Asirvatham et al., 2022). In developing regions, notably Sub-Saharan Africa (SSA), cooperative members have increased their incomes through production expansion and capital concentration. Cooperatives enhance farmer well-being by providing credit, market data, and securing higher market prices for their products(Geffersa and Islam, 2024). Additionally, they reduce transaction costs and fulfil various roles, such as boosting member income, enhancing productivity and product quality, and improving production, marketing, and overall livelihoods(Behera and France, 2016).

Despite the favorable conditions for tea production, smallholder farmers in Kericho need help marketing their produce. In Kenya, tea marketing faces stiff competition, and there is a shift from a vertically integrated plantation production system to market coordination(Mohan, 2016). These challenges include limited market access, price volatility, high transaction costs, and inadequate bargaining power. Individual farmers cannot often navigate these challenges effectively, so cooperative societies have emerged as a crucial mechanism to support them(Tefera et al., 2017). Cooperatives enable farmers to pool resources, enhance their collective bargaining power, access better markets, and ultimately improve their incomes(Gyau et al., 2014). This means independent parties, including smallholder farmers, coordinate their activities through a market mechanism, a decentralized driven approach to determining marketing channels of their interest. However, there needs to be more concern about future marketing and Sustainability. A recent report by the Tea Board of Kenya (Kenya, 2023) stated that smallholders had lost about 50 billion in revenue due to the informal tea business, also known

as tea hawking. Furthermore, the report reveals that registered companies operate on high production costs in tea processing to produce made tea due to a decline in smallholder farmers' production. Research by (Herath and Weersink, 2009, Tumusiime et al., 2014, Kabanda, 2023) highlights the complexities inherent in vertically integrating production and agroindustrialization. Cooperative membership and considerations for collective marketers are therefore crucial.

Previous studies have focused on cooperative membership's impact on other farming sectors' household income rather than on small-scale tea farmers(Vu et al., 2020, Tran and Goto, 2019). Additionally, these studies did not control for the potential endogeneity of cooperative membership. Research by (Ji et al., 2023) on Chinese pig farmers found that cooperative membership increased income and product competitiveness. This paper focuses on smallholder tea farmers, analyzing the impact of cooperative membership on household income and marketing strategies in Kericho, Kenya. It addresses the following research question: Does the marketing effectiveness of members in cooperatives improve Income? According to (Tran and Goto, 2019) attenuates that cooperatives serve as vital income sources, offering cheap products to members and supporting their access to production techniques and credit capital. They help small households access market information and natural resources, lowering transaction costs and training. In Kenya, cooperatives have been leading the negotiation of better terms in contract farming and lowering input material prices. Therefore, many farmers value cooperatives as a collection and aid in marketing, particularly for crops grown on a large scale (Ncube, 2020).

The role of cooperatives in enhancing the livelihoods of farmers has been widely acknowledged in the literature. For instance, studies in Ethiopia have shown that agricultural cooperatives have been instrumental in boosting productivity and income among smallholder farmers by providing better access to resources and facilitating collective bargaining(Bernard et al., 2010). Similarly, in Kenya, cooperatives have been found to empower farmers by offering training, financial services, and market linkages, which significantly contribute to rural development and poverty alleviation(Wanyama et al., 2009). In India, farmer cooperatives have been crucial in promoting sustainable agricultural practices and enhancing food security, particularly through initiatives like the Amul cooperative, which has successfully improved dairy farming practices and farmer incomes(Shimokado, 2021). While there is substantial literature on the benefits of cooperatives in general, research explicitly on impact of cooperative membership on the tea sector in Kenya, particularly in Kericho, remains under-explored.

This study aims to bridge this gap by focusing on two objectives; (1) To examine how cooperative membership affects the marketing approaches and methods used by tea farmers in Kericho, with a particular focus on changes in marketing channels, techniques, and pricing strategies. (2) To analyze the economic benefits of cooperative membership, specifically its impact on the overall income and financial stability of the farmers. Through this, study based on analysis hypothesized that cooperative membership significantly improves marketing strategies, providing better market access and enhanced promotional activities, and leads to a statistically significant increase in the income levels of tea farmers in Kericho.

This study contributes to the literature in two folds: first, using the cross-sectional data from Kericho County, the study focuses on smallholder tea farmers, which is understudied given its crucial role for accounting about 46% of total tea production in Kenya,(Board, 2022). Although several cooperatives exist under various agricultural sectors, little is known about their role in boosting the marketing in tea farming and marketing value chains, following previous studies done in Kenya (Warucu and Lufuke, 2024, Onyilo and Adong, 2019, Wanjau et al., 2019, Wanyama, 2016). However, these studies had limitation in elaborating inferences particularly nexus of cooperatives and farmers income. To our knowledge, this is the first study linking tea and income to provide policy understanding.

Secondly, we link the different methodological approaches and regional demographics. To do this, our research study used endogenous switching regression to analyze cooperation's effects. Thus, endogenous switching regression addresses selection bias and accounts for endogeneity (Abdulai and Huffman, 2014, Tesfay, 2020, Bidzakin et al., 2019). We incorporated Propensity score matching in previous studies using

propensity score matching for robustness check. Additionally, factual and counterfactual scenarios are calculated for specific policy support measures.

The rest of the study is organized as follows: Section 2 Literature review, focusing cooperatives and tea marketing in Kenya. Section 3, Materials and Methods section 4, Results and discussions. Finally, Section 5 Concludes.

LITERATURE REVIEW

The history of Kenya's cooperatives dates back to 1908, when membership was limited to white colonial settlers. The first Cooperative Society in Kenya was established with the primary objective of purchasing fertilizer, chemicals, seeds, and other farm inputs and then marketing products to leverage economies of scale (Kamakia, 2016). The government began regulating cooperatives in 1931. By 1946, Africans initiated a movement to gain the right to participate in the economy through cooperatives (Wanjau et al., 2019). This led to the introduction of a new Cooperative Societies' Ordinance and the eventual repeal of the Cooperative Societies Act No. 12 of 1997, which almost caused the collapse of the cooperative movement in Kenya. Recognizing the crucial role of cooperatives in national socio-economic development, the colonial government pursued institutional and legislative reforms to avert the decline of cooperatives. Later, the Cooperative Societies (Amendment) Act No. 2 of 2004 and the creation of new Cooperative Societies Rules (Kenya, 2022). These developments strengthened the Cooperative Tribunal Court's ability to expedite and resolve pending cases. The SACCO Societies Act, enacted in 2008, acknowledged the growing importance of SACCOs and enforced stricter prudential standards. At Kenya's independence in 1963, about 1,000 registered cooperatives were firmly established, focusing on producing, marketing, and processing agricultural products (Birchall, 2004).Today, Kenya has over 25,000 cooperatives. As of 2022, there were 7,898 agrarian societies, up from 7,729 in the previous year (Tshishonga and Okem, 2016). Most cooperatives (2,854) are multi-produce based and include various other institutions. Cooperatives are vital in combating rural poverty, enhancing farmers' risk management, and expanding income opportunities (Geffersa and Islam, 2024). Cooperative societies play a pivotal role in enhancing agricultural marketing by providing farmers a platform to pool their resources and improve market access.

In many developing countries, individual farmers often need help with significant challenges (Ma et al., 2018) in reaching profitable markets due to high transaction costs, limited market information, and inadequate bargaining power. Cooperatives help to mitigate these issues by enabling farmers to collectively market their produce, which reduces individual transaction costs and improves market efficiency. By aggregating produce from multiple farmers, cooperatives can negotiate better prices, secure favorable terms with buyers, and access larger markets otherwise inaccessible to individual farmers. Kenya's agricultural sector, mainly tea and coffee, heavily relies on cooperatives. The Kenya Tea Development Agency (KTDA) manages small-scale tea farmers through its network of over 600,000 smallholder farmers, who produce over 60% of the country's tea. Similarly, coffee cooperatives, such as the Kenya Coffee Producers Association, play a pivotal role in production and marketing, ensuring farmers receive better prices for their coffee. In the dairy sector, cooperatives like the Kenya Cooperative Creameries (KCC) have been instrumental in processing and marketing milk, enhancing the livelihood of dairy farmers. These cooperatives provide critical services such as access to credit, market information, and inputs, significantly improving agricultural productivity and farmers' incomes.
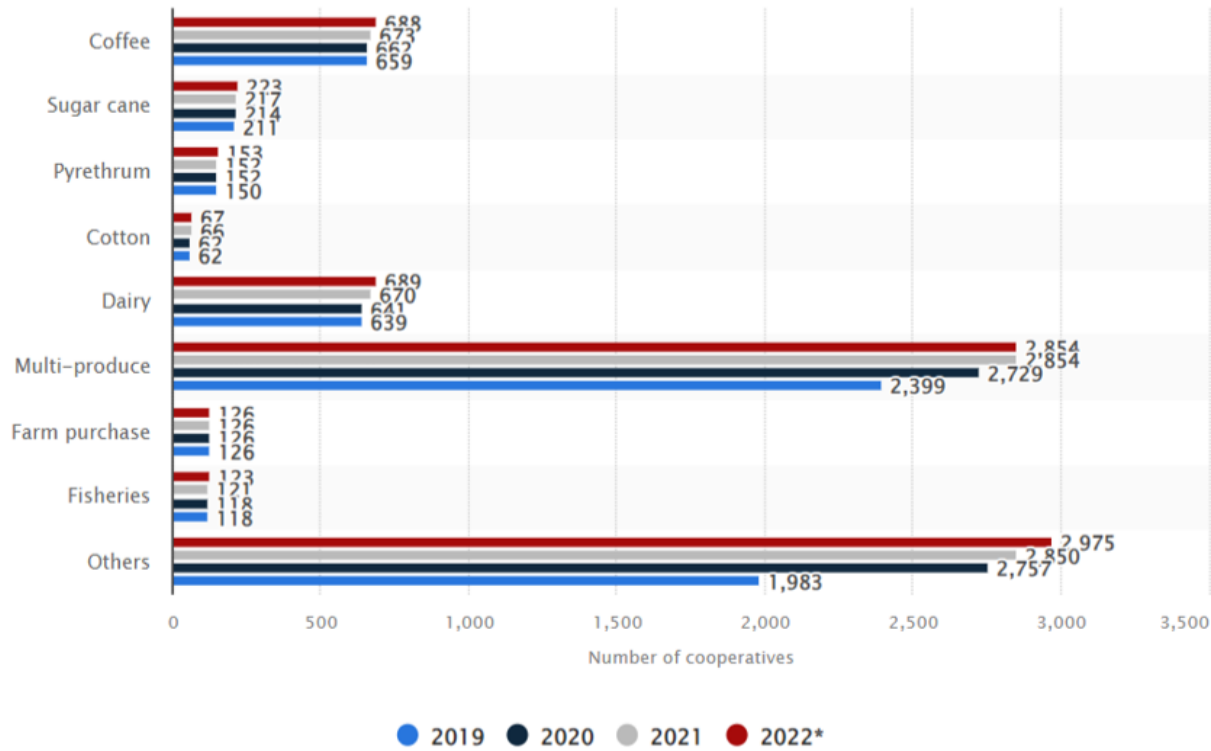
Figure 1.: Agricultural cooperatives from 2019-2022

Source: Cooperative Alliance of Kenya (2022)

Cooperative and Tea Marketing

Kenya's agricultural sector, mainly tea and coffee, heavily relies on cooperatives. The Kenya Tea Development Agency (KTDA) manages small-scale tea farmers through its network of over 600,000 smallholder farmers, who produce over 60% of the country's tea(Board, 2022). Similarly, coffee cooperatives, such as the Kenya Coffee Producers Association, play a pivotal role in production and marketing, ensuring farmers receive better prices for their coffee. Kenya tea commercialization operates in the dualistic type of production involving smallholder farmers and tea estates. Marketing and Kenya Tea Development Agency was established in 2000 as a private holding company, Kenya Tea, to manage tea commercialization and promotion. With 69 factories and over 163,000 hectares of land, it has produced 267 million tea leaves, the world's largest farmer organization.

Despite the oversight, KTDA faces challenges in the tea industry, leading some smallholder producers to explore alternative markets and engage in informal practices like tea hawking. Low global tea prices have impacted revenue streams, financial constraints, and reduced yields due to climate change disruptions. Management issues, corruption, internal conflicts, and political uncertainty have eroded farmer trust, prompting a shift towards alternative options. Kenya, a major tea exporter, relies heavily on tea, coffee, mate, and spices, accounting for 24% of total exports. Therefore, cooperation is a panacea, and when effectively enhanced, it can change the lives of many livelihoods, particularly on Income. The tea industry involves cultivating green-leaf tea and processing it into black tea. Green leaf tea has a 30-50-year economic lifespan, with manual and machine picking. Harvesting is labor-intensive, requiring fertilizer and pruning for year-round harvesting. The process requires 50 plucking rounds annually. In June 2021, Kenya exported 44 thousand metric tons of tea, valued at 9.5 billion Kenyan shillings (approximately $86.2 million). Pakistan is the largest client, accounting for 35% of Kenya's tea exports.

Kenya currently has an area under tea of 111,002 hectares. It produces more than 450 million kg of tea yearly, resulting in significant economic gains of about 23% of all foreign exchange revenues, roughly 2% of the

GDP. Therefore, cooperative membership plays a critical role in this sector, particularly in marketing information and access to credit for its members. Tea consumption in Kenya is projected to reach 150,000 metric tons by 2026, increasing from 140,000 metric tons in 2022(KTDA,2023). Despite this demand, Kenya faces challenges in the tea farming sector that cooperatives can help address. Cooperatives play a vital role in poverty reduction by empowering society members and boosting economic activities (Bharti, 2021). Facilitating tea farmers to join cooperatives aligns with the Cooperative Societies Act No. 12, promoting inclusive membership and cooperative development spearheaded by the Kenyan government, especially in rural areas (Katundu, 2020) . Numerous programs have been implemented in Kenya to support agricultural development through cooperatives, including gazettement and inclusions to track and minimize recent trends in corruption and embezzlement of funds(Kenya, 2022). Despite these illustrations in tea industry, research on cooperatives and marketing remains unexplored, study seeks to address this gap by analyzing how cooperative membership impacts tea marketing strategies and the income levels of smallholder tea farmers in Kericho and it can be applied to other tea growing area particularly developing countries

MATERIALS AND METHODS

Description of Study Site

Kericho County, situated in the western Rift Valley of Kenya, is renowned for its extensive tea plantations, which are among the largest globally. The region was chosen since it is the leading county in tea production, contributing approximately 46% of Kenya's total tea output when combined with Bomet and Nandi counties. The landscape, characterized by plains, undulating hills, and a humid climate, provides optimal conditions for tea cultivation. Average annual temperatures range from 15 to 20°C (288 to 293 K), with elevations between 1500 and 2300 meters above sea level. These factors facilitate continuous tea production throughout the year. Tea farming in Kericho involves both smallholder farmers and large multinational corporations, including Finlay's, Kaisugu, and Unilever. The Momul family, with nearly a century of tea cultivation, supplies tea to brands such as Yorkshire Tea as shown in Fgure 1 below.
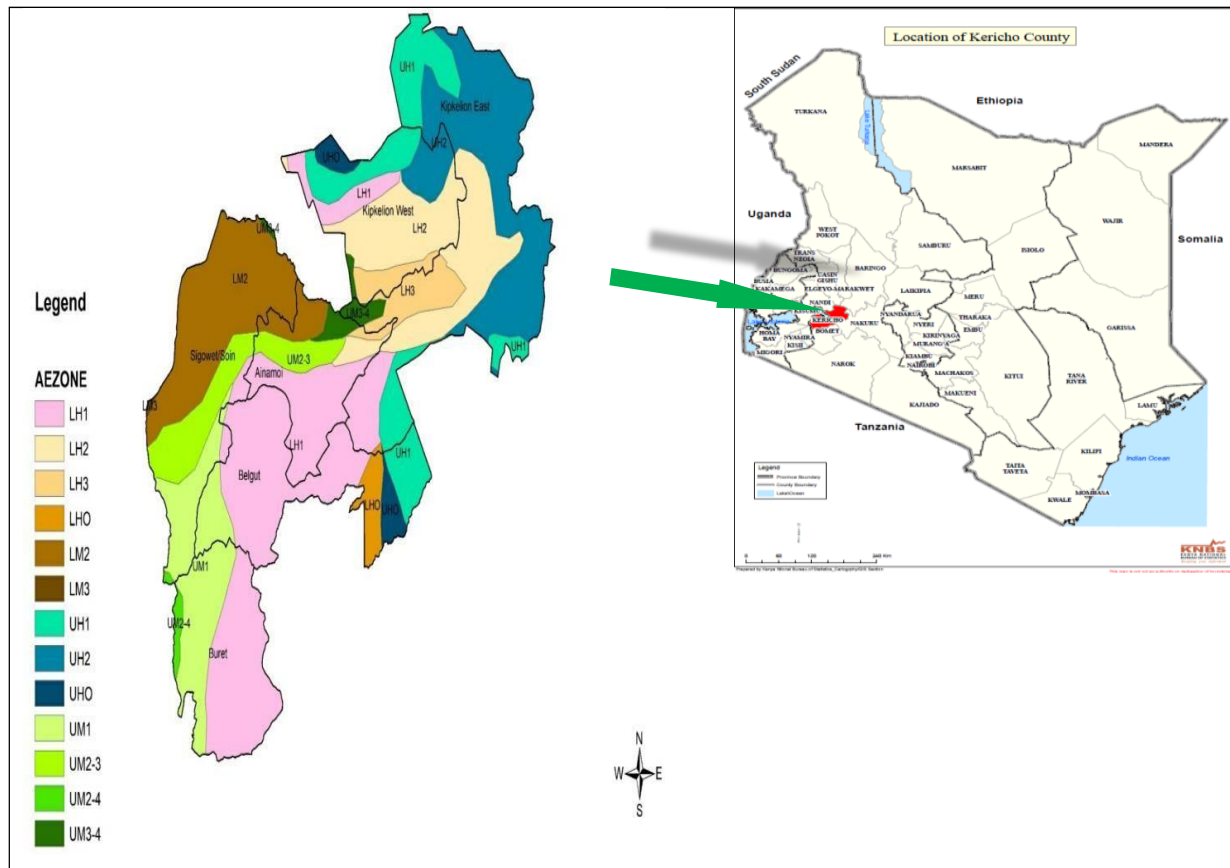

Figure 1. Map of study domain.

Sampling Method and Data

The study's data were collected from a household survey conducted from July to December 2023. A three-step sampling procedure was employed. In the first stage, the survey focused on households; targeting groups of green tea farmers: those participating in cooperative marketing and those not participating in collaborative marketing. In the second step, six regions within Kericho were purposefully selected. These regions supply tea to KTDA factories, Kapchebet Tea Factory, Litein Tea Factory, Roret Tea Factory, Londiani Tea Factory, and Kapsuser Tea Factory. Both have a long history of green tea cultivation and represent a significant portion of household tea farms. The selection criteria included the total size of household farms under tea, the existence of tea marketing centers, and tea productivity potential. Regions were chosen to ensure sufficient sample sizes within budget constraints. Village leaders helped identify households participating in these marketing channels.

In the third stage, households were sampled through face-to-face interviews. All smallholder farmers within the identified regions were considered, acknowledging that cooperative participants might be fewer due to resource constraints. Control households, or non-cooperative participants, were randomly selected from the same villages as the treatment groups based on a generated list of villages' tea collection centers (14 villages in total) using the Yamane formula (Adam, 2020). An approximately equal number of control and treatment households were sampled from each town, as per tea delivery registers provided by tea farmers' cooperatives and factory extension managers. Ten senior graduates from Kabianga University were pursuing agricultural-related courses, and four county staff members from the Ministry of Agriculture helped collect data using a smartphone-based questionnaire translated into the local language. The questionnaire focused on household tea production, farm characteristics, farm size, tea harvesting techniques, detailed tea sales, and inputs over the last 12 months. Household heads were also asked to provide monthly income reports from tea for the past year and other vital assets. Each household visit took an average of 15 minutes, and household representatives were given two black tea bags.

Since there was no existing data on the current level of awareness of cooperative participation in the study area, the sample size was determined using Cochran's (1977) formula for finite population sample size calculation. It was assumed that half of the smallholder farmers in the population perceive cooperative membership as important. Based on this assumption, a sample size of 351 households was initially obtained, as shown in Equation 1.

$$n_1 = \frac{Z_1^2 - \frac{\alpha}{2}}{e^2} P(1 - P) \tag{1}$$

After excluding 40 households that did not report tea production or declined to disclose household income and information about cooperatives, we had 311 valid households. From these, 195 actively participated in cooperative marketing, and 119 did not participate in collaborative marketing. We used a subset of data to answer our research question, ultimately working with 311 valid households.

Theoretical and Conceptual Framework

The tea farmer's decision on cooperative marketing for their tea can be based on Random Utility Model (RUM) following previous works (Frick et al., 2019, Duong et al., 2023). The decision rule for a risk-neutral, utility-maximizing tea farmer will choose a marketing channel with high utility $U_{t,A} > U_{t,N}$, let S_t latent variable that denotes the difference between benefits from adopting a specific marketing channel (e.g., formal or informal). S* can be expressed as a function of observable variables, and therefore, the simplified Eq is as follows:

$$S_t = U_{t,A,Ch} - U_{t,N,Ch} > \begin{cases} 1 & \text{if } S_t > 0 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

$S_t = f(X_{t,})$ Ch, Zt, Ch, where $X_{t \text{ and Ch}}$ represent observable variables specific to the tea marketing channel (like transaction costs, market prices, accessibility). $Z_{t \text{ and Ch}}$ represent random variables capturing uncertainties or unobservable factors influencing the decision-making process for that particular marketing channel.

Empirical Strategy

This study examines the impact of cooperative membership on tea marketing strategies and farmers' Income in Kericho, Kenya. Previous research has used quasi-experimental techniques like propensity score matching (PSM) to reduce bias in selecting marketing participants (Xie et al., 2022, Mason et al., 2017). PSM creates a control group by matching each participant with a non-participant with similar observable characteristics. However, PSM may produce partial estimates because unobservable traits can influence the decision to participate in marketing(Oloo and Parkes, 2021, Ma et al., 2018). Instrumental (IV) and proxy variables are often used (Wooldridge, 2015). However, (Peel, 2014) argues that IV techniques are unsuitable for limited dependent variable models due to their nonlinearity. For binary outcomes, various methods, such as the Linear Probability Model (LPM) and Two-Stage Least Squares (2SLS) (Chatla and Shmueli, 2017) and the Bivariate Probit Model (BPM) (Seo and Hwang, 2022) are available. LPM is criticized for generating inconsistent marginal effects when predicted probabilities fall outside the (0,1) range.

Although 2SLS and BPM provide more accurate estimates, they are less efficient and prone to assumptions about the validity of instruments(Klungel et al., 2015) compared to the Full Information Maximum Likelihood (FIML) technique(Hao et al., 2018). Therefore, we use an Endogenous Switching Regression (ESR) model employing the FIML approach, which has been effectively applied in studies analyzing yield, crop income, and household expenditure (Kumar et al., 2018, Ma et al., 2023).

Endogenous Switching Regression

Using a two-stage process, the ESR model quantifies the effects not randomly assigned to participants. The initial phase employs a probit regression model to ascertain the likelihood of a decision to participate, as shown in equation 3.

$$I^* = C\beta + \omega, \text{ with } I = \begin{cases} 1 \text{ if } I* > 0 \\ 0 \text{ if otherwise} \end{cases} \tag{3}$$

U_i^* is not observable, but we observe a binary indicator variable (U_i), represented by 1 for cooperative membership by the ith household and 0 otherwise. α is a vector of parameters to be estimated is ε a random error term with mean zero and variance σ^2. Given that farm households decide to become members of cooperatives or not, the impact of cooperative membership on the household income is specified for two regimes conditional on U_i:

Regime 1: $$\mathbf{Y}_{i \text{ Member}} = \beta_A \mathbf{X}_i + \varepsilon_{ai}, \text{ if } U_i = 1 \tag{4}$$

Regime 2: $$\mathbf{Y}_{i \text{ Non-member}} = \beta_N \mathbf{X}_i + \varepsilon_{ni}, U_i = 0 \tag{5}$$

Where $\mathbf{Y}_i$ represents a vector of outcome variables income for the ith farm household, $\mathbf{X}$ represents social economic characteristics of farmers, β_A and β_N are a vector of parameters to be estimated in the member and non-member regime, respectively, whereas ε_{ai} and ε_{ni} are error terms. It is important to note that variables in $\mathbf{G}$ and $\mathbf{X}$ are allowed to overlap. To achieve proper identification, at least one variable in $\mathbf{G}$ must not appear in $\mathbf{X}$. In this case, distance and Neighbors in cooperatives were the instruments used, and the falsification test was conducted to confirm the instrument's validity. Also, according to the (Fuglie & Bosch, 1995), error terms (in Equations 4, 5a and 5b) are assumed to follow a tri-variate normal distribution with zero mean and a non-singular covariance matrix specified as:

$$\text{Cov}\,(\varepsilon_a, \varepsilon_n, \varepsilon_v,) = \begin{bmatrix} \sigma_a^2 & \sigma_{an} & \sigma_{av} \\ \sigma_{an} & \sigma_n^2 & \sigma_{nv} \\ \sigma_{av} & \sigma_{nv} & \sigma_v^2 \end{bmatrix} \tag{6}$$

Where σ_a^2, σ_n^2, and σ_v^2 are the variances, assumed to be one (Greene, 2003) of the error terms ε_a, ε_n and ε_v, respectively. σ_{an} is the covariance of ε_a and ε_n; σ_{av} is the covariance of ε_a and ε_v; and σ_{nv} is the covariance of ε_n and ε_v.

To calculate the average treatment effect on the treated (ATT) and untreated (ATU), the members' and non-members' expected outcome values can be compared in real and hypothetical scenarios. The ESR framework allows for the computation of the expected values in the actual and counterfactual scenarios (Lokshin & Sajaia, 2004)defined as follows:

$$ATT = E(Y_{it}^1 \mid C = 1) = X_{ij}^1 \gamma^1 + \sigma_{1r}\lambda^1 \_ E(Y_{it}^2 \mid C = 1) = X_{ij}^1 \gamma^2 + \sigma_{2\varepsilon}\lambda^1 \tag{7}$$

$$E(Y_{it}^1 \mid U = 1) = X_{ij}^1 \gamma^1 + \sigma_{1r}\lambda^1 \tag{9}$$

$$E(Y_{it}^2 \mid U = 1) = X_{ij}^1 \gamma^2 + \sigma_{2\varepsilon}\lambda^1 \tag{8}$$

RESULTS AND DISCUSSIONS

Descriptive Statistics

Table 1 presents the definition and statistical characteristics of the variables utilized in the empirical analysis. The selection of independent variables was informed by prior research on the factors influencing farmers' participation in cooperative membership.

Regarding gender demographic characteristics, participants had a slightly higher proportion of females (51.1%) than non-participants (48.0%), suggesting active involvement of women in tea cooperatives. Participants were younger (mean age 40.04 years) than non-participants (mean age 46.65 years), indicating a higher prevalence of cooperative membership among younger individuals. Participants had a higher mean level of education (6.00 years) compared to non-participants (5.57 years), suggesting that education influences farmers' decisions to join cooperatives. They also had more farming experience (2.65 years) than non-participants (1.98 years), implying that experienced farmers are likelier to join cooperatives. Market access was slightly lower for participants (mean 0.70) than non-participants (mean 0.75). Still, credit access was higher for participants (mean 0.28) than non-participants (mean 0.09), indicating that credit availability influences cooperative membership.

Participants lived further from markets (mean 53.50 km) than non-participants (mean 36.59 km), suggesting that those from markets are likelier to join cooperatives. Participants had more extensive land holdings dedicated to tea (mean 1.28 ha) compared to non-participants (mean 0.61 ha) and kept more tea bushes (mean 137.34) compared to non-participants (mean 123.52). Access to extension services was significantly higher among participants (mean 0.98) than among non-participants (mean 0.52), indicating the importance of extension services in cooperative membership. Participants had slightly higher monthly off-farm Income (mean 30.38 Ksh) than non-participants (mean 28.57 Ksh), suggesting additional income opportunities from cooperative membership. Participants had a higher proportion of household decision-makers involved in cooperatives (mean 0.97) than non-participants (mean 0.86). The total land size was more significant for

participants (mean 2.26 ha) than for non-participants (mean 1.40 ha), indicating that participants generally had more extensive land holdings.

Table 1. Descriptive statistics on mean comparison differences between households under cooperatives and non-users

Variables	Participants		Non-Participants		t-test
	Mean	SD	Mean	SD	
Group membership	0.87	0.02	0.88	0.05	0.82
Gender	0.51	0.50	0.48	0.50	0.34
Age	40.04	11.83	46.65	16.8	0.99
Education	6.00	1.35	5.57	1.65	0.00**
Marital status	1.95	0.01	1.90	0.04	0.24
Farming experience	2.65	1.11	1.98	1.07	0.00
Market Access	0.70	0.45	0.75	0.44	0.74
Credit access	0.28	0.02	0.09	0.04	0.00***
Market distance	53.50	70.95	36.59	27.49	0.05
Size of land used for tea	1.28	1.09	0.60	0.67	0.00*
Access to extension service	0.98	0.15	0.52	0.51	0.00
Monthly off-income per Kg (Ksh)	30.38	16.49	28.56	16.13	0.24
Household size	5.15	0.10	5.39	0.31	0.45
On-farm Income	6379.536	553.0187	6637.5	1213.568	0.8759
Total land size	2.258743	.0785347	1.4	.1929245	0.0003

Determinants of cooperatives membership within study domains.

Table 2 presents the results of a probit regression analysis, which examines the factors influencing households' decisions to participate in cooperatives participation and green tea marketing. Tea prices negatively influence tea farmers to participate in cooperatives. This implies that as farmers' tea prices decrease, they increase their participation in cooperatives as they seek higher prices due to collective bargaining. It revealed that price difference has a significant and positive impact on the participation of smallholder farmers in tea cooperatives and affects the probability of participating in cooperatives. The p-value (0.000) suggests that this relationship is statistically significant by 1%. Price differences in the market usually drive smallholder farmers; more participants in cooperatives prefer to sell their tea leaves at a reasonable price. This finding corroborated the findings (Rueda et al., 2019) that price incentives and the demand for cash basis influence market decisions, especially when households need to utilize a given need amount regularly. For cooperative groups, including registered companies, prices are usually determined monthly, unlike non-participants, where direct transactions and other agreements exist.

Informal tea is negative and significant at 1%, indicating that when smallholder farmers join or participate in informal marketing, there is a decrease in participation in cooperative membership since informal farmers usually pay low prices based on cash-on-delivery mechanisms. Membership in cooperatives ensures farmers' awareness, strong bargaining power, and good knowledge of the tea markets, as they can have information about tea marketing channels in Kericho County. These results are consistent with (Abdul-Rahaman and Abdulai, 2020). Informal marketing affects cooperatives and reduces farmers' participation due to the need for price controls imposed by intermediaries. Under well-organized tea marketing, farmers in farmers' groups have

a key in collective decision-making that influences the welfare of farmers by improving conditions and empowerment.

Market access is also a negative and significant key determinant in cooperative membership; the results show that the near and convenience marketplace decreases participation in other markets as opposed to non-participants. Collaborative groups are usually assembled, and their collective actions are close and convenient to their memberships. A study corroborates the findings by (Abelló et al., 2014) that market proximity influences the farmers to ease the transactions and reduce the time and additional transportation costs, especially for perishable products like green tea leaves.

They are plucking standardized tea negatively and significantly influencing marketing participation in cooperatives. It implies that higher plucking standards significantly decrease the probability of participating in cooperatives because of quality considerations. The first step in tea manufacturing is plucking leaves; it's a tedious process whereby only two leaves and a bud are recommended to enhance pleasing aroma, quality, taste, and good brand(Pou et al., 2019). Further, the results correspond to (Shah and Pate, 2016), who found that the level of requirements in the formal sector is a production challenge; in this context, especially during peak production, smallholder farmers usually shift to private companies and intermediaries who will later blend, mix and resell the tea leaves to registered companies with anticipation of high monthly prices from the formal sector. Therefore, cooperatives boost tea marketing regarding quality maintenance among tea farmers.

The second payment had a substantial significant impact of 1%. It positively influenced the level of participation in cooperatives—an increase in Bonus stimulated participation of cooperatives due to high prices due to the group. Results had Similar findings from (Harrizon et al., 2016, Bonus, 1986), whereby based on economic theory, a price increase is usually an incentive to producers. Bonus payments can serve as a means to encourage tea workers to work diligently, maintain high product quality, and achieve production goals (Zhang et al., 2020). A financial incentive aims to boost morale, increase productivity, and reward those contributing significantly to the tea production process.

Table 2: Probit results on factors influencing households to participate in cooperatives

Participation decision	Coef.	Std. Err	p>|z|
Tea price	-0.64	0.20	0.00***
Farm experience	0.07	0.11	0.50
Education level	0.04	0.03	0.18
Informal tea marketing	-0.47	0.15	0.00***
Access	-0.06	0.13	0.61
Market access	-0.33	0.08	0.00***
Duration of payments	-0.15	0.21	0.47
Plucking standards	-0.31	0.06	0.00***
Access to credit	-0.00	0.20	0.98
Bonus income	0.60	0.23	0.00***
Mode of sales	-0.23	0.17	0.18

Number of obs =   311

LR chi2(9)   = = 199.38

Prob > chi2   = 0.0000

Pseudo R2   = 0.4853

Log likelihood = -105.73584

Note: The symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Source: Authors' computation derived from survey data (2023)

Determinants of Cooperative membership and effects on Household Income

The results in Table 3 are derived from an endogenous switching regression model estimated using Full Information Maximum Likelihood (FIML) to assess cooperative membership's impact on tea marketing and household income. The ESRM coefficients indicate that rho_1 is negative and statistically significant, while rho_2 is positive but insignificant. This suggests self-selection in accessing microcredit, though it does not affect non-users who decide to take credit. The likelihood ratio test in joint dependence of the three equations, as indicated in Table 3. The variation in coefficient estimates cooperatives and non-users underscores the superiority of the switching regression model over a simple treatment effect model (Addai et al., 2023),

The ESR results are presented in three sections, as indicated in Table 3. The initial column (1) reveals the probit model, representing farmers' participation decisions on cooperative membership. Five variables from eleven are statistically significant in determining cooperative participation decisions. The results indicate social and economic characteristics such as age, land size, market access, distance, and neighborhood participation. Age and land size influence membership participation. It implies that as farmers age, their participation in cooperatives' tea marketing increases, meaning that aged tea farmers prefer membership as it goes well with previous marketing experiences. These findings resonate with the study (Gashaw and Kibret, 2018).

Further, land size influences. The participation of the cooperative membership. This implies that, as farm sizes decrease, cooperative participation increases. Farmers prefer group membership as their smaller lands would be productive and profitable only in collaborative groups. Findings correspond to (Haile, 2016) in Ethiopia, who found that land size influences cooperatives' participation decisions, particularly on medium farms.

Additionally, market access, distances to the marketing centers, and Neighbour participation influence the decision to join the cooperatives. This implies that the availability of market access increases the involvement of cooperatives; this is supported by the increases in the distances to the market, whereby farmers in cooperatives can reduce transactions, particularly transport on collective responsibility. Neighbour participation is positively significant in that as farmers' awareness about social interaction increases, farmers would wish to be aware and involved like the Neighbors; hence, it is, it is possible to join the cooperatives to derive the associated benefits. These findings corroborate the findings by (Wu et al., 2023) in China, who found that social interactions influence cooperatives.

As shown in Table 5, columns (3) and (5) represent estimates for the second phase in the switching regression model for the effects of cooperatives on household income for tea farmers using cooperative marketing strategy and non-users, respectively. Positive and statistical significances are observed from the coefficients of the age of household and market access. This implies that age and marketing access correspond to cooperatives' household income effects. These findings resonate with study findings by (Grashuis and Su, 2019) that the age factor in the farmer's experiences in deciding reliable marketing and preferably cooperative impacts considerably on farmers' marketing and bargaining power. Further, the positive and significant determinants were observed in land size and household size. This implies that tea farmers with relatively large farms and larger household sizes impact farmers' incomes. This is because having a large farmer size requires more labor. Hence, larger household size influences participation and cooperative marketing. The findings correspond with the findings of (Mojo et al., 2017), who studied cooperatives' effects in Ethiopia, that household size matters in cooperatives' decisions and labor supply. Finally, negative and significant coefficients were observed in marketing access; as the marketing access decreases, it affects farmers' Income, as without proper markets, tea farmers get exploited by intermediaries and private entities(Kagira et al., 2012, Langford, 2021).

Table 3: Determinants of Cooperative membership and determinants of Income

Explanatory variables	Participation decision		Cooperative membership		Non -Members	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coeff	St. Err	Coeff	St. Err	Coeff	St. Err
Age	0.080***	0.020	-0.020***	0.016	-0.030*	0.015
Education	0.210	0.700	0.230	0.230	-0.141	0.42
Access to credit	0.050	0.198	0.001	0.125	-0.063	0.163
Tea plucking standard	-1.210	0.198	-0.172	0.253	0.073	0.229
Gender	0.070	0.285	-0.020	0.091	-0.080	0.180
Household's size	-0.030	0.080	0.043*	0.025	0.086	0.053
Land size	-0.281**	0.140	0.110**	0.050	0.120**	0.060
Experience	-0.020	0.020	0.001	0.007	0.016	0.014
Market Access	1.270***	0.369	-0.231*	0.131	-0.819**	0.328
Distance	1.252***	0.292				
Neighbour participation	0.680***	0.249				
Constant	-3.116**	1.207	12.823	0.358	12.595	0.594
Model Diagnostics						
Log-likelihood	-492.2389					
Number of obs	311					
LR test of Indep. eqns.	13.99***					
/lns1			-0.687***	0.070		
/r1			-1.299***	0.312		
/lns2					-0.690***	0.188
/r2					-1.051**	0.506

Notes: *** p<.01, ** p<.05, * p<.1

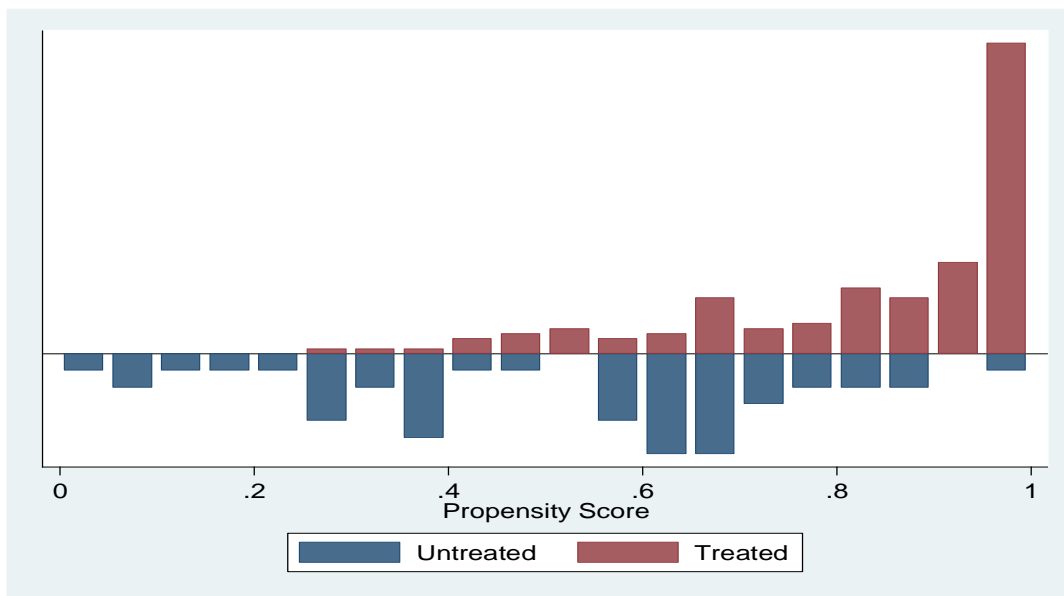## Impact of cooperative membership on household income

As shown in the table above, the ATT coefficients were positive and significant, suggesting that cooperative membership increases farm and household incomes regardless of the estimation model. Thus, the results confirm the estimated results of the ESR model and provide evidence that the results of this research are robust. The Average Treatment Effect on the Treated (ATT) and the Average Treatment Effect on the Untreated (ATU) helped quantify the treatment effect of cooperative membership on Income for households with and without membership. The Average Treatment Effect on the Treated (ATT) shows that families with cooperative membership experience a statistically significant increase in Income. The Income for households with membership stood at 9.91 compared to 9.42 for those without membership, representing a treatment effect

of 0.858. The standard error indicates the estimate's precision and the 8% change suggests a positive impact of cooperative membership on household income.

Similarly, the 0.591 Average Treatment Effect on the Untreated (ATU), with a standard error of 0.033, indicating a percentage change of 4.34, reveals a significant positive effect of cooperative membership on Income for households that were not initially treated. Thus, cooperative membership positively impacts income even for families that do not participate directly in cooperatives. This can be attributed to the collective bargaining power that cooperative members benefit from, enabling them to negotiate better prices for their products. This increases Income for individual households as they secure more favorable terms in the market.

Matching algorithm and quality Matching

According to (Caliendo and Kopeinig, 2008), quality matching is necessary for the matching algorithms to balance the propensity scores and ensure the matching is effective. We tested the balance by comparing the distribution of predicted propensity scores for cooperative members and non-member farmers.
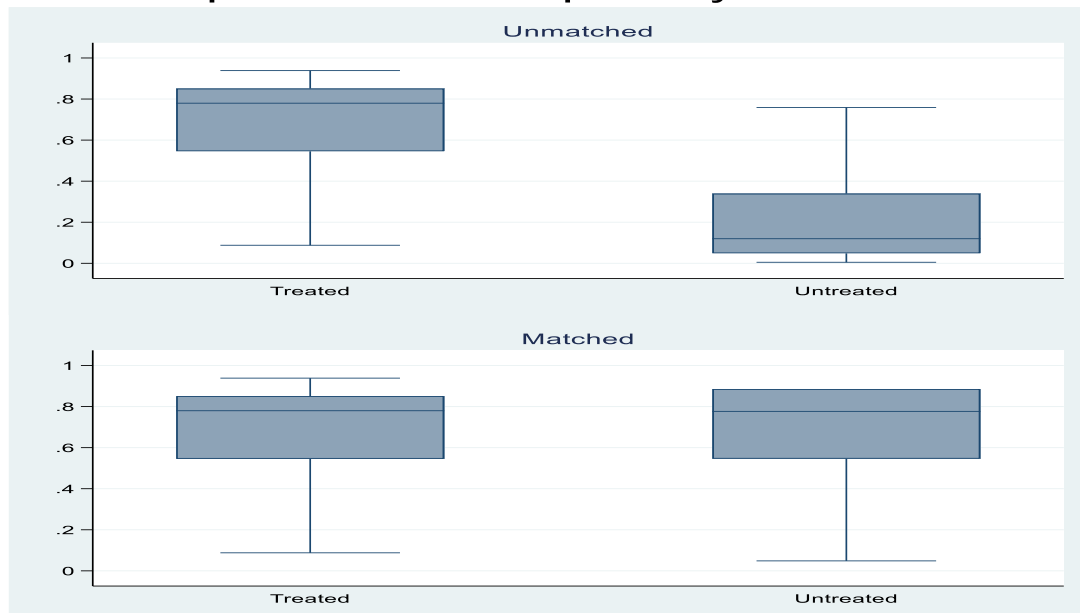

Figure 3: Distribution of estimated propensity scores across treatment and control groups

Table 4: Impact of cooperative membership on tea marketing household income

Treatment Effect	Cooperative participants	Non-participants	Coeff	St Err	% change
ESR ATT	9.91	9.42	0.858***	0.02	8
ATU	10.01	9.42	0.591***	0.033	4.34
PSM					
NNM	9.91	9.71	0.20	0.266	1.67
KM	9.91	9.73	0.18	0.258	1.85
RM	9.91	9.91	0.001	0.047	0.01

Note: ** and *** represent significance at 5% and 1% probability levels, respectively

Source: Own computation based on a survey (2023)

Robustness Checks

To ensure the robustness of our results, we employed the propensity score matching (PSM) method. Robustness testing is crucial to verify that our findings are consistent and not sensitive to the specific analytical methods used. Before performing the matching, we tested the balance of the propensity scores. The distribution of predicted propensity scores for member and non-member farmers indicates ample joint support for propensity scores among both groups (Fig. 3). Table 4. presents the estimated effects of cooperative membership on household income using nearest-Neighbour matching (NNM) and kernel-based matching (KBM) methods. Both methods consistently show that cooperative membership has a significantly positive impact on household income. PSM allows us to control for potential biases due to observable characteristics, ensuring that the observed effects are due to cooperative membership rather than other factors.

The consistency of the positive impact across different matching methods underscores the robustness of our findings. This robust evidence suggests that cooperative membership enhances tea marketing strategies, leading to higher household incomes for members. The findings are reliable and confirm that cooperative membership offers substantial economic benefits to farmers.

CONCLUSIONS

This study analyzed the impact of cooperative membership on smallholder tea farmers' participation decisions in Kericho County, Kenya, using household survey data collected between July and December 2023. The results indicate that cooperative membership significantly influences various socioeconomic factors among tea farming households. Older individuals and smaller families are more likely to join cooperatives, and smaller landholders also show a higher propensity for cooperative membership. Market access, distance, and the presence of neighbours or friends in cooperatives positively and significantly affect cooperative membership decisions. The findings highlight that cooperative membership has a positive spill-over effect on the Income of non-participating households due to the enhanced collective bargaining power that enables cooperative members to secure better prices for their products.

The econometric analysis further reveals that cooperatives provide an essential platform for resource sharing, knowledge exchange, and adopting best practices, collectively contributing to improved agricultural techniques, increased productivity, and higher member incomes. The study's treatment effects indicate that cooperative participants experience significant income gains compared to non-participants, as evidenced by the

coefficients from various matching methods (ESR, PSM, NNM, KM, and RM). Additionally, age, household size, land size, market access, and Neighbour participation significantly impact cooperative membership and income levels. The analysis underscores the pivotal role of cooperatives in fostering economic resilience and growth among smallholder tea farmers in Kericho County.

Smallholder farmers hold a significant portion of the Income-generating population from tea exports globally, given that Kenya is ranked the third largest producer of black tea. It is essential to address cooperatives beyond income increase, as shown in the rise of 8% for cooperative membership in marketing. It is important to fully consider how tea smallholder farmers, through cooperatives, can improve the social and economic conditions of tea farmers. This other key area entails facilitating access to resources, training, and markets, which collectively influence household income, living standards, education, and healthcare access. Policymakers, agricultural extension services, and development organizations should prioritize improving infrastructure, particularly road networks, to facilitate more accessible access to cooperatives in remote areas. Targeted initiatives informed by this study can bolster cooperative engagement among tea farmers and enhance their economic resilience through competitive tea marketing that values tea quality and sustainability.

RESEARCH LIMITATIONS

Finally, the study has implications for future research in that cross-sectional data was used to examine the impact of cooperative membership participation on marketing and the overall effects on household income. Therefore, future studies using panel data around this subject are encouraged to corroborate our findings in this study. Additionally, since the data are self-reported by respondents, there is potential for varied perceptions and biases in their answers. These limitations should be acknowledged to provide a more comprehensive understanding of the study's implications. Nevertheless, given the robust empirical strategy and the absence of empirical evidence, this study provides valuable insights into understanding how cooperative membership acting as a collective bargaining platform improves and eases tea marketing of smallholder farmers.

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