



FOLUR
Food • Land Use • Restoration
ETHIOPIA

**Preventing Forest Loss, Promotion Restoration and
Integrating Sustainability into Ethiopia's Coffee Value
Chains and Food Systems:**

FOLUR-Ethiopia

Baseline Study Report

Green Development Pathway Consulting (GDPC) PLC



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Summary

The Food Systems, Land Use, and Restoration (FOLUR) project in Ethiopia seeks to promote sustainable practices in coffee value chains while addressing deforestation and land restoration. Ethiopia, as the birthplace of coffee, plays a vital role in global coffee markets and environmental sustainability. The sector contributes over 50% of the nation's export revenue and supports 25% of the population. However, despite growth in production, this has largely been due to land expansion rather than productivity improvements. Smallholder farms dominate the sector, with 95% of coffee grown on plots of less than two hectares. To enhance productivity and ensure sustainability, the Ethiopian Coffee and Tea Authority (ECTA) is implementing strategies such as quality-focused marketing systems, vertical integration, and a National Coffee Strategic Plan. These initiatives aim to increase production, support smallholders, and conserve Ethiopia's unique biodiversity.

The study used a descriptive research design to establish a baseline for socio-economic, demographic, and environmental variables in four coffee-producing regions: Oromia, Sidama, South Ethiopia, and Southwest Ethiopia. Data collection involved surveys, interviews, and focus group discussions across 22 project woredas, covering 3,378 households. The study employed multi-stage sampling techniques and systematic random sampling to ensure representative findings. Data analysis included descriptive and inferential methods, providing insights into land use, income sources, demographic characteristics, and coffee production patterns.

Key findings reveal significant regional disparities. Sidama leads in productivity, with households earning the highest income from coffee, while Southwest Ethiopia, despite larger landholdings, struggles with lower yields. Oromia and South Ethiopia exhibit diverse production systems but face challenges related to market access and sustainability. Education levels, gender roles, and marketing practices influence productivity and household incomes, highlighting the need for region-specific interventions.

To address these challenges, the FOLUR project should prioritize enhancing coffee productivity by scaling best practices from high-performing regions such as Sidama. Expanding cooperative networks and specialty coffee markets will provide better revenue opportunities for smallholder farmers. Additionally, integrating agroforestry and sustainable farming practices will conserve biodiversity and ensure the long-term viability of coffee farming. These efforts will not only boost farmer incomes but also contribute to Ethiopia's leadership in sustainable coffee production.

1 Chapter One: Introduction

The Food Systems, Land Use, and Restoration (FOLUR) project in Ethiopia is a key initiative designed to promote sustainable practices in agriculture, forestry, and land management. With its rich biodiversity and significant agricultural potential, Ethiopia plays a critical role in global food security and environmental sustainability efforts. Coffee, a cultural and economic cornerstone of the country, is central to these objectives. As the birthplace of coffee, Ethiopia is renowned for its diverse varieties, distinct flavors, and deep-rooted traditions of cultivation. The coffee sector is a vital component of the Ethiopian economy, contributing more than half of the nation's export revenue and supporting nearly 15 million households. Approximately 25% of the population is engaged in coffee production, processing, and marketing, highlighting its importance as a livelihood source (ECTA, 2018)¹.

The coffee sector in Ethiopia is predominantly smallholder-based, with 95% of production occurring on farms averaging less than 2 hectares (Mitiku et al. 2017²). Production systems are diverse, including forest coffee, semi-forest coffee, garden coffee, and plantation coffee. Over the years, Ethiopia's coffee production has steadily increased, rising from 180 million tons in 1993 to 471 million tons in 2017. This growth, however, has been driven more by land expansion than productivity gains, as yields have remained relatively unchanged. Ethiopia has an additional 5.47 million hectares of land potentially suitable for coffee cultivation, underscoring its capacity for further expansion (ECTA, 2018).

Coffee is Ethiopia's largest export commodity, generating over \$1.3 billion annually (International Coffee Organization, 2023). Smallholder farmers, who produce 95% of Ethiopia's coffee, generate up to 60% of their household income from coffee (FAO, 2021). However, climate

¹ Ethiopian Coffee and Tea Authority. 2018. Ethiopia Coffee sector policy reform. Ethiopian Coffee and Tea Authority.

² Mitiku, F., Mey, Y., Nyssen, J., & Maertens, M. (2017). Do Private Sustainability Standards Contribute to Income Growth and Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia. MDPI, Basel, Switzerland

change and price volatility pose risks, with studies projecting a 40-60% decline in suitable coffee-growing areas in Ethiopia by 2050 (Moat et al., 2017). The sector also exhibits low productivity (0.7–0.8 tons/hectare compared to the global average of 1.5 tons) due to limited access to inputs and technology (USAID, 2022). Thus, to ensure the long-term sustainability of coffee farming, it is critical to focus on enhancing productivity and quality while preserving biodiversity.

Ethiopia has taken significant steps to transform its coffee sector, with efforts led by the Ethiopian Coffee and Tea Authority (ECTA). Re-established in 2016, ECTA aims to double coffee production, rejuvenate aging coffee plants, and maximize quality to increase foreign exchange revenue and farmer incomes. The authority is currently developing a National Coffee Strategic Plan and Roadmap to improve key areas, including research, production, processing, value addition, and marketing. Moreover, new directives encouraging vertical integration and direct marketing of quality-certified coffee aim to replace the flat-price system, which disincentivizes quality and productivity. By rewarding premium coffee production, these measures seek to enhance smallholder incomes and ensure a more equitable value chain.

A crucial strategy to stabilize the agricultural frontier involves maintaining smallholder coffee farms' profitability and sustainability. When farmers produce high-quality coffee that commands better prices, they are more likely to protect their coffee farms, adopt agroforestry practices, and contribute to biodiversity conservation. Initiatives that enhance quality, traceability, and recognition of Ethiopian coffee in specialty markets are vital for improving export revenues and smallholder livelihoods while preserving the country's rich biodiversity. Projects promoting sustainable coffee production are essential for ensuring food security and maintaining Ethiopia's unique coffee species and ecosystems.

The success of sustainability-focused projects, such as FOLUR, depends on well-designed strategies that actively engage key stakeholders, particularly smallholder farmers in the coffee value chain. A comprehensive baseline assessment is vital for achieving this goal. It provides a thorough understanding of the socioeconomic characteristics of coffee-producing households,

including gender roles, economic status, and land use patterns. It also evaluates livelihoods, technology adoption rates, and perceptions of climate change, ensuring that interventions are aligned with household capacities and needs. Furthermore, baseline studies establish benchmarks for key indicators such as crop yields, income levels, and biodiversity, enabling the measurement of project impact over time. By fostering stakeholder participation and addressing critical issues in the coffee value chain, the FOLUR project can effectively prevent forest loss, promote restoration, and integrate sustainability into Ethiopia's coffee sector. This will not only enhance farmer livelihoods but also reinforce Ethiopia's global reputation as a leader in high-quality, sustainable coffee production.

Increasing the productivity of smallholder coffee farms and establishing reliable market channels for better prices is crucial for sustaining coffee production in Ethiopia. When farmers produce higher-quality coffee and earn better incomes, they are more likely to protect and maintain diverse coffee farms, expanding agroforestry systems that contribute to the conservation and restoration of Ethiopia's rich and biodiverse landscapes. Therefore, a key strategy for stabilizing the agricultural frontier is ensuring that coffee farms remain profitable and sustainable, with improvements in quality and access to specialty markets. Initiatives that focus on enhancing the quality, traceability, and recognition of Ethiopian coffee play a critical role in increasing export revenues, improving smallholder farmers' incomes, and ensuring food security while preserving the country's biodiversity.

Projects promoting the sustainability of coffee production are fundamental not only for improving livelihoods but also for conserving coffee species and ecosystems. The success of these projects hinges on how they are designed, particularly their engagement with key stakeholders—especially smallholder farmers—along the coffee value chain. Active participation of these stakeholders ensures long-term sustainability and continuity of such initiatives. To prevent forest loss, promote restoration, and integrate sustainability into the coffee value chain, it is essential to understand the socio-economic conditions of coffee-producing households. This includes examining their

livelihoods, land use practices, technology adoption rates, and vulnerability to climate change, as these factors directly influence their ability to adopt modern farming practices and adapt to changing climatic conditions.

A baseline study focused on these aspects is essential for the FOLUR Ethiopia project, which aims to prevent deforestation, promote restoration, and create sustainable coffee value chains. This study gathers data on community structures, gender roles, economic conditions, agricultural practices, crop yields, and the use of both timber and non-timber forest products (NTFPs), providing valuable insights into the challenges and opportunities within Ethiopia's coffee sector. Additionally, by examining the adoption of modern technologies and climate change perceptions, the study informs strategies to enhance resilience, boost coffee quality, improve market access, and increase farmer incomes. This baseline also provides benchmarks for tracking the project's progress and measuring its impact over time, ensuring adaptive implementation that supports both environmental sustainability and economic growth for Ethiopian coffee farmers.

2 Chapter Two: Methodology

2.1 Study Design

The **study design** used in this study helped to conduct research in a systematic way. This survey produced baseline data using descriptive types of research design and collected cross-sectional data from coffee growing and other households. In this regard, the study inculcates the major features of socio-economic characteristics of households together with other important variables in coffee growing households in four regions.

2.2 Sampling frame and sampling size

The baseline study uses multiple stage sampling techniques. Four regional states namely Oromia, Sidama, South Ethiopia, and Southwest Ethiopia were purposely selected since the project is implemented in these regions, which are renowned places for coffee production. Nine zones namely Bench Sheko, Buno Bedele, Gedio, Illuababor, Jimma, Kaffa, Sidama, West Arsi, and West Guji have been included in the second stage. These zones have been already identified by the project for future interventions.

The sample size determination formula developed by Kochran (1977) was used to estimate the sample size. The presentation of the sample size determination follows as given below.

$$n = \frac{Z^2 pq}{d^2}$$

To obtain the maximum possible sample size from each woreda, we used $p=0.5$. This reduces the biases emanating from small sample size. Since the population is finite for each woreda, we used a finite sample size selection for each woreda using the following formula to obtain the actual sample size.

$$n_s = \frac{n}{1 + \frac{n}{N}}$$

Where n_s is the actual sample size considered in this survey. N is the total population in each woreda.

The baseline study covered 22 project woredas found in 9 zones of Oromia, Sidama, Southwest Ethiopia, and South Ethiopia. Sample size for quantitative household survey had been in the estimate of 3,040 HHs (380 HHs per zone on average). However, this figure has been changed after application of relevant sample size determination models and the data size has increased to 3378.

The baseline study has focused on collecting and analyzing data about community structures, gender roles, economic and life status, land use and holdings, crop production and yields, livestock production and yields, use of timber and non-timber forest products (NTFPs), household businesses and incomes, vulnerability to climate change.

2.3 Sampling technique

Systematic random sampling techniques were used to select representative households. In this regard, all households in the kebele were listed and a systemic random sampling technique was used to select the sample. Data for this study was collected through a combination of methods, including a well-structured questionnaire, and secondary data review. The survey questionnaire was developed using Kobo Toolbox and administered via smartphones using ODK Collect, ensuring efficient data capture. For the woreda-level KIs, a guide was created using Google Forms, and the interviews were also conducted and collected through smartphones. All collected data was subsequently fed into a tablet for analysis, providing a comprehensive and streamlined approach to data gathering. Extensive survey questionnaires were developed to collect crucial. This was done after identifying preliminary variables and conducting data research.

Following a two-day training session, the study assigned 62 data collectors and 8 supervisors. Subsequently, a one-day pilot survey was promptly conducted in Jimma and Hawassa to verify the questionnaire. The enumerators and supervisors are highly skilled professionals who gather data under strict supervision, resulting in the production of high-quality data. Every stage of the survey process was meticulously considered to ensure the production of valid and reliable results. To generate the baseline output, the process begins with data entry, cleaning, and processing. To

prevent data falsification, all necessary checks were carried out at every stage, both in the office and in the field. Data collectors were tracked using GIS and the length of time they spent in each household has been recorded.

Additionally, the collected data were analyzed using a combination of descriptive and inferential statistical methods to provide a comprehensive understanding of findings of the study. Furthermore, detailed interpretations of the findings were carried out to emphasize their practical implications, ensuring that the results could inform actionable strategies. The data analysis was performed using STATA software, version 14. This comprehensive approach allows understanding of the data, supporting informed decision-making and targeted interventions.

3 Chapter Three: Baseline Results

3.1 Demographic characteristics at Regional Levels

The sociodemographic characteristics of households in the selected regions, namely Oromia, Sidama, South Ethiopia, and Southwest Ethiopia were analyzed. The results show that the four regions are statistically different at 1 % in terms of demographic characteristics. Accordingly, the average age of households' heads differs significantly across regions, with the highest age is recorded in South Ethiopia (47.93 years) followed by Oromia (45.19). Sidama (42.5) and Southwest Ethiopia (43.36) have slightly younger household heads compared to the overall average of 44.75 years.

Household family size differs across the regions, with Oromia having largest average household size (7.39) followed by South Ethiopia (7.19), both are above the overall average of 6.9 members. On the other hand, Sidama and Southwest Ethiopia have smaller household size of 6.52 and 6.50 members, respectively. The results of the landownership status of households also show that the proportion of land-owning households ranges from 95 to 100% in each region, aligning closely with the overall average of 99%. The average land size held by households, however, varies significantly: Southwest Ethiopia has the largest average land size per household (2.69 hectares), far exceeding the overall average of 1.78 hectares, whereas Sidama has the smallest (1.15 hectares) and the result is statistically significant at 1 percent ($p < 0.01$).

Table 1: Sociodemographic characteristics of respondents in the study regions

Sociodemographic Variables	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Age [Years]	45.19	42.50	47.93	43.36	0.0000	44.75
Household (HH) Size [No.]	7.39	6.52	7.19	6.50	0.0000	6.90
Land Ownership [Proportion]	0.95	1.00	1.00	0.99	0.0000	0.99
Land Size (Hectares)	1.94	1.15	1.34	2.69	0.0000	1.78

Source: Survey(2024)

The education levels of household heads across regions also show statistically significant difference ($p = 0.000$). As indicated in Table 1, illiteracy rates are highest in Southwest Ethiopia, where 34% of household heads are illiterate, significantly above the total average of 21%. Conversely, household heads in Sidama have a lower illiteracy rate at 13%. The proportion of household heads with primary education is highest in South Ethiopia (57%), exceeding the overall average of 51%, while Southwest Ethiopia has a lower percentage of primary-educated household heads (43%). Secondary education levels vary slightly, with Sidama showing a higher average proportion of secondary-educated household heads (19%) than the overall rate of 15%. The attainment of diploma-level education or higher is relatively low across all regions, but Sidama (9%) surpasses the overall average of 5%.

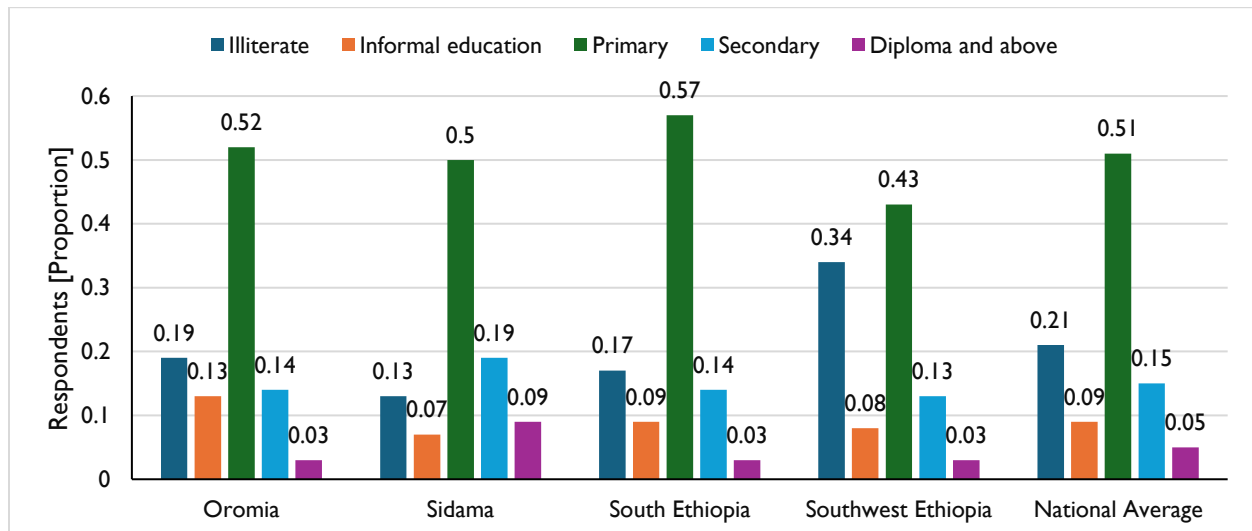


Figure 1: Education status of the study regions

Source :Survey(2024)

Figure 2 displays the results of gender and marital status of household heads in the four regions. The result shows statistically significant differences among regions on the gender of household heads ($p < 0.01$). Among the respondents, 93 percent of households in Oromia and 90 percent of households in Southwest Ethiopia (90%) are male headed, which is marginally higher than the overall average of 88%. Meanwhile, Sidama (81%) has a notably lower percentage of male-headed households. In the same way, the results of the survey in general showed that the lion's share of

households (more than 90 %) are married in all regions but with significant difference across the four regions ($p = 0.010$). In this regard, both Oromia and Sidama have the highest rates of married households, each at 96%, which is slightly above the total average of 94%. In contrast, South Ethiopia has the lowest rates of married households (92%), slightly below the total average.

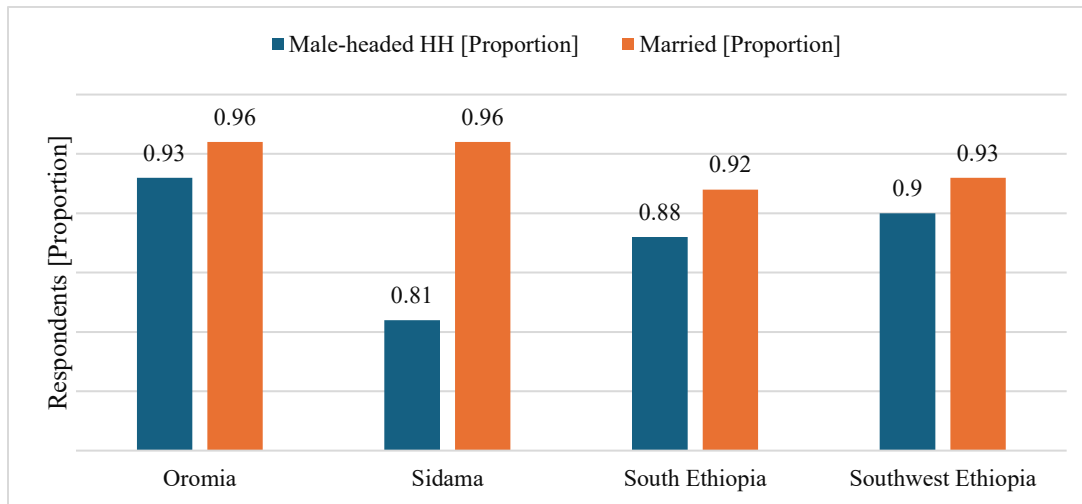


Figure 2: Gender and Marital status of respondents in the study regions

Source :Survey(2024)

3.2 Demographic characteristics at Zonal Levels

The demographic characteristics of households across the nine zones were also examined. All sociodemographic characteristics of households across Bench Sheko, Buno Bedele, Gedio, Illuababor, Jimma, Kaffa, Sidama, West Arsi, and West Guji revealed statistically significant differences at 1 percent (Table 3). For instance, the average age of the head of the household is the highest in Bench Sheko (40.2 years) and is the lowest in Gedio (47.9 years). Household sizes also differ significantly, with the largest average sizes in West Arsi and West Guji (8.4 members each) and the smallest in Illuababor (4.6 members). Land ownership rates of households reveal high degree of similarity, with most zones reporting around 90% ownership; however, Gedio, Sidama, and West Guji have a full 100% ownership rate. The average land size owned differs substantially across zones, with Bench Sheko and Buno Bedele having larger land sizes (3.0 and 3.1 hectares, respectively), while Illuababor has the smallest average land size with 0.9 hectares.

Table 2: Sociodemographic characteristics of respondents at zone level

Sociodemographic characteristics	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Age [Years]	40.2	44.1	47.9	46.5	46.1	46.5	42.5	44.1	45	0
Household (HH) Size [No.]	6.6	7.1	7.2	4.6	6.7	6.4	6.5	8.4	8.4	0
Land Ownership [Proportion]	0.9	0.9	1	0.8	0.9	0.9	1	0.9	1	0
Land Size (Hectares)	3	3.1	1.3	0.9	1.9	2.4	1.1	1.5	2.1	0

Source :Survey(2024)

Figure 3 also shows that the education level of household heads is significantly different across zones ($p < 0.01$). Illiteracy rates are highest in Kaffa (35%) and lowest in West Guji (12%). Informal education rates are relatively low across zones, but Jimma stands first with 29% of household heads having informal education only. Completion rates of primary education are highest in Buno Bedele (70%) and lowest in Jimma (38%). A completion rate of secondary education goes as low as 1 percent in Kaffa and is above 15 percent in Illuababor, Sidama, West Arsi, Bench Sheko and West Guji. The completion rates of higher education levels (diploma and above) are less than 5 percent in all zones except Sidama where the corresponding figure is 9% (Table 3).

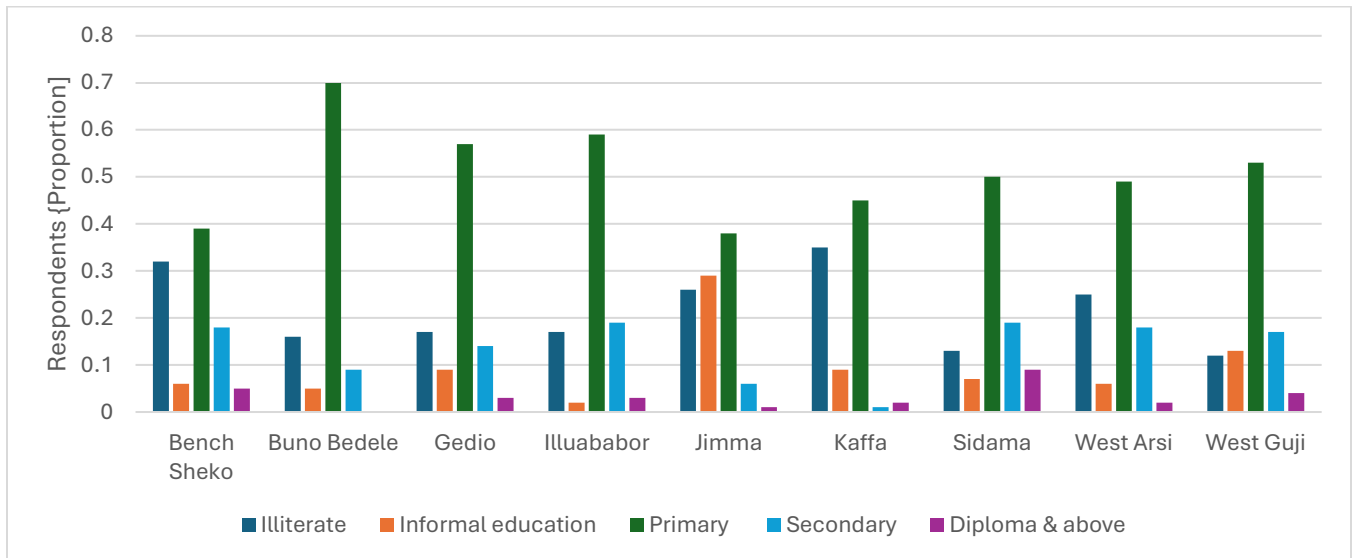


Figure 3: Gender and Marital status of respondents in the study's worda

Source : Survey(2024)

Gender of household head and marital status of respondents also vary across zones (Figure 1.). The result shows that the proportion of male-headed household is 90 percent in all zones except Sidama where 80 percent of the households are male headed. In the same pattern, marital status among household heads also exhibits similar figures across zones, where almost all zones reported that 90 percent of households are married.

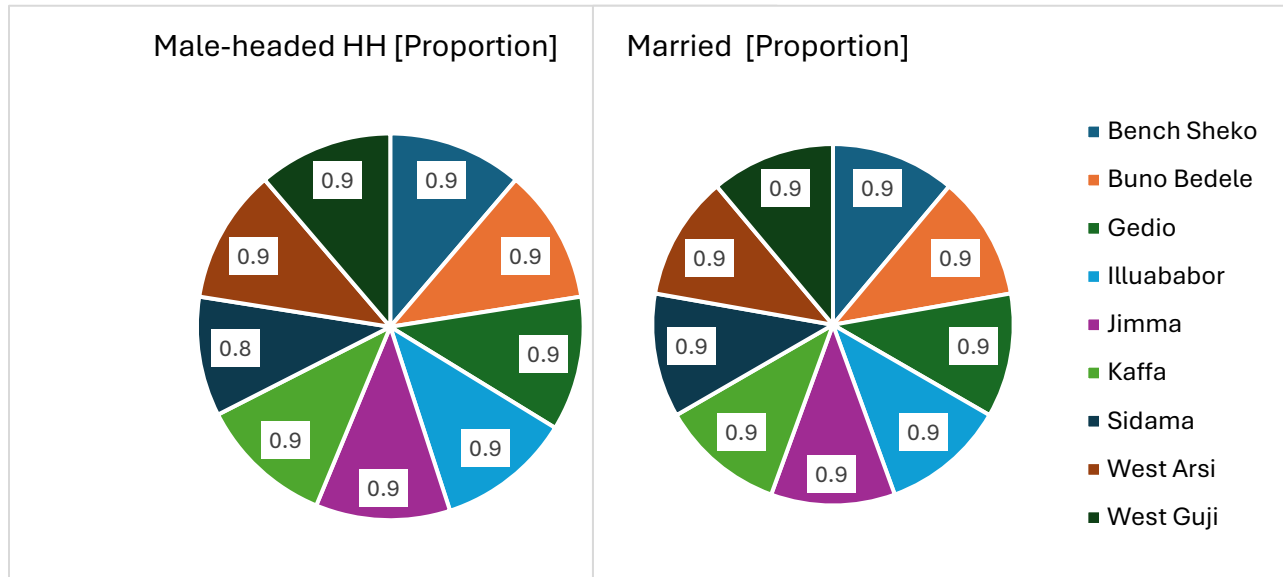


Figure 4: Gender and Marital status of respondents at zonal levels

Source: Survey (2024)

4 Income and Livelihood Characteristics

4.1 Income and Livelihood Characteristics at Regional levels

In this study, income refers to the financial earnings that farmers generate from various sources including agricultural activities. These include revenue from the sale of crops (such as coffee, maize, or teff), livestock products (milk, meat, or eggs), non-timber forest products (such as honey or spices), and other farm-related activities. It may also include supplemental income from non-agricultural sources, such as small-scale businesses, casual labor, or remittances. Income levels for rural farmers are often influenced by factors such as market access, productivity, crop quality, land size, and seasonal variability in agricultural outputs. Furthermore, livelihoods encompass the broader set of resources, activities, and strategies that enable respondents (farmers) and their households to sustain their daily needs and improve their well-being. This includes not only their income but also access to basic social services.

The income and livelihood characteristics of households were analyzed, revealing that agriculture serves as the primary economic activity across the four regions. In this regard, Table 4 presents level of income with their respective sources in each region. The mean income sources in the studied regions show substantial differences across regions ($p < 0.01$). In terms of agricultural income, Sidama has the highest mean crop income of ETB 3,218.30, substantially exceeding the total average of ETB 2,160.09. Oromia and Southwest Ethiopia also have crop incomes close to the total average, while in South Ethiopia the lowest at ETB 1,253.61 was recorded. Regarding coffee income, Sidama and Oromia exhibit significantly higher mean income, with means of ETB 11,449.00 and ETB 9,895.00, respectively, above total average of ETB 8,026.50. Conversely, South and Southwest Ethiopia show much lower coffee incomes of 5,520.00 ETB.

In livestock-related income, Sidama again has the highest level of income from animal sales (ETB 1,831.00), followed by Southwest Ethiopia, Oromia, and South Ethiopia, all falling closer to total average of ETB 1,345.25. The income from milk and dairy products shows similar patterns with

Southwest Ethiopia has the highest milk and related product income (ETB 476.00) and remains the only region above the total average of ETB 257.00.

Households also obtain income from forest products. The result shows that forest-related incomes also reflect statistically significant difference across regions ($p < 0.01$). Sidama has the highest mean firewood income of ETB 237.00, far above the total average of ETB 126.50, while Southwest Ethiopia has the lowest mean firewood income (ETB 24.00). Sidama also leads in timber related income (ETB 147.00), significantly higher than the total average of ETB 64.50, while the other regions show lower and relatively similar timber incomes. Significant difference is also noted in non-timber forest product income, with Southwest Ethiopia's ETB 218.67 notably exceeding the total average of ETB 74.16.

Household obtain income from wages, remittance and other income sources. In this regard, Sidama and South Ethiopia report the highest mean wage incomes of ETB 680.00, surpassing the total average of ETB 470.75, whereas Southwest Ethiopia falls substantially below the total average (155.00). Remittance income does not vary significantly among regions, with all values near the total average of ETB 333.15. However, other income sources such as miscellaneous earnings show substantial difference at regional levels, with Oromia (ETB 1,637.03), above total average of ETB 761.32, while Southwest Ethiopia has the lowest mean income of ETB 284.40.

Table 3: Income and livelihood characteristics (Region level)

Income	Descriptions	Oromia	Sidama	South	Southwest	Sig.	Total
Agriculture Income	Crops Income [ETB]	1,999.65	3,218.30	1,253.61	2,168.78	0.000	2,160.09
	Coffee[ETB]	9,895.00	11,449.00	5,242.00	5,520.00	0.000	8,026.50
	Animal Sale [ETB]	1,369.00	1,831.00	770.00	1,411.00	0.002	1,345.25
	Milk & Dairy Products	209.00	180.00	163.00	476.00	0.092	257.00
Forest- Related Income	Firewood [ETB]	99.00	237.00	146.00	24.00	0.000	126.50
	Timber [ETB]	48.00	147.00	34.00	29.00	0.012	64.50
	Non-Timber Forest	23.20	39.80	14.95	218.67	0.000	74.16
Other Sources of Income	Wage Income [ETB]	368.00	680.00	680.00	155.00	0.000	470.75
	Remittance [ETB]	981.13	108.33	162.76	80.36	0.384	333.15
	Other Income [ETB]	1,637.03	647.01	476.84	284.40	0.000	761.32

Source: Survey (2024)

4.2 Income and Livelihood Characteristics at zone levels

Table 5 shows the mean income levels across zones for various income sources. The result shows that there are statistically significant differences on various income categories across regions. For instance, agricultural income is the highest in Sidama Zone with a mean crop income of ETB 3,218, followed by West Arsi Zone (ETB 2,907) and Bench Sheko Zone (ETB 2,835). The crop income is lowest in Gedio Zone at ETB 1,253. Likewise, coffee income varies across zones, with West Guji Zone obtaining the highest income (ETB 17,196) followed by Buno Bedele Zone (ETB 12,062) and Sidama Zone (ETB 11,449). Animal sale income also shows significant difference, with West Arsi Zone exhibiting the highest (ETB 2,163) and Illuababor Zone reported the lowest (ETB 633) ($p < 0.01$). Milk and dairy products income is the highest in Bench Sheko Zone at ETB 815, followed by Buno Bedele Zone with at ETB 509, whereas Illuababor Zone reports the lowest dairy income of ETB 79. This income difference is significant at 1 %.

Forest-related incomes also exhibit significant differences across regions with 1 percent level of significance. In this regard, firewood income is the highest in Sidama Zone (ETB 237), whereas Buno Bedele Zone accrues almost no income from this source (ETB 3). Timber income also varies across regions, with Sidama Zone and West Arsi Zone obtained the highest income of ETB 147 and ETB 154, respectively, and Bench Sheko and Illuababor Zones fetched the minimal values (Table 6). Non-timber forest product income is notably highest in Bench Sheko Zone (ETB 302), while all other regions fall well below total average.

Households fetch income from other sources including wages, remittance and other sources. Toward this end, the results of the survey revealed that wage income is the highest in Sidama Zone (ETB 680), followed by Jimma Zone (ETB 645). Remittance income of households is the highest in Jimma Zone (ETB 3,338) followed by Buno Bedele (ETB 465) and West Arsi (ETB 407), whereas households in Bench Sheko (ETB 87.8) and Kaffa zones (ETB 72.9) obtained the lowest amount of remittance. Likewise, other income varies considerably, with Buno Bedele Zone at the top (ETB 5,755) and Kaffa Zone the lowest (ETB 88.80).

Table 4: Income of households by source (in Birr)

Income Sources	Description	Bench Sheko Zone	Buno Bedele Zone	Gedio Zone	Illuababor Zone	Jimma Zone	Kaffa Zone	Sidama Zone	West Arsi Zone	West Guji Zone	Sig.
Agricultural Income	Crops Income	2,835.00	1,660.00	1,253.00	1,761.00	1,784.00	1,505.00	3,218.00	2,907.00	1,882.00	0.000
	Coffee	8,739.00	12,062.00	5,242.00	5,267.00	6,049.00	2,316.00	11,449.00	1,897.00	17,196.00	0.000
	Animal Sale	1,890.00	1,634.00	770.00	633.00	1,078.00	934.00	1,831.00	2,163.00	1,317.00	0.000
	Milk & Dairy	815.00	509.00	163.00	79.00	88.00	139.00	180.00	187.00	241.00	0.000
Forest Related	Firewood	14.00	3.00	146.00	9.00	36.00	34.00	237.00	185.00	160.00	0.000
	Timber	54.00	-	34.00	39.90	27.00	4.38	147.00	154.00	29.80	0.010
	Non-Timber Forest Products	302.00	56.40	14.90	67.60	18.30	135.00	39.80	4.46	10.00	0.000
Other Sources of Income	Wage Income	223.00	81.10	250.00	489.00	645.00	88.30	680.00	489.00	183.00	0.000
	Remittance	87.80	465.00	162.00	145.00	3,338.00	72.90	108.00	407.00	170.00	0.060
	Other Income	480.00	5,755.00	476.00	1,049.00	1,504.00	88.80	647.00	767.00	953.00	0.000

Source: Survey (2024)

5 Expenditure characteristics

5.1 Expenditure characteristics of households at regional levels

The expenditure pattern of households plays paramount importance to visualize the welfare of households. The key expenditure of households comprises food and nonfood components. The nonfood components include alcohol, transport, social contribution, health, firewood, school, tax and other components (cloth, shoes etc.). The result shows that except for Sidama regional states, food expenditure of households is greater than the corresponding non-food expenditure. This is evidenced by the fact that the share of food expenditure reaches as high as 65 percent in southern Ethiopian and goes as low as 35 percent in Sidama regional states. The other two regions have comparable shares of food expenditures.

Table 6 exhibits the food and non-food expenditure of households in the four regions. The result revealed that Southwest Ethiopia has the highest average food expenditure with ETB 6,354.09, significantly above than the total average of ETB 5,239.42, while Sidama's household registers the lowest food expenditure of ETB 3,164.62. Oromia and south Ethiopia regional states have comparable food expenditures, which are close to the total average (Table 7). These regional differences in food expenditure are statistically significant at 1 percent.

The non-food expenditure components of households comprise a range of goods and services. The result in general shows that the four regions have different expenditure patterns. For instance, alcohol spending is the highest in Southwest Ethiopia (ETB 630.66) and lowest in Sidama

(ETB 104.97). The average expenditure of households on alcohol is nearly ETB 372. Transport expenditure (ETB 850.40) is the highest in Oromia which is slightly above the total average of ETB 749.07) followed by Southwest Ethiopia (ETB 825.36), whereas South Ethiopia has the lowest average (ETB 519.49).

Social contribution is one of the biggest components of nonfood expenditure in the four regions. In this regard, the result exhibits significant difference across regions, with Sidama having the highest expenditure of ETB 1,175.85, while Southwest Ethiopia spends the least (ETB 461.89). Health expenditures are particularly high in Southwest Ethiopia at ETB 1,984.44, and is the lowest in South Ethiopia at ETB 288.98.

Firewood is the main sources of energy in Ethiopia. As a result, households expend significant portion of their income on firewood. The result reveals that firewood expenditure is the highest in Southwest Ethiopia (ETB 580.10) and is the lowest in Oromia (ETB 437.86), with the total average of ETB 493.84. School expenditure is above the total average of ETB 661.35 in Sidama (ETB 980.79) and lowest in South Ethiopia (ETB 461.55). Tax payments per household varies significantly; with Sidama paying the highest tax at household level (ETB 474.26), which is higher than the total average of ETB 309.24, whereas South Ethiopia has the lowest tax expenditure per household (ETB 154.51). Other expenditures are considerably higher in Sidama (ETB 1,171.76), above the total average of ETB 599.63, while Southwest Ethiopia has the lowest corresponding figure (ETB 234.76).

Table 5: Food and non-food expenditures across regions (in Birr)

Expenditure Characteristics	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Food Expenditure [ETB]	5,568.40	3,164.62	5,870.58	6,354.09	0.000	5,239.42
Nonfood Expenditure						
Alcohol	423.35	104.97	329.48	630.66	0.000	372.12
Transport	850.40	801.04	519.49	825.36	0.000	749.07
Social Contributions	527.37	1,175.85	559.73	461.89	0.000	681.21
Health	784.11	765.65	288.98	1,984.44	0.000	955.80
Firewood	437.86	506.99	450.42	580.10	0.008	493.84
School	660.55	980.79	461.55	542.52	0.000	661.35
Tax	318.24	474.26	154.51	289.96	0.000	309.24
Other	543.13	1,171.76	448.87	234.76	0.000	599.63
Total Non-Food expenditure	4545.01	5981.31	3213.03	5549.69		
Share of food expenditure	0.55	0.35	0.65	0.53		0.52

Source: Survey (2024)

5.2 Expenditure characteristics of households at zonal levels

Food and nonfood expenditure as zonal level has been examined. The result is summarized at Table 7. The result revealed that there are significant differences in both food and nonfood spending across zones. Food expenditure is notably highest in Kaffa (7,461 ETB) and West Arsi (6,724 ETB), while Sidama reports the lowest expenditure (3,164 ETB).

Regarding non-food expenditure, alcohol expenditure is also significantly different across zones, with Bench Sheko spending the most (819 ETB) and Sidama spending the least (104 ETB). Transport expenditure shows a similar trend, with Jimma spending the highest (1,284 ETB), while Gedio and Illuababor report the lowest figures (519 ETB and 641 ETB, respectively). Social contributions also reveal considerable differences, with Sidama spends the highest (1,175 ETB); while Illuababor spends the least (110 ETB).

Health expenditure is highest in Bench Sheko (2,499 ETB), whereas Gedio spends the least (288 ETB). Firewood expenditure is highest in Kaffa (834 ETB), while Jimma has the lowest expenditure (159 ETB). School expenditures are relatively high in West Guji and Sidama (982 ETB and 980 ETB, respectively), while Illuababor spends the least (281 ETB), potentially indicating

differences in educational costs or priorities. Tax expenditures also vary, with Sidama and Kaffa reporting higher amounts (474 ETB and 312 ETB, respectively). Finally, other expenditure is the highest in Sidama (1,171 ETB) and the lowest in Illuababor (114 ETB).

Table 6: Food and non-food expenditures (Zone level)

Expenditure	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Food Expenditure [ETB]	5,241.00	4,740.00	5,870.00	4,628.00	6,294.00	7,461.00	3,164.00	6,724.00	5,107.00	0.000
Nonfood Expenditure										
Alcohol [ETB]	819.00	402.00	329.00	219.00	500.00	442.00	104.00	232.00	542.00	0.000
Transport [ETB]	1,146.00	697.00	519.00	641.00	1,284.00	505.00	801.00	649.00	786.00	0.000
Social Contributions [ETB]	638.00	595.00	559.00	110.00	401.00	286.00	1,175.00	827.00	575.00	0.000
Health [ETB]	2,499.00	1,289.00	288.00	981.00	761.00	1,472.00	765.00	783.00	562.00	0.000
Firewood [ETB]	324.00	195.00	450.00	627.00	159.00	834.00	506.00	543.00	587.00	0.000
School [ETB]	752.00	500.00	461.00	281.00	495.00	333.00	980.00	592.00	982.00	0.000
Tax [ETB]	267.00	171.00	154.00	109.00	390.00	312.00	474.00	355.00	370.00	0.000
Other [ETB]	342.00	967.00	448.00	114.00	454.00	127.00	1,171.00	372.00	684.00	0.000

Source: Survey (2024)

6 Access to basic social services

6.1 Access to basic social services at Regional Levels

The data reveal significant regional disparities in access to basic social services across four Ethiopian regions, with statistically significant differences ($p \leq 0.05$) for all services. Oromia and Southwest Ethiopia generally exhibit longer travel times compared to Sidama and South Ethiopia. For instance, accessing a main road takes nearly 88 minutes in Oromia but it takes only 16 minutes in South Ethiopia, while accessing financial institutions require 146 minutes in Southwest Ethiopia, which is over 40 minutes longer than the next highest region (Oromia). Notably, Sidama and South Ethiopia show relatively better access to health (38–44 minutes) and education (26–35 minutes). The extreme high average values for health services (126 minutes) and financial institutions (425 minutes) suggested severe accessibility challenges, skewing national averages.

These disparities highlight inequities in infrastructure development and resource allocation. Longer travel times in Oromia and Southwest Ethiopia may results in socio economic impediments. Addressing these gaps is vital for equitable development, as prolonged travel times hinder economic participation, healthcare access, and educational outcomes, exacerbating poverty cycles. Policymakers must prioritize context-specific infrastructure provisions to reduce regional imbalances and align with sustainable development goals.(Table 9).

Table 7: Access to basic social services (Regional level)

Access to Basic Social Services	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Main road [minutes]	87.7	26.49	16.34	34.96	0.000	48.29
Town [minutes]	81.49	55.18	39.43	95.56	0.015	75.44
Market [minutes]	84.23	64.36	77.39	126.45	0.000	88.11
Health [minutes]	59.2	44.45	38.90	60.42	0.000	126.19
Education [minutes]	29.9	34.61	26.03	29.61	0.000	48.40
Financial institutions	137.9	101.98	80.94	146.08	0.000	425.05

Source: Survey (2024)

6.2 Access to basic social services at Zonal Levels

The analysis of zonal-level accessibility to basic services reveals significant inter-zonal disparities in travel durations to critical infrastructure. Access to main road networks demonstrates pronounced variability, with Gedio zone exhibiting the shortest mean travel time (16 minutes), contrasting sharply with Buno Bedele zone, where residents endure the longest duration (422 minutes). Similarly, accessibility to urban centers shows notable differences, with Sidama (55.2 minutes) and West Guji (45.4 minutes) zones reporting the lowest mean travel durations, while West Arsi zone experiences the most protracted access times (246 minutes), exceeding the shortest zonal average by approximately 5.4 times. Such variability highlights the need for spatially granular policy interventions to address systemic accessibility gaps in underserved regions. The same pattern is observed on market accessibility. Buno Bedele and Sidama have relatively shorter mean times of accessing markets (83.5 and 64.3 minutes, respectively), while Illuababor and Jimma both report 125 minutes, indicating greater difficulty of accessing markets. Health service access reveals striking disparities, especially in West Arsi, where the mean access time is 1,766 minutes, significantly higher than in regions like Buno Bedele (28.8 minutes) and Illuababor (32.3 minutes). This reflects critical differences in healthcare accessibility across regions.

For educational access, times are generally lower, with Gedio at 17.5 minutes, while in West Arsi it requires 446 minutes to arrive at schools, suggesting accessibility gap in the zone. Access to financial institutions also indicates significant differences ($p < 0.01$), as West Arsi records an exceptionally high mean time of 7,152 minutes, whereas Gedio and Sidama report shorter times of 80.9 and 101 minutes, respectively.

Table 8: Access to basic social services at zonal level in minutes

Access to basic social services	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Main road	22.80	422.00	16.00	8.04	90.40	47.00	26.40	32.8	25.80	0.000
Town	99.00	96.60	39.40	112.00	117.00	92.10	55.20	75.00	45.40	0.000
Market	125.00	83.50	77.30	45.00	125.00	127.00	64.30	99.4	62.40	0.000

Ministry of Planning and Development

Health	57.60	28.80	38.90	32.30	91.80	63.20	44.50	54	59.20	0.000
Education	29.90	29.10	26.00	17.50	38.90	29.30	34.60	29.9	28.60	0.000
Financial institutions	178.00	156.00	80.90	112.00	168.00	114.00	101.00	156	110.00	0.000

Source :Survey(2024)

7 Membership and women empowerment

7.1 Membership to different groups at regional levels

Households belong to both indigenous and modern institutions, which provide them with access to resources, timely information, and better bargaining power. This membership also helps expand their market access and ensures efficient use of inputs and outputs. The result in Table 11 shows that in terms of financial services, Oromia (5%) shows considerably lower participation than the total average of 14%, while Sidama (13%), South Ethiopia (24%), and Southwest Ethiopia (14%) are closer to total average of 14 percent. Membership status of households in the coffee producer group is notably high in South Ethiopia (47%), far higher than the total average, while Sidama (25%) is slightly higher than the total average, whereas Oromia (13%) and Southwest Ethiopia (8%) fall far from the total average of 23 percent. Households are also members of the water user group. The result shows 27% of households in Sidama regional states are members of the water user group, higher than Oromia (8%) and South Ethiopia (22%). Southwest Ethiopia lags significantly at only 1% compared to the total average of 15%. Households in Oromia have the highest participation in forest user groups with 32%, which is above the total average of 22%, while Sidama (1%) exhibits the lowest figure. South Ethiopia (24%) and Southwest Ethiopia (29%) have comparable figures with the total average.

The results in general revealed that only 10 percent of households are member of credit/microfinance. The corresponding figure in South Ethiopia (14%) slightly exceeds the total average while they are lower in other regions (Oromia, Sidama, and Southwest Ethiopia). The membership status of household in the mutual help group is relatively higher when compared to microfinance and credit. This is evidenced by that fact that nearly 67 percent of households in Sidama regional states are members of mutual help group and the corresponding figures are 57 percent for South Ethiopia, 51 percent for Oromia and 49 percent for South West Ethiopia. On the other wing, participation of households in trade and business association groups is low across regions. The results show that all regions' membership rates lie between 5% and 11% with a total average rate of 8%. Finally, membership in civic groups is highest in Oromia (25%), followed by

Sidama (21%), South Ethiopia (22%), and Southwest Ethiopia (9%), exhibiting varying levels of participation.

Table 9: Proportion of membership status of households to different groups

Membership and women empowerment	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Member of Financial services	0.05	0.13	0.24	0.14	0.000	0.14
Member of Coffee Producer Group	0.13	0.25	0.47	0.08	0.000	0.23
Member of Water User Group	0.08	0.27	0.22	0.01	0.000	0.15
Forest User Group	0.32	0.01	0.24	0.29	0.000	0.22
Member of Credit/Microfinance Group	0.09	0.09	0.14	0.07	0.000	0.10
Member of Mutual Help Group	0.51	0.67	0.57	0.49	0.000	0.56
Member of Trade and business association Group	0.05	0.11	0.11	0.05	0.000	0.08
Member of Civic Group	0.25	0.21	0.22	0.09	0.000	0.19

7.2 Membership status of households for various groups at Zonal levels

The membership status of households in various groups has been also analyzed at Zonal level. Table 12 presents the membership status of households across various zones. Considerable differences have been revealed in the participation of households in financial services, producer groups, and community memberships. For example, membership status of households in financial services shows the highest proportion in Bench Sheko (15%) and the lowest in West Arsi (4%) while the rest of the zones fall in between these two zones. Similarly, membership of households in coffee producer group is the highest in Buno Bedele (48%) followed by Gedio (47%), while West Arsi and West Guji report the lowest rate of participation with 5% and 8%, respectively.

The rate of participation of households in water user group in Sidama regional state is 27%, which is significantly higher than the corresponding figures of Bench Sheko, Illuababor, and West Arsi, where the rate of participation falls in between 1% to 2%. The rate of participation of households in forest user groups is the highest in West Arsi (89%) followed by Buno Bedele (73%) and Gedio (24%). Membership of households in credit/microfinance groups is also varied, with Buno Bedele exhibiting the highest rates (23%) and West Arsi registered the lowest rates (2%).

Moreover, membership status of households in mutual help groups is notably high across many zones, especially Sidama (66%), West Guji (71%), and Kaffa (58%) exhibited the highest rate of membership status, whereas Illuababor (17%) and West Arsi (45%) registered the lowest rates of participation. The differences in trade and business associations are relatively small, with Sidama and Gedio having slightly higher membership rates (11% each), while other zones report lower figures. Finally, membership in civic groups is highest in Buno Bedele (88%), showing a strong community-oriented engagement compared to zones such as West Arsi (8%) and West Guji (13%).

Table 10: Membership Different Groups

Membership and women empowerment	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Member of Financial services [proportion]	0.15	0.05	0.24	0.04	0.04	0.12	0.14	0.04	0.06	0.000
Member of Coffee Producer Group [proportion]	0.06	0.48	0.47	0.09	0.13	0.09	0.25	0.05	0.08	0.000
Member of Water User Group [proportion]	0.02	0.28	0.22	0.02	0.09	0.01	0.27	0.08	0.03	0.000
Forest User Group [proportion]	0.14	0.73	0.24	0.36	0.08	0.43	0.01	0.89	0.04	0.000
Member of Credit/Microfinance Group [proportion]	0.05	0.23	0.14	0.03	0.10	0.08	0.09	0.02	0.08	0.000
Member of Mutual Help Group [proportion]	0.41	0.51	0.57	0.17	0.42	0.58	0.66	0.45	0.71	0.000
Member of Trade and business association Group [proportion]	0.01	0.09	0.11	0.03	0.04	0.08	0.11	0.03	0.07	0.000
Member of Civic Group [proportion]	0.02	0.88	0.22	0.33	0.23	0.16	0.21	0.13	0.08	0.000

8 Coffee Production and Marketing

8.1 Coffee production at regional levels

In Ethiopia, coffee farming can be broadly categorized into two types: traditional coffee farms and modern coffee farms. Traditional coffee farms represent the indigenous, small-scale systems of coffee cultivation practiced by smallholder farmers. These farms are often integrated into natural forest ecosystems or family plots, relying on minimal external inputs. Local coffee varieties are commonly grown under the shade of indigenous trees, and farming practices are low-intensity, using organic methods with little to no chemical fertilizers, pesticides, or advanced irrigation systems. Manual labor is the primary source of work, and the coffee produced in these systems is renowned for its distinct flavors, often sought after in specialty markets.

Modern coffee farms, in contrast, are characterized by commercial and intensive production practices. These farms are typically larger and employ improved coffee varieties, advanced farming techniques, and external inputs such as chemical fertilizers, pesticides, and irrigation systems. They are often owned by cooperatives, private enterprises, or larger organizations, with a focus on maximizing productivity and yield. Mechanized processes are commonly used for planting, maintenance, and harvesting, allowing for consistent quality and scale of production.

The primary differences between traditional and modern coffee farms lie in their scale, cultivation practices, productivity, and environmental impact. Traditional farms are small-scale, environmentally friendly, and promote biodiversity through integration with natural ecosystems. They often produce lower yields but deliver unique flavor profiles valued in niche markets. Modern farms, however, prioritize large-scale production and higher yields, which can sometimes come at the cost of greater environmental impact due to chemical use and monocropping practices. Despite these differences, both types of farms play a vital role in Ethiopia's coffee industry, contributing to the country's cultural heritage and economy.

In this study, the modality of coffee production, total area allotted for coffee production, quantity of coffee produced and sold in the four regions were analyzed and displayed at Table 13.

The comparative analysis of traditional and modern coffee farming systems across four Ethiopian regions (Oromia, Sidama, South Ethiopia, Southwest Ethiopia) reveals significant heterogeneities in ownership patterns, land allocation, productivity, and market engagement. **Traditional coffee farming systems** exhibit widespread adoption, with ownership proportions ranging from 64% (Southwest Ethiopia) to 96% (South Ethiopia), underscoring their socio-agrarian dominance. Sidama demonstrates high productivity of traditional coffee production with 19 Qt/ha, which is very high compared to Southwest Ethiopia's (3.53 Qt/ha), despite allocating marginally less land (0.56 ha vs. 0.76 ha in Southwest Ethiopia). Oromia, while allocating the largest mean area to traditional cultivation (0.93 ha), yields moderate productivity (7.63 Qt/ha). Commercialization rates remain low overall (mean sold: 3.58 Qt), though Sidama's better performance correlates with higher sales (6.05 Qt), indicative of regional disparities in value-chain integration.

Modern coffee farming systems, though less prevalent (ownership: 30–44%), demonstrate different level of productivity across regions. Sidama exhibited higher yield (17.36 Qt/ha), surpassing Oromia (8.75 Qt/ha) and Southwest Ethiopia (5.22 Qt/ha), despite comparable land allocations (0.33–0.95 ha). Notably, modern systems exhibit enhanced commercialization, with mean sales volumes (5.44 Qt) exceeding traditional systems by 52%, particularly in Oromia (7.14 Qt sold). Southwest Ethiopia's modern farms, however, reflect lower productivity, producing only 5.22 Qt/ha despite allocating 0.72 ha. These findings suggest that modern methods, while not universally adopted, may amplify yield and market participation where agroecological and infrastructural conditions are favorable.

In a nutshell, these results, Sidama emerges as a high-performing region across both systems, Conversely, Southwest Ethiopia's systemic underperformance, evident in low traditional yields (3.53 Qt/ha) and modern inefficiencies, signals structural barriers, including limited access to technology, extension services, or capital. The elevated commercialization of modern systems, despite lower adoption, advocates for targeted scaling of climate-resilient practices and value-

chain investments to optimize productivity. However, the persistence of traditional farming underscores its cultural and ecological relevance, necessitating policies that hybridize indigenous knowledge with precision agriculture. Future research should prioritize multivariate analyses to disentangle the effects of biophysical, economic, and institutional variables on Ethiopia's coffee sector sustainability.

Table 11: Coffee Production at regional levels

Coffee Production and Management	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Traditional Coffee Farm						
Respondents owning traditional coffee farm [Proportion]	0.7	0.88	0.96	0.64	0	0.8
Area allotted in hectare	0.93	0.56	0.91	0.76	0	0.79
Amount produced (Qt)	7.1	9	5.18	2.68	0.018	6.12
Production per hectare (Qt/ha)	7.63	19	5.69	3.53	0.015	30.8
Amount sold	3.43	6.05	4.42	2.11	0	3.58
Modern Coffee Farm						
Respondents owning modern coffee farm [Proportion]	0.3	0.31	0.43	0.44	0	0.37
Area allotted in hectare	1.02	0.33	0.95	0.72	0.01	0.76
Amount produced (Qt)	8.93	5.73	4.87	3.76	0.016	5.82
Production per hectare (Qt/ha)	8.75	17.36	5.13	5.22	0.02	7.66
Amount sold	7.14	5.3	4.05	3.93	0.003	5.44

Source: Survey(2024)

8.2 Coffee production at zone levels

Table 13 shows the modality of coffee production, area allocated, quantity produced and sold in the zones. The findings reveal notable differences between traditional and modern coffee farms in Ethiopia across various regions. Traditional coffee farms are prevalent, with a higher proportion of respondents owning traditional farms in most regions, such as Gedio and Sidama, where 96% and 88% of respondents, respectively, report ownership. In contrast, modern coffee farms remain less common, with relatively low ownership proportions across all regions, though areas like Kaffa and Bench Sheko show higher figures (66% and 62%, respectively). Traditional farms are typically smaller in size, with regions like West Arsi and Sidama allocating an average of 0.43 ha and 0.56 ha per farm, respectively, while modern farms tend to occupy larger plots, with areas

like Jimma and Bench Sheko allotting 1.63 ha and 1.61 ha, respectively. This larger size reflects the more commercial nature of modern coffee farming practices, which require more space and investment. In terms of coffee production, traditional farms yield less on average, with Jimma's traditional farms producing 7.12 Qt, whereas modern farms in the same region produce 15.90 Qt, demonstrating the higher productivity of modern systems due to improved practices and coffee varieties. However, there is some variation within the regions, as in Sidama, where traditional farms yield 8.47 Qt, but modern farms only produce 5.72 Qt, highlighting regional differences in productivity. The amount of coffee sold also varies significantly, with traditional farms in Sidama selling a large amount of 8,916 Qt, while other regions like West Arsi sell only 19 Qt. In comparison, modern farms consistently sell larger quantities, especially in Jimma, which reports a high sale of 88,120 Qt, reflecting the efficiency and scale of modern farming methods.

When examining production per hectare, traditional coffee farms show considerable variation across regions, with yields as high as 19.30 Qt/ha in West Arsi but as low as 3.28 Qt/ha in Bench Sheko. Modern farms, on the other hand, generally achieve higher yields per hectare, with Buno Bedele showing the highest production at 10.58 Qt/ha. However, even modern farms exhibit some variability, as seen in Kaffa, where production per hectare is 6.95 Qt/ha, which is lower compared to regions like Sidama, where modern farms yield 17.33 Qt/ha. This demonstrates that, while modern farming practices lead to more efficient land use and higher productivity, factors such as regional conditions, climate, and farm management influence outcomes. Overall, the findings suggest that traditional coffee farms are still dominant in Ethiopia but tend to be less productive and have lower sales compared to modern coffee farms. Modern coffee farming, with its larger land sizes and higher yields per hectare, appears to offer greater potential for increased coffee production and sales. However, the varying success across regions indicates the importance of local factors, such as soil quality, climate, and access to resources, in shaping farm productivity. The results highlight the need for strategies that support both traditional and modern farming systems, with an emphasis on improving practices, increasing productivity, and enhancing farmer incomes to boost Ethiopia's coffee export potential.

Table 12: Coffee Production at zone levels

Management	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Traditional Coffee Farm										
Respondents owning traditional coffee farm [Proportion]	0.69	0.89	0.96	0.71	0.71	0.58	0.88	0.15	0.91	0
Area allotted in hectare	0.99	1.08	0.91	0.74	0.67	0.72	0.56	0.43	1.27	0
Amount produced (Qt)	3.25	5.13	5.17	4.48	7.12	2	8.47	8.3	1.3	0
Amount sold (Qt)	3.11	3.35	4.42	2.51	6.4	1.12	6.05	8.2	1.3	0
Production per hectare (Qt/ha)	3.28	4.75	5.68	6.05	10.64	2.78	15.12	19.3	1.02	0
Modern Coffee Farm										
Respondents owning modern coffee farm [Proportion]	0.22	0.62	0.43	0.52	0.15	0.66	0.31	0.09	0.33	0
Area allotted in hectare	1.61	1.04	0.95	0.99	1.63	0.42	0.33	0.66	0.69	0
Amount produced (Qt)	6.24	11	4.87	7.01	15.9	2.92	5.72	12.4	4.71	0.01
Amount sold (Qt)	4.97	11	4	4	9.86	2.31	5.3	11.6	4.69	0
Production per hectare (Qt/ha)	3.88	10.58	5.13	7.08	9.79	6.95	17.33	18.79	6.83	0.015

Source :Survey(2024)

9 Coffee Marketing

9.1 Coffee buyers at regional levels

Households sell their coffee to different bodies. The find revealed that 56% of coffee-producing households in Oromia sell their coffee to collectors. 66 percent of coffee producing households in Southwest Ethiopia sold their coffee to collectors, while in Sidama the corresponding figure goes as low as 36%. On average 54% of the total households, sell their coffee to collectors. Households also sell their coffee to assemblers, but the magnitude is very small. It is only 8 percent of the total households sell their coffee to assemblers but there is variation among regions. For example, it is only 17 percent of households in Southwest Ethiopia sell their products to assemblers. The figure is even getting very small in other regions, namely Oromia and Sidama where only 5% of producers sold their coffee to assemblers.

The other significant market outlet for coffee-producing farmers are wholesalers. In this regard, 43 percent of coffee producing households in South Ethiopia sell their coffee to wholesalers, significantly higher than the total average of 22%. The corresponding figure is only 6 percent for Sidama. Regarding primary cooperatives for export, Sidama has the highest proportion, with 47% of producers selling to export-focused cooperatives, far exceeding the total average of 28%. Coffee producing farmers in Oromia and Southwest Ethiopia have lower engagement with export-focused cooperatives. This is evidenced by the fact that only 14% of coffee producers sell their coffee to export oriented cooperatives.

Primary cooperatives also serve as an alternative marketing outlet. Nearly 30 percent of Coffee producing households sell their coffee to primary cooperatives but there is significant difference among regions. For instance, in South Ethiopia (46%) sell their coffee to local cooperatives, whereas 18 percent of coffee producing households in Southwest Ethiopia uses local cooperatives as a marketing outlet. Finally, 31 and 14 percent of households in Oromia and South Ethiopia, respectively, sell their products to retailers, whereas less than 2 percent of households in Southwest Ethiopia sell their coffee to retailers.

Table 13: Proportion of coffee buyers at Regional Levels

Buyers	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total average
Collectors	0.56	0.36	0.58	0.66	0.000	0.54
Assemblers	0.05	0.05	0.05	0.17	0.000	0.08
Wholesaler	0.14	0.06	0.43	0.24	0.000	0.22
Primary cooperatives (export)	0.14	0.47	0.35	0.14	0.000	0.28
Primary cooperatives (local)	0.24	0.32	0.46	0.18	0.000	0.30
Retailers	0.31	0.1	0.14	0.02	0.000	0.14

Source :Survey(2024)

9.2 Coffee Buyers at Zonal levels

Coffee collectors emerge as the dominant buyer type in most zones, with particularly high proportions in Buno Bedele (90%), Gedio (80%), and Bench Sheko (70%). In contrast, Illuababor and Sidama exhibited lower proportions of producers selling to collectors compared. Overall, the mean percentage of producers selling to collectors is 52%, though zonal preferences and practices vary widely. Assemblers play a minor role as an outlet for coffee producing farmers across zones, with no presence in Buno Bedele and Gedio, and only 1% of producers in Illuababor sell to them. Albeit, 23 percent of coffee producers in Jimma sell their coffee to assemblers. The overall mean percentage of producers selling to assemblers is 9%, indicating that assemblers are a less common buyer type across the regions.

Coffee producing households also sell their coffee to wholesalers. In this regard, Gedio has the highest proportion of producers selling to wholesalers (40%) followed by Bench Sheko(20%) and Illuababor(20%) whereas only 3 percent of households in Buno Bedele sell their coffee to wholesalers. Nearly 19% of coffee-producing households sell their coffee to whole sellers, entailing that wholesalers are more prominent marketing outlets in some regions but are not in some other zones. Other outlets such as primary cooperatives are most prominent in Sidama (50%) and Gedio (40%), whereas it is not that important in Bench Sheko, Illuababor, and West Arsi where nearly 10 percent of coffee producing households uses as an alternative outlet. In the other wing, Buno Bedele (50%) and West Guji (40%) intensively use local market cooperatives as their outlet, whereas Bench Sheko and West Arsi (1%) almost do not use it as a key outlet.

Retailers are most active in Sidama (70%) and Illuababor (50%), but they are absent in Bench Sheko and Gedio. Concisely, these findings illustrate the diverse roles of buyers and suggest region-specific strategies to optimize market engagement and support for coffee producers.

Table 14: Coffee buyers at zonal Levels

Buyers	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Collectors [proportion]	0.70	0.90	0.60	0.80	0.30	0.60	0.40	0.30	0.60	0.000
Assemblers [proportion]	0.10	-	0.10	-	0.01	0.23	0.05	0.12	0.10	0.000
Wholesaler [proportion]	0.20	0.03	0.40	0.20	0.10	0.30	0.10	0.20	0.20	0.000
Primary cooperatives (export) [proportion]	0.10	-	0.40	0.10	0.40	0.20	0.50	0.10	0.10	0.000
Primary cooperatives (local) [proportion]	0.10	0.01	0.50	0.30	0.20	0.30	0.30	0.01	0.40	0.000
Retailers [proportion]	-	0.10	0.10	-	0.50	0.04	0.10	0.70	0.20	0.000

Source :Survey(2024)

10 Coffee price information

10.1 Coffee price information at regional levels

The availability and sources of information on coffee prices vary significantly by region. Sidama and South Ethiopia do well in terms of access to information on coffee prices for respondents with 67% and 64% of households that produce coffee, respectively, have access to coffee price information, both of which are higher than the overall average of 55%. Conversely, just 47% and 43% of people in Oromia and Southwest Ethiopia, respectively, have access to information on coffee prices. Oromia (39%) and Southwest Ethiopia (35%), which both surpasses the overall average of 24%, rely heavily on radio and television as a source of information, whilst Sidama (9%) and South Ethiopia (13%) do not. The overall average of using mobile app as a key source of coffee pricing is 14%, while the figures are the highest in Sidama (15%) and Southwest Ethiopia (20%) where coffee producing farmers relatively use mobile app as the sources of information. Households in South Ethiopia and Oromia, however, report lower utilization rates of 11%. The other source of coffee pricing information is cooperatives. The biggest percentages of coffee producing farmers (51%) and 49%, respectively, in Sidama and South Ethiopia rely on them for information on coffee prices, above the overall average of 42%. Oromia is significantly less dependent on cooperatives than other regions, at 31%. Regarding other information sources, South Ethiopia is the most reliant (75%) and is followed by Oromia (69%) and Southwest Ethiopia (68%), all of which are higher than the overall average of 66%. However, Sidama's percentage is the lowest at 51%.

Table 15: Coffee price information at regional levels

Coffee Price Information	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total average
Respondents with coffee price information [proportion]	0.47	0.67	0.64	0.43	0.000	0.55
Source of your information						
Radio/TV [proportion]	0.39	0.09	0.13	0.35	0.000	0.24
Mobile/apps [proportion]	0.11	0.15	0.11	0.2	0.001	0.14
Cooperatives [proportion]	0.31	0.51	0.49	0.36	0.000	0.42
Others [proportion]	0.69	0.51	0.75	0.68	0.000	0.66

Source :Survey(2024)

10.2 Coffee price information at Zonal Levels

Table 17's results indicate notable geographical variations in coffee pricing information sources and accessibility. Buno Bedele has the highest percentage of respondents (90%) who claim having access to information on coffee prices overall, whereas Bench Sheko has the lowest percentage (30%). While only 1% of respondents in West Arsi have access to information on coffee prices, Sidama (70%) likewise had greater access than the overall average of 55%.

When it comes to the source of coffee price information, radio/TV is widely used in some regions, particularly in West Arsi, where 100% of respondents rely on it. However, other regions such as Sidama (10%) and Gedio (10%) show very low reliance on radio/TV. The total average for radio/TV usage is 24%. In contrast, mobile/apps are more popular in West Arsi (50%), with other regions like Jimma (23%) and Bench Sheko (22%) reporting relatively high usage, while regions like Illuababor (7%) and Gedio (11%) use mobile/apps minimally. The total average for mobile/apps usage by coffee producing farmer is 14%.

Households also use cooperatives as a source of coffee pricing information. In this regard, the result shows that the largest percentage of coffee producing farmers in Sidama (51%) and West Guji (56%) use cooperatives as a source of coffee marketing information, both of which surpass the overall average of 42%. Buno Bedele, on the other hand, exhibits least reliance on cooperatives (1%), whereas 23 % and 75% of coffee producing farmers in Illuababor and Kaffa, respectively use cooperatives as a source of coffee pricing information. Finally, other sources mainly personal ties have also been the other major sources of coffee pricing. For instance, coffee-producing farmers in Buno Bedele (78%) and Gedio (75%) heavily rely on other sources as a source of coffee price information . Sidama (51%) has the fairly reliance on this category, whilst West Arsi reports using no additional sources.

Table 16: Coffee price information at regional levels

Coffee Price Information	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Respondents with coffee price information [proportion]	0.30	0.90	0.60	0.50	0.60	0.50	0.70	0.01	0.40	0.000
Source of your information										
Radio/TV [proportion]	0.20	0.40	0.10	0.50	0.50	0.50	0.10	1.00	0.20	0.000
Mobile/apps [proportion]	0.22	0.10	0.11	0.07	0.23	0.18	0.15	0.50	0.03	0.000
Cooperatives [proportion]	0.24	0.01	0.49	0.23	0.32	0.43	0.51	-	0.56	0.000
Others [proportion]	0.69	0.78	0.75	0.62	0.63	0.68	0.51	-	0.70	0.000

Source :Survey(2024)

11 Coffee Management and Technology adoption

11.1 Coffee Management Practices (Regional Levels)

Significant variations exist across Oromia, Sidama, South Ethiopia, and Southwest Ethiopia, in terms of coffee management practices. These variations are particularly evident in the amount of land devoted to coffee cultivation, pruning techniques, and household ownership of old coffee. For instance, 68% and 69 % of coffee producing farmers in Oromia and Sidama and South Ethiopian owned old coffee, which is marginally higher than the 66% average for all households (Table 19). In contrast, the ownership rate in southwest Ethiopia is lower than the total average with 58%.

South Ethiopia allots the smallest amount of land (0.48) to old coffee, whereas Sidama has the largest average land allotted to old coffee (1.04 hectares). Nevertheless, these differences are not statistically significant. An average of 0.79 hectares of land are allotted for old coffee cultivation. In South Ethiopia, 58% of coffee producing farmers practiced coffee pruning, which is far higher than the overall average of 32%. On the other hand, the pruning rate in Oromia is only 26%, and in Southwest Ethiopia, it is even lower at 17%. These differences are statistically significant.

The primary reasons for not pruning also differ across regions. Lack of skill is the most common reason mentioned by 60% of respondents in Southwest Ethiopia and 56% in Oromia. In Sidama, 58% of households report lack of knowledge as a barrier. Additionally, 36% of respondents in South Ethiopia and 30% in Sidama indicate that the age of coffee trees affects pruning decisions. Lastly, "other" reasons are noted by 26% of respondents in Oromia, considerably higher than the total average of 16%.

Table 17: Coffee Management Practices (Regional Levels)

Coffee Management Practices	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Household owing old coffee standings [Proportion]	0.68	0.69	0.69	0.58	0.000	0.66
Area in hectare	0.96	1.04	0.48	0.68	0.562	0.79
Respondents practicing Coffee pruning [Proportion]	0.26	0.27	0.58	0.17	0.000	0.32

Reason for not pruning						
Lack of skill [Proportion]	0.56	0.47	0.46	0.60	0.000	0.52
Lack of knowledge [Proportion]	0.52	0.58	0.35	0.30	0.000	0.44
Age of tree [Proportion]	0.12	0.30	0.36	0.30	0.000	0.27
Other [Proportion]	0.26	0.10	0.15	0.11	0.000	0.16

Source : Survey(2024)

11.2 Coffee Management Practices at regional levels

Significant regional variations exist in household ownership of older coffee trees, land area allotted to coffee production, pruning practices, and reasons for not pruning (Table 20). The overall average household with old coffee is 66%. The corresponding figures for Illuababor and Buno Bedele reach as high as 92% and 90%, respectively, and goes as low as 58% and 59 % in Bench Sheko and Kaffa, respectively. The average area of land used for coffee in Jimma is 1.36 hectares, which is much higher than 0.48 hectares reported in Buno Bedele and Gedio.

Pruning practices show considerable differences across regions, with only 15% of households in Kaffa practicing coffee pruning compared to 67% in Illuababor and 58% in Gedio. Overall, about 32% of households practice coffee pruning. There are skills, knowledge and coffee tree related factors that limit the application of coffee pruning. For instance, lack of skill is prevalent in West Guji (75%) and Kaffa (67%), while Bench Sheko and Buno Bedele report comparatively lower corresponding figures (53% and 33%, respectively) but still show higher magnitude. Similarly, lack of knowledge is most common in Buno Bedele (68%) and Sidama (58%) but less so in Kaffa (35%) and West Arsi (46%). Tree age as a barrier to pruning is most common in Bench Sheko (41%) but is least reported in Illuababor (12%) and West Guji (11%). Finally, other reasons for not pruning are most frequently mentioned in West Arsi (49%) and Buno Bedele (42%).

Table 18: Coffee Management Practices (Zonal Levels)

Coffee Stand Management Practices	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Household owing old coffee standings [Proportion]	0.58	0.90	0.69	0.92	0.89	0.59	0.69	0.16	0.64	0.000
Area in hectare	0.53	0.48	0.48	0.50	1.36	0.83	1.03	0.47	1.11	0.620
Respondents practicing Coffee pruning [Proportion]	0.19	0.26	0.58	0.67	0.24	0.15	0.27	-	0.27	0.000
Reason for not pruning										
Lack of skill [Proportion]	0.53	0.33	0.46	0.26	0.56	0.67	0.47	0.47	0.75	0.000
Lack of knowledge [Proportion]	0.26	0.68	0.35	0.56	0.49	0.35	0.58	0.46	0.52	0.000
Age of tree [Proportion]	0.41	0.32	0.36	0.12	0.16	0.20	0.30	0.00	0.11	0.000
Other [Proportion]	0.08	0.42	0.15	0.32	0.08	0.13	0.10	0.49	0.17	0.000

Source :Survey(2024)

12 Adoption of Coffee Productivity Enhancing Technologies

12.1 Adoption of Coffee Productivity at regional levels

Households adopt various coffee productivity-enhancing practices. For instance, South Ethiopia has the highest proportion of respondents trained in pruning (58%), compared to Oromia (29%), Sidama (36%), and Southwest Ethiopia (37%). This is significantly higher than the overall average of 40%. Similarly, South Ethiopia has the highest proportion of respondents with pruning skills (29%), exhibiting higher figure compared to the overall average of 20%. In addition, 81% of respondents in South Ethiopia have received extension support, which is higher than Oromia (79%) and Southwest Ethiopia (74%). These regions have marginally higher corresponding figures than the overall average of 76%. In a nutshell, South Ethiopia has shown better engagement in many coffee productivity enhancing technologies and practices.

South Ethiopia also excels in weed control, with 97% of respondents practicing it, followed by Sidama (88%) and Southwest Ethiopia (81%), while Oromia stands at 71%. The overall average for weed control is 84%, and the results are statistically significant across regions. Insect and disease control practices also show significant regional disparities. Coffee producing households in South Ethiopia and Sidama with 51% and 56%, respectively practice disease control. These figures are far higher than Oromia (23%) and Southwest Ethiopia (28%). Shade management activities also reflect regional differences, with South Ethiopia (85%) and Sidama (84%) practicing shade management at much higher rates than Oromia (57%) and Southwest Ethiopia (60%), both of which fall below the overall average of 72%. In addition, Sidama (79%) and South Ethiopia (83%) show the highest engagement in soil fertility improvement, surpassing Oromia (45%) and Southwest Ethiopia (31%). Similarly, Sidama and South Ethiopia heavily engage in mulching practices, with proportions of 77% and 78%, respectively, far above Oromia (37%) and Southwest Ethiopia (26%), compared to the total average of 55%.

Sidama (81%) and South Ethiopia (76%) are the two regions with the highest rates of coffee replanting, outpacing Oromia (58%), and the overall average is 72%. Likewise, Sidama (73%) and

South Ethiopia (68%) have the highest rates of shade replanting, while Oromia (47%) and Southwest Ethiopia (55%) have the lowest rates, with an overall average of 61%. Finally, compared to the overall average of 67%, new coffee planting is highest in Southwest Ethiopia (74%) and Sidama (73%), followed by South Ethiopia (64%), and Oromia (55%).

Table 19: Coffee Productivity technology adoption (Regional Levels)

Productivity enhancing practices	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total Average
Respondents trained on pruning	0.29	0.36	0.58	0.37	0.000	0.40
Respondents who have pruning skill	0.17	0.19	0.29	0.13	0.000	0.20
Respondents who got extension services	0.79	0.68	0.81	0.74	0.027	0.76
Coffee stand Management activities practiced by respondents						
Weed control activities [proportion]	0.71	0.88	0.97	0.81	0.000	0.84
Insect control practice	0.20	0.56	0.51	0.19	0.000	0.37
Disease control activities [proportion]	0.23	0.51	0.56	0.28	0.000	0.40
Shade management activities [proportion]	0.57	0.84	0.85	0.60	0.000	0.72
Soil fertility improvement [proportion]	0.45	0.79	0.83	0.31	0.000	0.60
Mulching practice [proportion]	0.37	0.77	0.78	0.26	0.000	0.55
Soil and water conservation activities [proportion]	0.32	0.69	0.49	0.34	0.000	0.46
Fencing activities [proportion]	0.38	0.80	0.25	0.53	0.000	0.49
Coffee replanting [proportion]	0.58	0.81	0.76	0.74	0.000	0.72
Shade replanting [proportion]	0.47	0.73	0.68	0.55	0.000	0.61
New coffee planting [proportion]	0.55	0.73	0.64	0.74	0.000	0.67

Source: Survey(2024)

12.2 Adoption of Coffee Productivity Zonal Levels

The adoption of coffee productivity-enhancing technologies varies significantly among zones (Table 21). When it comes to pruning training, Sidama and Gedio have the highest rates (58% and 52%, respectively), while Bench Sheko has the lowest rate with 15%. Significant disparities have also been observed in the skill level required for pruning, with Bench Sheko and Buno Bedele reporting the lowest adoption rates at 13% and Gedio and Illuababor reporting the highest rate at 39%. Buno Bedele and Kaffa dominate with 98% and 89%, respectively, while Sidama is at the bottom with 68%. The use of extension services also differs significantly ($p < 0.01$).

Weed control practices are most prevalent in Buno Bedele and Gedio, with adoption rates of 97%, while West Arsi reports the lowest at 18%. Insect control practices show a similar trend, with Gedio and Sidama leading at 51% and 56%, respectively, while Bench Sheko and West Arsi have lower rates at 16% and 7%. Disease control practices also vary significantly ($p < 0.01$), with Gedio and Sidama exhibiting the highest rates at 55% and 51%, respectively, and Buno Bedele and West Arsi reporting the lowest rates at 7%. Shade management practices are widely adopted in Sidama (84%) and West Guji (73%), but West Arsi again has the lowest adoption rate at just 16%.

Soil fertility improvement practices are more commonly adopted in Gedio and Sidama (83% and 79%, respectively), while West Arsi reports the lowest at 25%. Mulching practices follow a similar pattern, with highest adoption rates in Gedio and Sidama (78% and 77%, respectively) and lowest adoption rates in West Arsi (15%). Soil and water conservation practices are most common in Sidama (69%) and Gedio (49%), with West Arsi again showing the lowest at 9%. Fencing practices show a significant difference. In this regard, households in Sidama (80%) and Kaffa (62%) exhibited the highest rate of adoption, while West Arsi reports the lowest adoption rate at 18%. In terms of replanting practices, coffee replanting is most prevalent in Sidama, Kaffa, and Jimma (81% each), while West Arsi again shows the lowest rate at 17%. Shade replanting practices are widely adopted in Kaffa and Sidama (71% and 73%, respectively), with West Arsi at the bottom with 15%. New coffee planting practices are also more commonly adopted in Buno Bedele, Jimma, and Kaffa (75%, 75%, and 74%, respectively), while West Arsi reports the lowest at just 15%.

Table 20: Coffee Productivity technology adoption (Regional Levels)

Adoption of coffee Productivity enhancing Technologies	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Households trained in pruning [proportion]	0.15	0.41	0.58	0.52	0.44	0.39	0.48	0.11	0.47	0.000
Households with required skills of pruning [proportion]	0.13	0.13	0.29	0.39	0.16	0.13	0.34	0.39	0.39	0.000
Households used extension service [proportion]	0.62	0.98	0.81	0.88	0.75	0.89	0.68	-	0.66	0.000
Coffee stand Management activities practiced by respondents										
Weed control activities [proportion]	0.82	0.97	0.97	0.93	0.82	0.79	0.88	0.18	0.73	0.000
Insect control practice	0.16	0.09	0.51	0.29	0.16	0.21	0.56	0.07	0.48	0.000
Disease control activities [proportion]	0.26	0.07	0.55	0.44	0.11	0.31	0.51	0.07	0.49	0.000
Shade management activities [proportion]	0.47	0.56	0.85	0.75	0.60	0.73	0.84	0.16	0.68	0.000
Soil fertility improvement [proportion]	0.22	0.33	0.83	0.31	0.55	0.40	0.79	0.25	0.48	0.000
Mulching practice [proportion]	0.18	0.09	0.78	0.13	0.47	0.35	0.77	0.15	0.64	0.000
Soil and water conservation activities [proportion]	0.21	0.30	0.49	0.24	0.57	0.48	0.69	0.09	0.48	0.000
Fencing activities [proportion]	0.45	0.56	0.25	0.29	0.65	0.62	0.80	0.18	0.27	0.000
Coffee replanting [proportion]	0.67	0.66	0.76	0.59	0.81	0.80	0.81	0.17	0.61	0.000
Shade replanting [proportion]	0.38	0.47	0.68	0.37	0.67	0.71	0.73	0.15	0.52	0.000
New coffee planting [proportion]	0.74	0.75	0.64	0.64	0.75	0.74	0.73	0.15	0.59	0.000

Source: Survey(2024)

13 Land use land cover

13.1 Land use land cover At Regional Levels

Table 22 presents the land use land cover of households in Oromia, Sidama, South Ethiopia, and Southwest Ethiopia. The following section presents key results.

Ethiopia's agricultural landscape exhibits marked regional specialization, shaped by agroecological conditions, cultural practices, and market integration. Oromia stands out for its high- cereal productivity, yielding 19.32 Qt on 0.85 hectares (22.74 Qt/ha), a stark contrast to Sidama's 3.09 Qt on 3.39 hectares (0.91 Qt/ha). Southwest Ethiopia dominates spice cultivation (3.98 Qt produced, 4.71 Qt sold), while South Ethiopia excels in enset production (32.87 Qt), a culturally vital staple. Sidama, despite near-universal enset engagement (99% of farmers), produces modest yields (10.59 Qt), indicating subsistence-oriented practices. Commercialization patterns further highlight regional priorities: high-value vegetables and spices show robust sales (e.g., Southwest Ethiopia sells more of its spice production, implying surplus trade), whereas Oromia's fodder sector (179.20 Qt produced, 76.79 Qt sold) aligns with its livestock-driven economy. However, Southwest Ethiopia's low fodder productivity (25.73 Qt on 3.13 ha), underscores mismatches between land allocation and output.

The findings advocate for context-specific interventions to amplify strengths and address inefficiencies. Southwest Ethiopia's spice sector and South Ethiopia's enset systems offer scalable models for climate-resilient, nutrient-dense crops, while Oromia's cereal high productivity could inform best-practice dissemination. Sidama's low cereal yields and Southwest Ethiopia's fodder gaps warrant targeted investments. Enhancing market infrastructure for high-value crops (e.g., spices, vegetables) could boost smallholder incomes, whereas preserving enset's dual role in subsistence and commerce is critical for food security.

Table 21: Farming activities in the study area (Regional levels)

Farming activities	Oromia	Sidama	South	Southwest	Sig.	National
Pusle crops						
Respondents engaged in production	0.09	0.19	0.05	0.30	0.000	0.16
Area allocated in hectare	0.33	1.60	0.12	0.54	0.420	0.65
Amount produced [Qt]	3.20	1.30	1.38	2.59	0.000	2.12
Amount sold [Qt]	2.13	1.27	0.86	1.29	0.000	1.66
Cereals crops						
Respondents engaged in production	0.46	0.44	0.15	0.61	0.000	0.42
Area allocated in hectare	0.85	3.39	0.18	1.05	0.288	1.37
Amount produced [Qt]	19.32	3.09	2.29	10.98	0.046	8.92
Amount sold [Qt]	8.19	3.01	1.46	6.36	0.094	5.63
Vegetables						
Respondents engaged in production	0.13	0.19	0.35	0.35	0.000	0.26
Area allocated in hectare	0.13	0.12	0.08	0.11	0.008	0.11
Amount produced [Qt]	6.91	4.19	3.17	5.27	0.000	4.89
Amount sold [Qt]	5.59	3.45	3.13	4.85	0.0000	4.67
Fruits						
Respondents engaged in production	0.16	0.42	0.52	0.43	0.000	0.38
Area allocated in hectare	0.09	0.09	0.02	0.14	0.000	0.09
Amount produced [Qt]	12.00	5.41	12.30	6.01	0.531	8.93
Amount sold [Qt]	5.20	5.25	6.17	5.58	0.000	5.52
Spices Crops (Turmeric, Ginger etc.)						
Respondents engaged in production	0.02	0.02	0.04	0.17	0.000	0.06
Area allocated in hectare	0.04	0.09	0.06	0.24	0.055	0.11
Amount produced [Qt]	0.54	1.64	0.56	3.98	0.267	1.68
Amount sold [Qt]	0.38	1.47	0.46	4.71	0.001	3.08
Enset						
Respondents engaged in production	0.42	0.99	0.96	0.45	0.000	0.71
Area allocated in hectare	0.41	0.36	0.32	0.14	0.000	0.31
Amount produced [Qt]	13.33	10.59	32.87	11.72	0.000	17.13
Amount sold [Qt]	5.72	5.51	30.35	3.51	0.000	9.80
Fodder						
Respondents engaged in production	0.25	0.25	0.03	0.24	0.000	0.19
Area allocated in hectare	1.79	0.16	0.05	3.13	0.839	1.28
Amount produced [Qt]	179.20	15.23	7.07	25.73	0.000	56.81
Amount sold [Qt]	76.79	11.57	1.23	0.79	0.0000	53
Tea						
Respondents engaged in production	0.00	0.00	-	0.01	0.089	0.00
Area allocated in hectare	0.40	0.13	-	1.05	0.715	0.40
Amount produced [Qt]	400.00	0.25	-	30.60	0.001	107.71
Amount sold [Qt]	-	0.125	-	30.60	0.500	21.87
Tree (Private plantation)						
Respondents engaged in production	0.11	0.18	0.21	0.16	0.000	0.17
Area allocated in hectare	0.20	0.10	0.40	0.15	0.000	0.21
Amount sold [ETB]	7252	6643	6702	5280	0.0000	6506

Source: Survey (2024)

13.2 Land use land cover Zonal Levels

Ethiopia's agricultural production varies significantly across regions, reflecting distinct agroecological conditions, market linkages, and crop preferences. Pulse crops, for instance, show limited adoption, with only 10% of farmers engaged in most regions, though Kaffa (50%) showed higher rate of adoption. Despite modest land allocation (0.10–1.60 hectares), West Arsi achieves notably higher pulse production (8.00 quintals) and sales (4.50 quintals). Cereal crops, by contrast, have been produced by the largest share of households, particularly in Bench Sheko (57%) and West Arsi (73%). Sidama leads in land allocation (3.39 hectares), while Illuababor and West Arsi dominate production (41.20 and 27.10 quintals, respectively). However, there is significant disparities on sales such as West Arsi's 22 quintals whereas Jimma with 2 quintals. Vegetable yields ranges from 3.17 quintals in Gedio to 17.80 quintals in West Arsi, with the latter dominating sales (14.88 quintals). Fruit production, concentrated in Illuababor (23.80 quintals) and Gedio (12.30 quintals) but with minimal rate of commercialization (e.g., 6.41 quintals in Illuababor).

Regional specialization is further evident in spices, enset, and niche commodities. Spice crops exhibited minimal engagement ($\leq 20\%$ of farmers), with Bench Sheko producing the highest yield (5.47 quintals) but negligible sales (e.g., 0.23 quintals in Buno Bedele). Enset, a staple crop, demonstrates widespread adoption in Gedio and West Guji (90% participation), with Gedio excelling in production (32.80 quintals) and sales (30.30 quintals). Tea cultivation, limited to West Guji (74.90 quintals production) and Illuababor (30.60 quintals sales), aligns with agroclimatic suitability, while private tree plantations generate substantial income in Illuababor (9,932 ETB) and West Arsi (9,889 ETB), likely tied to timber or agroforestry ventures.

The analysis underscores regional disparities in sales, despite comparable yields, point to uneven market access exemplified by West Arsi's dominance in vegetable sales versus Jimma's low cereal sales. Policymakers should prioritize enhancing market infrastructure in high-yield regions like Gedio (enset) and West Arsi (vegetables, pulses) to translate production into economic gains. Simultaneously, investments in value chains for underutilized crops (spices, tea) could unlock growth.

Table 22: Farming activities in the study area (Zonal levels)

Farming	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Pulse crops										
Respondents producing	0.10	0.10	0.10	0.10	-	0.50	0.20	0.01	0.20	0.000
Area allocated in hectare	0.30	0.60	0.10	0.20	-	0.60	1.60	0.40	0.30	0.890
Amount produced [Qt]	2.74	4.78	1.39	4.00		2.57	1.34	8.00	2.75	0.000
Amount sold	1.49	4.23	0.86	2.25		1.27	1.27	4.50	1.4	0.000
Cereal Crops										
Respondents producing	0.57	0.94	0.15	0.67	0.32	0.65	0.44	0.73	0.19	0.000
Area allocated in hectare	1.09	0.83	0.18	0.67	0.65	1.00	3.39	1.26	0.55	0.860
Amount produced [Qt]	15.20	8.19	2.29	41.20	13.10	7.25	3.09	27.10	4.60	0.000
Amount sold	10.10	2	1.46	7.43	2.19	3.05	3.01	22	4.5	0.000
Vegetables										
Respondents engaged in	0.40	0.20	0.30	0.10	0.01	0.30	0.20	0.10	0.20	0.000
Area allocated in hectare	0.14	0.04	0.08	0.11	0.03	0.08	0.12	0.21	0.14	0.000
Amount produced [Qt]	5.20	7.73	3.17	7.77	1.50	5.33	4.19	17.80	3.76	0.000
Amount sold [Qt]	4.47	6.85	3.13	6.50	0.99	5.23	3.45	14.88	3.52	0.000
Fruits										
Respondents engaged in	0.48	0.36	0.52	0.20	0.14	0.37	0.42	-	0.18	0.000
Area allocated in hectare	0.19	0.03	0.02	0.06	0.14	0.06	0.09	-	0.14	0.000
Amount produced [Qt]	7.24	11.70	12.30	16.00	23.80	4.41	5.41	-	4.52	0.680
Amount sold [Qt]	7.16	7.44	6.17	14.50	6.41	4.00	5.25	-	3.71	0.000
Spices Crops (Turmeric, Ginger, Cardamom)										
Respondents engaged in	0.20	0.10	0.04	0.02	-	0.10	0.02	-	0.01	0.000
Area allocated in hectare	0.31	0.01	0.06	0.05	-	0.12	0.09	-	0.11	0.040
Amount produced [Qt]	5.47	0.35	0.56	1.43	-	1.92	1.64	-	0.50	0.230
Amount sold [Qt]	5.25	0.23	0.46	1.25	-	0.85	1.47	-	0.27	0.000
Enset										
Respondents engaged in	0.20	0.20	0.90	0.10	0.10	0.70	0.90	0.30	0.90	0.000
Area allocated in hectare	0.10	0.01	0.32	0.03	0.06	0.14	0.36	0.22	0.51	0.000
Amount produced [Qt]	8.07	13.30	32.80	4.75	2.75	12.50	10.50	27.70	11.70	0.000
Amount sold [Qt]	7.39	-	30.30	1.75	1.84	2.68	5.5	8.58	7.39	0.000
Tea crop										
Respondents engaged in	-	0.01	-	-	0.01	-	-	-	2.70	0.000
Area allocated in hectare	-	0.40	-	-	1.05	0.13	-	-	0.37	0.000
Amount produced [Qt]	400.00	-	-	-	-	-	-	-	74.90	0.000
Amount sold [Qt]	-	-	-	-		30.6	0.13	-	-	0.000
Tree (Private plantation)										
Respondents engaged in	0.14	0.39	0.21	0.14	0.03	0.18	0.18	0.12	0.06	0.000
Area allocated in hectare	0.22	0.15	0.40	0.14	0.12	0.09	0.10	0.22	0.39	0.000
Amount sold [ETB]	7211	5292	6702	7360	9932	6889	6643	9889	4810	0.000

Source: Survey(2024)

14 Off farm and training activities of households

14.1 Off farm and training activities at regional levels

Households engage in different off farm activities and Table 24 summarizes various off-farm activities and decision-making patterns across different regions in Ethiopia. The findings highlight the presence of regional differences in engagement with off-farm activities, training received, and decision-making processes in households. Accordingly, Oromia (24%) and Sidama (23%) had higher proportions of households who received training on Participatory Forest Management (PFM) compared to South Ethiopia (14%) and Southwest Ethiopia (16%). These figures exceed the total average of 19%, with a statistically significant difference across the regions at 1 %. Similarly, in terms of business training, Oromia (9%) and Sidama (6%) showed relatively higher engagement compared to South Ethiopia (4%) and Southwest Ethiopia (2%), all surpassing the total average of 5%, with a significant difference ($p < 0.01$).

The government offered the lion's share of the training (62 % of the total). In this regard, nearly 85 percent of the training in Oromia was offered by the government, followed by Southwest Ethiopia, South Ethiopia, and Sidama with 59%, 57%, and 48%, respectively. Other CSOs and private agents also played vital role. in this regard, other CSOs had the highest engagement in Southwest Ethiopia (52%) and South Ethiopia (41%), compared to only 4% in Sidama and 24% in Oromia, while private agents were more prominent in Sidama (56%) compared to other regions.

Households engage in non-agricultural off-farm activities. In this regard, households in South Ethiopia (24%) had the highest proportion engagement in businesses, which is significantly higher than Oromia (7%), Sidama (11%) and Southwest Ethiopia (4%). Of the nonagricultural activities, Street vending was most prominent in Oromia (18%), whereas Sidama (4%), South Ethiopia (4%), and Southwest Ethiopia (3%) had much lower participation in street vending. Domestic workers were more common in Oromia (15%) than in other regions, with Sidama not having any respondents engaged in this activity. Day labor also saw significant regional differences, with South Ethiopia (31%) having the highest proportion, exceeding the total average of 20% ($p = 0.027$).

Participation in food and restaurant activities was highest in Sidama (19%), which is notably higher than the total average of 10%.

Off-farm income also varied, with South Ethiopia (ETB 6,223.29) showing the highest average income, surpassing both Oromia (ETB 4,257.56) and Sidama (ETB 3,424.90), though the difference was not statistically significant ($p = 0.120$), indicating a comparable income range across regions. Regarding decision-making in the household, purchasing food decisions were predominantly made by both husband and wife in all regions, with the highest proportion in Oromia (77%), compared to the total average of 69%. Husband and wife also shared decision-making duties, with significant regional variation. For instance, decisions regarding selling crops and livestock products were mostly made jointly by both spouses, particularly in South Ethiopia (87%), which was significantly higher than the total average of 79%.

Table 23: Off-farm activities and Training (Regional levels)

Off-farm activities and Training	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig. Value	Total Average
Respondents received training on PFM [Proportion]	0.24	0.23	0.14	0.16	0.000	0.19
Respondents received training on business skills [Proportion]	0.09	0.06	0.04	0.02	0.000	0.05
Training deliverers						
Government [Proportion]	0.85	0.48	0.59	0.57	0.000	0.62
Other CSOs [Proportion]	0.24	0.04	0.41	0.52	0.001	0.30
Private agent [Proportion]	0.15	0.56	0.12	0.24	0.000	0.27
Respondents involved in businesses [Proportion]	0.07	0.11	0.24	0.04	0.000	0.12
Business activities respondents involved in						
Street vendors [Proportion]	0.18	0.04	0.04	0.03	0.001	0.07
Domestic workers [Proportion]	0.15	-	0.08	0.06	0.025	0.07
Day laborers [Proportion]	0.19	0.12	0.31	0.19	0.027	0.20
Transportation services [Proportion]	0.07	0.02	0.02	0.13	0.044	0.06
Food and restaurant [Proportion]	0.02	0.19	0.04	0.13	0.000	0.10
Waste picking [Proportion]	-	-	-	-	-	-
Guard and keeping community [Proportion]	0.05	0.02	0.01	0.03	0.442	0.03
Other [Proportion]	0.49	0.63	0.86	0.53	0.000	0.63
Off-farm income						
Off-farm income [ETB]	4,257.56	3,424.90	6,223.29	4,311.89	0.120	4,554.41
Decision maker on purchasing of food items for household						
Adult female [Proportion]	0.01	-	0.01	0.01	0.107	0.01
Adult male [Proportion]	0.00	0.01	0.02	0.02	0.011	0.01
Both husband and wife [Proportion]	0.77	0.67	0.74	0.58	0.000	0.69
Husband [Proportion]	0.11	0.12	0.04	0.13	0.000	0.10
Wife [Proportion]	0.11	0.19	0.19	0.27	0.000	0.19
Decision maker on selling of crops and livestock-related products of the household						
Adult female [Proportion]	0.01	-	0.02	0.01	0.032	0.01
Adult male [Proportion]	0.01	0.01	0.04	0.02	0.000	0.02
Both husband and wife [Proportion]	0.79	0.79	0.87	0.72	0.000	0.79
Husband [Proportion]	0.16	0.13	0.01	0.19	0.000	0.12
Wife [Proportion]	0.04	0.07	0.06	0.05	0.040	0.06

Source: Survey(2024)

14.1 Off farm and training activities at zonal Levels

The analysis of training received and engagement in off-farming activities across various zones. 66 percent of households in Buno Bedele reported that they received training on Participatory Forest Management (PFM), while the corresponding figures in is 5%. Other regions such as Illuababor (35%) and Sidama (23%) demonstrated moderate engagement in PFM training, suggesting regional disparities in access to such resources.

Similarly, training on business skills showed high differences. Buno Bedele had the highest proportion of households which had taken training (26%), while zones such as Bench Sheko (2%) and Kaffa (3%) reported minimal participation. This significant difference, with a p-value of 0.000, further emphasizes the uneven distribution of business training across regions. When examining who delivered the training, it was clear that government institutions played a significant role in most zones, especially in Buno Bedele (98%) and Jimma (93%). On the other hand, Other CSOs had more influence in Bench Sheko (67%) and West Arsi (56%), while private agents contributed significantly in Sidama (56%) and Illuababor (47%).

Households' engagement in off-farming businesses also varied, with Gedio (24%) and Illuababor (29%) showing higher engagement in off-farming activities, while Bench Sheko (4%) and Kaffa (3%) had lower participation rates. Respondents in Jimma were notably involved in street vending (63%) and food and restaurant businesses (17%), while Buno Bedele had no respondents participating in these activities, and Sidama (19%) and West Guji (31%) had notable rates of participation. The involvement in day laborers was particularly high in West Arsi (67%) compared to regions like Jimma (6%) and Bench Sheko (20%). Off-farm income levels were relatively similar across regions, with Buno Bedele reporting the highest at ETB 6,966 and Illuababor the lowest at ETB 3,501. However, the p-value of 0.510 indicates that these differences in income are not statistically significant, suggesting that while some regions report higher off-farm income, these differences are not substantial enough to be considered meaningful across the regions.

Regarding intra-household decision-making, Buno Bedele exhibited the highest proportion of joint decision-making on purchasing food items, with 96% of households indicating that both the husband and wife were involved. This trend was also observed in other regions such as West Arsi (91%) and Sidama (67%), where joint decision-making was prevalent. However, adult males had a larger role in decision-making in zones such as Jimma and Bench Sheko, whereas wife-only decisions being more common in Sidama (19%). These differences in decision-making roles were significant at 1 percent. When it came to decisions on selling crops and livestock products, Buno Bedele (96%) and West Arsi (91%) showed a dominant role for both husbands and wives in the decision-making process, with husbands having more influence in regions such as Bench Sheko and Jimma.

Table 24: Off-farm activities and Training (Zonal levels)

Training and Engagement in off-farming activities	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig
Training Respondents received										
Respondents received training on	0.14	0.66	0.14	0.35	0.05	0.18	0.23	0.32	0.14	0.000
Respondents received training on	0.02	0.26	0.04	0.10	0.05	0.03	0.06	0.11	0.06	0.000
Training deliverers										
Government [Proportion]	0.33	0.98	0.59	0.53	0.93	0.75	0.48	0.92	0.75	0.000
Other CSOs [Proportion]	0.67	0.20	0.41	0.33	-	0.42	0.04	0.56	0.07	0.000
Private agent [Proportion]	0.22	0.05	0.12	0.47	0.13	0.25	0.56	0.08	0.21	0.000
Respondents involved in	0.04	0.04	0.24	0.29	0.05	0.03	0.11	0.02	0.04	0.000
Business activities respondents involved in										
Street vendors [Proportion]	0.05	-	0.04	0.02	0.63	-	0.04	-	0.31	0.000
Domestic workers [Proportion]	0.05	-	0.08	0.09	0.19	0.08	-	-	0.38	0.000
Day laborers [Proportion]	0.20	0.33	0.31	0.18	0.06	0.17	0.12	0.67	0.13	0.010
Transportation services	0.05	-	0.02	0.05	0.19	0.25	0.02	-	0.06	0.000
Food and restaurant [Proportion]	0.10	-	0.04	-	0.06	0.17	0.19	-	0.06	0.000
Waste picking [Proportion]	-	-	-	-	-	-	-	-	-	
Guard and keeping community	0.05	-	0.01	0.07	-	-	0.02	0.17	-	0.1900
Other [Proportion]	0.55	1.00	0.86	0.64	0.13	0.50	0.63	0.17	0.38	0.000
Off-farm income and Intra-household decision										
Off-farm income [ETB]	4,428.00	6,966.00	6,223.00	3,501.00	5,187.00	4,118.00	3,424.00	3,833.00	4,550.00	0.510
Decision maker on purchasing of food items for household										
Adult female [Proportion]	0.00	0.01	0.01	0.01	0.01	0.02	-	0.00	0.00	0.1800
Adult male [Proportion]	0.01	-	0.02	0.01	0.01	0.03	0.01	-	0.00	0.0100
Both husband and wife	0.38	0.96	0.73	0.73	0.59	0.78	0.67	0.91	0.77	0.0000
Husband [Proportion]	0.21	0.01	0.04	0.13	0.33	0.04	0.12	0.02	0.03	0.0000
Wife [Proportion]	0.39	0.02	0.19	0.12	0.05	0.14	0.19	0.07	0.19	0.0000
Decision maker on selling of crops and livestock-related products of the household										
Adult female [Proportion]	0.00	0.01	0.02	0.01	0.01	0.02	-	0.00	0.00	0.040
Adult male [Proportion]	0.01	-	0.04	0.01	0.01	0.03	0.01	-	0.00	0.000
Both husband and wife	0.61	0.96	0.87	0.69	0.63	0.84	0.79	0.91	0.79	0.000
Husband [Proportion]	0.34	0.01	0.01	0.16	0.31	0.05	0.13	0.02	0.18	0.000
Wife [Proportion]	0.04	0.02	0.06	0.13	0.04	0.07	0.07	0.06	0.01	0.000

Source: Survey(2024)

15 Climate change

15.1 Climate change perception at regional levels

Households perceived climate change in various regions. In this regard, the findings in Table 26 show that the proportion of individuals who have heard about climate change. The result showed that 66% of households in Oromia, 68% in Sidama, 80% in South Ethiopia, and 48% in Southwest Ethiopia have heard about climate change. The overall average level of awareness is 66%.

Regarding the sources of information about climate change, the most common source across the regions is friends or family, with proportions ranging from 43% in Sidama to 69% in South Ethiopia. Overall, 52% of those who heard about climate change accessed information from this source. This suggests that informal channels, such as social networks, play a significant role in spreading climate-related information. Radio ranks as the second most popular source of information, with a significantly larger percentage in Southwest Ethiopia (57%) than in other regions, albeit the average for all regions is 38%. Another important source is television, which accounts for between 9% in Southwest Ethiopia and 25% in South Ethiopia, and overall 17 percent of households got the information from television. Extension workers (DAs) are another significant source of climatic information, which ranges of 37% in South Ethiopia to 62% in Oromia.

The majority of respondents across all regions report that they heard about climate change rarely, with proportions ranging from 66% in Oromia to 77% in Sidama, and with an overall average of 69%. However, 24% of respondents in South Ethiopia report that they ‘often’ heard about climate change. The proportion of households which heard about climate change ‘always’ is relatively low across all regions, with the highest at 9% in Oromia and Southwest Ethiopia, aligning with the total average of 7%. 70% in Oromia, 66% in Sidama, 73% in South Ethiopia, and 55% in Southwest Ethiopia stated that they have observed changes in climate over their lifetime.

The result also revealed that 31 percent of households have access to rainfall and temperature forecasts. 27% of respondents in Oromia and Southwest Ethiopia report that they have access to rainfall and temperature forecasts, while the corresponding figure in Sidama and South Ethiopia are 33 % and 38 %, respectively. The result further indicated that 27% of households in Oromia, 30% of households in South Ethiopia and 19 % of households in Southwest Ethiopia use weather forecast information for livelihood decisions, higher than the overall average of 24%.

Several adaptive measures were adopted by households using weather forecast information. For instance, 71% of households adjusted their planting time. In addition, 69% of households in Oromia, 45% in Sidama, 96% in South Ethiopia, and 72% in Southwest Ethiopia have adopted this strategy. Another common adaptation strategy is livelihood diversification, which has been used by 74% of households from South Ethiopia, 60% from Southwest Ethiopia, and 47% from Oromia. These figures are marginally higher than the overall average of 53%, whereas in Sidama, the percentage is lower at 31%. Other adaptation measures include shifting livelihoods (27% in Oromia, 24% in Sidama, 44% in South Ethiopia, and 35% in Southwest Ethiopia).

Table 25: Climate change and adaptive measures applied (Regional levels)

Climate change and adaptive measures	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total average
Heard about climate change						
No [Proportion]	0.23	0.30	0.19	0.37	0.000	0.27
Not sure [Proportion]	0.09	0.02	0.01	0.15	0.000	0.07
Yes [Proportion]	0.66	0.68	0.80	0.48	0.000	0.66
Source of information about climate change						
Television [Proportion]	0.22	0.11	0.25	0.09	0.000	0.17
Newspaper [Proportion]	0.01	0.02	0.03	0.01	0.022	0.02
Friends/families [Proportion]	0.47	0.43	0.69	0.47	0.000	0.52
Radio [Proportion]	0.38	0.14	0.44	0.57	0.000	0.38
DAs/Extension workers [Proportion]	0.62	0.41	0.37	0.59	0.000	0.50
Other [Proportion]	0.32	0.51	0.31	0.40	0.000	0.39
Frequency of hearing about climate						
Always [Proportion]	0.09	0.06	0.03	0.09	0.000	0.07
Often [Proportion]	0.24	0.17	0.32	0.22	0.000	0.24
Rarely [Proportion]	0.66	0.77	0.66	0.68	0.003	0.69
Changes in the climate over respondent's lifetime, particularly over the past 30 years						
Don't know [Proportion]	0.11	0.08	0.03	0.16	0.000	0.10
No [Proportion]	0.19	0.26	0.24	0.29	0.000	0.25
Yes [Proportion]	0.70	0.66	0.73	0.55	0.000	0.66
Access to information about rainfall and temperature forecast						
Access to information [Proportion]	0.27	0.33	0.38	0.27	0.000	0.31
Used weather forecast information for livelihood decisions						
Used weather forecast [Proportion]	0.27	0.20	0.30	0.19	0.000	0.24
Measures taken based on weather forecast information						
Planning time adjusted [Proportion]	0.69	0.45	0.96	0.72	0.000	0.71
Varietal selection [Proportion]	0.41	0.41	0.45	0.51	0.118	0.45
Livelihood diversification [Proportion]	0.47	0.31	0.74	0.60	0.000	0.53
Shift in livelihood [Proportion]	0.27	0.24	0.44	0.35	0.001	0.33
Advance sale of livestock [Proportion]	0.22	0.04	0.04	0.04	0.000	0.09
Advance water management [Proportion]	0.04	0.14	0.04	0.05	0.001	0.07
Advance pasture/animal feed [Proportion]	0.06	0.13	0.01	0.04	0.001	0.06
Insurance [Proportion]	0.01	-	0.17	-	0.000	0.04
Others [Proportion]	0.16	0.13	0.11	0.13	0.566	0.13

Source: Survey(2024)

15.2 Climate change perception at zone level

Result in Table 27 presents a detailed comparison of climate change awareness and information sources across various regions. Overall, the awareness of climate change varies significantly among zones. West Arsi has the highest proportion of people who have heard about climate change (92%), while Bench Sheko has the lowest figure with 39%. Other zones namely Gedio (80%) and Sidama (68%) exhibit relatively high awareness levels. Conversely, Bench Sheko has the highest proportion of people who have not heard about climate change (46%), with West Arsi reporting the lowest (7%). West Arsi stands out with 19% of respondents being unsure about climate change.

Personal networks, particularly friends and families, are the dominant source of information about climate change in most regions. For instance, Gedio (69%) and West Guji (73%) report the highest proportions of people obtaining information from friends and family, while Sidama (43%) and Bench Sheko (42%) have relatively lower reliance on these networks. Radio is another significant source of information, especially in regions such as Buno Bedele (79%), Kaffa (70%), and Jimma (70%), where a large proportion of the population receives climate-related information via radio. The influence of DAs/Extension workers is particularly strong in Jimma (72%) and West Guji (73%), suggesting the existence of more active climate communication efforts in these areas. Television is a less common source but is notably high in Illuababor (59%) and Jimma (29%). Newspapers appear to play a minimal role in most regions, with West Arsi being the only region with a noticeable proportion (7%) mentioning it as a source.

In terms of the frequency of hearing about climate change, most respondents report hearing about it rarely, with Buno Bedele (85%) and Sidama (77%) having the highest proportions in this category. West Guji stands out with a higher proportion of people hearing about climate change often (41%), followed by Gedio (32%) and Buno Bedele (29%). The frequency of hearing about climate change as always is still relatively low overall, with Illuababor having the highest proportion at 29%.

Table 26: Climate change and adaptive measures applied (Regional levels)

Climate change related information	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig.
Heard about climate change										
No [Proportion]	0.46	0.16	0.19	0.31	0.32	0.29	0.30	0.07	0.26	0.000
Not sure [Proportion]	0.15	0.04	0.01	0.17	0.02	0.15	0.02	-	0.19	0.000
Yes [Proportion]	0.39	0.81	0.80	0.52	0.66	0.56	0.68	0.92	0.55	0.000
Source of information about climate change										
Television [Proportion]	0.07	0.06	0.25	0.59	0.29	0.11	0.11	0.21	0.12	0.000
Newspaper [Proportion]	0.02	-	0.03	-	-	0.00	0.02	0.01	0.02	0.070
Friends/families [Proportion]	0.42	0.33	0.69	0.44	0.53	0.51	0.43	0.73	0.30	0.000
Radio [Proportion]	0.39	0.79	0.44	0.24	0.47	0.70	0.14	0.36	0.17	0.000
DAs/Extension workers	0.44	0.27	0.37	0.58	0.72	0.70	0.41	0.63	0.73	0.000
Other [Proportion]	0.48	0.47	0.31	0.09	0.33	0.35	0.51	0.08	0.51	0.000
Frequency of hearing about climate										
Always [Proportion]	0.07	0.02	0.03	0.29	0.06	0.12	0.06	0.12	0.09	0.000
Often [Proportion]	0.29	0.14	0.32	0.13	0.16	0.18	0.17	0.22	0.41	0.000
Rarely [Proportion]	0.64	0.85	0.66	0.58	0.78	0.70	0.77	0.66	0.49	0.000
Changes in the climate over respondent's lifetime, particularly over the past 30 years										
Don't know [Proportion]	0.21	0.03	0.03	0.23	0.06	0.10	0.08	-	0.19	0.000
No [Proportion]	0.33	0.26	0.24	0.17	0.21	0.25	0.26	0.06	0.22	0.000
Yes [Proportion]	0.46	0.71	0.73	0.61	0.73	0.64	0.66	0.94	0.59	0.000
Access to information about rainfall and temperature forecast										
Access to information	0.19	0.27	0.38	0.29	0.21	0.35	0.33	0.37	0.26	0.000
Weather forecast information for livelihood decisions										
Used weather forecast	0.15	0.32	0.29	0.28	0.15	0.22	0.20	0.49	0.20	0.000
Measures taken based on weather forecast information										
Planning time adjusted	0.33	0.82	0.96	1.00	0.98	0.98	0.45	0.22	0.90	0.000
Varietal selection [Proportion]	0.34	0.26	0.45	0.14	0.62	0.63	0.40	0.38	0.54	0.000
Livelihood diversification	0.66	0.20	0.74	0.19	0.53	0.57	0.31	0.65	0.51	0.000
Shift in livelihood [Proportion]	0.12	0.06	0.44	0.09	0.76	0.50	0.24	0.13	0.42	0.000
Advance sale of livestock	0.01	0.02	0.04	0.02	0.76	0.06	0.04	0.30	0.07	0.000
Advance water management	0.04	-	0.04	0.05	0.09	0.01	0.14	-	0.08	0.000
Advance pasture/animal feed	0.04	0.04	0.01	0.05	0.09	0.03	0.13	0.04	0.08	0.000
Insurance [Proportion]	-	-	0.17	-	-	-	-	-	0.03	0.000
Others [Proportion]	0.27	0.24	0.11	0.05	0.40	0.03	0.13	-	0.24	0.000

Source: Survey(2024)

16 Energy Saving Technologies

16.1 Energy Saving Technologies Usage at Regional Levels

The findings in Table 28 highlights the adoption and utilization of energy-saving technologies in different regions of Ethiopia. The result indicates that 12% of households in Oromia use fuel-efficient cook stoves, which is higher than the overall average of 9%. Conversely, only 2% and 3% of households in Sidama and South Ethiopia, respectively, had a fuel-efficient cook stove, indicating a comparatively low level of technology adoption in these regions.

Despite the fact that Southwest Ethiopia exhibits the longest usage of fuel-efficient cook stove at 5.7 years, households in Oromia also utilized cook stoves for longer periods of time, with households using them for an average of 4.48 years, longer than those in Sidama (2.2 years) and South Ethiopia (3 years) as well as longer than the national average of 3.85 years. The result also highlighted that 3 percent of households stopped using fuel efficient cook stove. The corresponding figure for Oromia is as high as 6 percent. The reasons to cease using fuel-efficient cook stoves vary. Households in Sidama (25%) and South Ethiopia (25%) mentioned incompatibility with the technology as a reason to stop using improved cooking stoves. However, this reason is not that much appealing in Oromia where only 3 percent of households stopped using cookstove because of households' incompatibility with the technology. Rather, inconvenience, space requirements, and unmet expectations were mentioned as the salient reason that triggered households to stop using improved fuel-efficient stoves. For example, 49% of households in Oromia stated that they quit using the stove due to its inconvenience.

Barriers to adopting fuel-efficient cook stoves also vary across regions. For instance, overall 33 percent of households responded that it is insufficient supply that limits them from using improved cookstoves. The respective figures reached as high as 59 and 33 percent in Sidama and Southwest Ethiopia. Incompatibility with existing cooking culture is also one of the reasons. In Oromia 6% of households mentioned incompatibility with existing cooking culture as a reason. The corresponding figure for Sidama and South Ethiopia are 3 % and 4%, respectively.

Affordability is another barrier. For instance, 15 percent of households in Oromia reported high price as one factor that hindered them from using improved cooking stoves. Overall, 8% of households mentioned high price of cook stoves as one barrier to use improved cook stove. Lack of awareness about the benefits of efficient cook stoves is also one of the most important factors that prevented households from using cookstove. Households in Oromia (56%) and Southwest Ethiopia (64%) mentioned that they were not aware of the benefits of fuel efficient cookstoves. Overall, 55% of households don't know the benefits of improved cook stoves.

Similar trends have been observed in the awareness and use of solar energy, with Southwest Ethiopia (68%) and Oromia (57%), both of which are higher than the overall average of 50%. Sidama (28%) has lowest awareness. The usage of solar energy mirrors this trend, with Southwest Ethiopia (88%) leading in the use of solar plates, followed closely by Oromia (77%), both higher than the total average of 77%. Other regions, including Sidama (67%) and South Ethiopia (74%), also report moderate usage. Briquettes, however, are seldom used, with South Ethiopia (7%) showing the highest proportion, reflecting a total average of 3%. Training on energy-efficient cook stoves is highest in Southwest Ethiopia (26%), with Sidama (8%) reporting the lowest participation, below the total average of 17%. Government involvement in training is most notable in Oromia (64%), with Southwest Ethiopia (54%) following, while Sidama (30%) and South Ethiopia (25%) report lower participation. NGOs are significant trainers in Sidama (80%) and Southwest Ethiopia (63%).

The current energy sources used for cooking reveal that households heavily rely on firewood as source of energy. This is evidenced by the fact that 96 % and 81% of households in South Ethiopia and Sidama, respectively used firewood planted by the household themselves. Oromia (57%) and Southwest Ethiopia (62%) also rely heavily on firewood. Overall, 74% of households used firewood planted by themselves as the main source of energy. Sidama and Oromia show significant reliance on firewood collected from forests (63% and 38%, respectively). Other sources of energy, such as animal residuals and electricity, remain minimal source of energy across

all regions, though Oromia and Southwest Ethiopia report slightly higher electricity usage (3%) compared to the overall average of 1%.

The willingness to adopt fuel efficient cookstove was analyzed. The result shows that 85 percent of households are willing to adopt fuel efficient cook stoves. Sidama (94%) and South Ethiopia (94%) exhibit the highest willing to adopt fuel-efficient cook stoves. High willingness is also reported by Oromia (76%) and Southwest Ethiopia (74%), albeit marginally below the overall average.

Table 27: Energy Saving Technologies Usage at Regional Levels

Energy source and Utilization Related information	Oromia	Sidama	South Ethiopia	Southwest Ethiopia	Sig.	Total average
Cooking stove usage						
Used fuel efficient cook stoves [Proportion]	0.21	0.02	0.03	0.08	0.000	0.09
Duration using cooking stove [Years]	4.48	2.20	3.00	5.70	0.019	3.85
Ceased cooking stove usage [Proportion]	0.06	0.02	0.02	0.03	0.000	0.03
Causes of ceasing cooking stove usage						
Incompatibility of the technology to our cooking [Proportion]	0.03	0.25	0.25	0.11	0.017	0.16
Inconvenience of using it [Proportion]	0.49	0.13	0.50	0.52	0.247	0.41
It required additional space [Proportion]	0.04	0.38	0.13	0.11	0.010	0.17
The benefit of it is not as expected [Proportion]	0.45	0.25	0.13	0.26	0.117	0.27
Causes for not to adopting fuel efficient cooking stoves						
Incompatibility of the technology to our cooking [Proportion]	0.06	0.03	0.04	0.01	0.000	0.03
Insufficiency supply of the stove [Proportion]	0.23	0.59	0.17	0.33	0.000	0.33
Negative feedback from users [Proportion]	0.00	-	0.00	0.00	0.625	0.00
Unaffordability due to high price [Proportion]	0.15	0.07	0.09	0.01	0.000	0.08
Lack of awareness about the benefits [Proportion]	0.56	0.31	0.68	0.64	0.000	0.55
Awareness and Utilization of Solar energy/other energy sources						
Aware about solar plat as a source of energy [Proportion]	0.57	0.28	0.48	0.68	0.000	0.50
Used solar plate as source of energy [Proportion]	0.77	0.67	0.74	0.88	0.000	0.77
Have information on cooking stove [Proportion]	0.33	0.29	0.19	0.22	0.000	0.26
Used briquettes as source of energy [Proportion]	0.02	0.01	0.07	0.03	0.000	0.03
Training on Solar energy						
Received training about cooking stove [Proportion]	0.23	0.08	0.09	0.26	0.000	0.17
Trainers						
Government [Proportion]	0.64	0.30	0.25	0.54	0.040	0.43
NGOs [Proportion]	0.54	0.80	0.38	0.63	0.212	0.59
Private vendor [Proportion]	0.04	-	0.25	0.02	0.022	0.08
Other agents [Proportion]	0.18	-	0.13	0.09	0.292	0.10
Willingness to use cooking stove						
Willing to use [Proportion]	0.76	0.94	0.94	0.74	0.000	0.85
Current source of Energy at home						
Firewood planted by the household [Proportion]	0.57	0.81	0.96	0.62	0.000	0.74
Firewood collected from forests [Proportion]	0.63	0.38	0.31	0.46	0.000	0.45
Animal residual [Proportion]	0.02	-	0.00	0.00	0.000	0.01
Biofuel [Proportion]	0.00	0.00	-	-	0.455	0.00
Electricity [Proportion]	0.03	0.01	0.01	0.00	0.000	0.01

Source: Survey(2024)

16.2 Energy Saving Technologies Usage at Zonal Levels

Table 29 shows significant zonal variations in the adoption and use of energy-saving technologies, particularly fuel-efficient cook stoves and solar energy sources. The proportion of households that use fuel-efficient cook stoves is the highest in Illuababor (53%) and West Arsi (58%), while zones such as Bench Sheko, Buno Bedele, Kaffa, Sidama, and West Guji have much lower adoption rates, ranging from 2% to 13%. There are also substantial differences in the length of time of using a cookstove; for example, Kaffa (6.80 years) had larger usage times than West Guji (1.75 years), and this difference is statistically significant at 1%. Buno Bedele has the highest percentage of households that stopped using cook stoves (23%) while Gedio and Sidama have the lowest percentages (2%).

Incompatibility with cooking cultures and practices is the most frequently mentioned reasons for ceasing stove usage in Gedio (25%) and Sidama (25%). Inconvenience is another major factor, especially in Illuababor (75%) and Jimma (100%). The requirement for additional space is also a key barrier, particularly in Kaffa (38%). Incompatibility with cooking needs is mentioned as one problem in Jimma (16%) and Kaffa (3%) that contribute for not adopting cookstoves. Insufficient supply of stoves is also another key barrier, particularly in Illuababor (59%) and Sidama (59%), while the corresponding figures in Bench Sheko and West Arsi are 18% and 19%, respectively. Affordability due to high prices is also mentioned as one reason that hindered household from using cookstoves. The highest rates were registered in Jimma (19%) and West Guji (17%).

Awareness of solar energy sources is generally high, with the highest rate in Buno Bedele (95%) and Kaffa (73%) and the lowest rates in Sidama (28%) and West Guji (36%). The proportion of households which use solar energy falls in conformity with this trend, with Buno Bedele (98%) and Kaffa (92%) showing the highest usage, and Sidama (67%) and West Guji (52%) exhibited the lowest. Households who took training on energy-efficient technologies is most common in Illuababor (54%) and least common in Jimma (1%). Most of the training was offered by the

government, especially in Buno Bedele (95%) and Jimma (100%), while NGOs play a significant role in regions such as Bench Sheko (69%) and Sidama (80%).

The willingness to adopt fuel-efficient cook stoves is high across most regions, with Sidama, West Arsi, and West Guji showing the highest willingness (94%-96%). However, regions like Bench Sheko and West Guji exhibited lower willingness levels (55% and 54%, respectively). Firewood remains the dominant source of cooking energy, with the highest usage in Gedio (96%) and Sidama (81%), and lower usage in regions such as Jimma (37%) and West Arsi (38%). Electricity usage for cooking is minimal across all regions, with the highest usage in Illuababor and Jimma (10%).

Table 28: Energy Saving Technologies Usage at zonal Levels

Energy saving technologies	Bench Sheko	Buno Bedele	Gedio	Illuababor	Jimma	Kaffa	Sidama	West Arsi	West Guji	Sig
Cooking stove usage										
Used fuel efficient cook stoves	0.08	0.13	0.03	0.53	0.07	0.08	0.02	0.58	0.05	0.000
Duration using cooking stove	4.54	6.30	3.00	5.30	2.77	6.80	2.20	4.40	1.75	0.000
Ceased cooking stove usage	0.03	0.23	0.02	0.03	0.04	0.03	0.02	0.05	0.03	0.000
Causes of ceasing cooking stove usage										
Incompatibility of the technology to	-	-	0.25	-	-	0.20	0.25	0.08	0.08	0.040
Inconvenience of using it	0.50	0.25	0.50	0.75	1.00	0.53	0.13	0.83	0.31	0.000
It required additional space	0.08	0.03	0.13	-	0.13	0.38	0.08	0.08	0.13	0.000
The benefit of it is not as expected	-	-	-	-	-	-	-	-	-	-
Causes for not to adopting fuel efficient cooking stoves										
Incompatibility of the technology to	0.01	-	0.04	-	0.16	0.01	0.03	0.04	0.03	0.000
Insufficiency supply of the stove	0.18	0.44	0.17	0.59	0.09	0.49	0.59	0.19	0.21	0.000
Negative feedback from users	-	-	-	-	-	-	0.02	-	-	0.000
Unaffordability due to high price	0.03	-	0.09	0.16	0.19	-	0.07	0.06	0.17	0.000
Lack of awareness about the	0.78	0.56	0.68	0.23	0.54	0.50	0.30	0.68	0.59	0.000
Awareness and Utilization of Solar energy/other energy sources										
Aware about solar plat as a source	0.56	0.95	0.47	0.53	0.71	0.73	0.28	0.56	0.36	0.000
Used solar plate as source of energy	0.83	0.98	0.74	0.70	0.85	0.92	0.67	0.72	0.52	0.000
Have information on cooking stove	0.19	0.51	0.19	0.53	0.26	0.24	0.29	0.43	0.19	0.000
Used briquettes as source of energy	-	0.09	0.07	0.02	0.01	0.06	0.01	-	0.01	0.000
Training on Solar energy										
Received training about cooking	0.26	0.27	0.09	0.54	0.01	0.27	0.08	0.18	0.14	0.000
Trainers										
Government [Proportion]	0.35	0.95	0.25	0.51	1.00	0.68	0.30	0.65	0.50	0.000
NGOs [Proportion]	0.69	0.05	0.38	0.65	1.00	0.59	0.80	0.76	0.67	0.000
Private vendor [Proportion]	-	0.05	0.25	0.02	-	0.03	-	0.12	-	0.000
Other agents [Proportion]	0.13	-	0.13	0.28	-	0.07	-	0.47	-	0.000
Willingness to use cooking stove										
Willing to use [Proportion]	0.55	0.62	0.94	0.98	0.89	0.92	0.94	0.96	0.54	0.000
Current source of Energy at home										
Firewood planted by the household	0.48	0.63	0.96	0.56	0.37	0.76	0.81	0.38	0.79	0.000
Firewood collected from forests	0.53	0.60	0.30	0.86	0.88	0.39	0.38	0.71	0.36	0.000
Animal residual [Proportion]	-	-	-	0.01	-	-	-	0.09	-	0.000
Biofuel [Proportion]	-	-	-	-	-	-	0.01	-	-	0.000
Electricity [Proportion]	-	-	0.01	0.10	0.10	0.01	0.01	0.04	0.02	0.000

Source: Survey(2024)

17 Way forward

To effectively prevent forest loss, promote restoration, and integrate sustainability into Ethiopia's coffee value chains and food systems, a multifaceted approach is essential. First, enhancing coffee productivity through the adoption of modern agricultural techniques and improved coffee varieties is crucial. By leveraging best practices from regions like Sidama, where productivity and market engagement are high, and other coffee-producing areas can improve yields while reducing the need for land expansion. Training programs and access to productivity-enhancing technologies should be prioritized to empower smallholder farmers to adopt sustainable farming practices that increase efficiency without compromising biodiversity.

Expanding cooperative networks and access to specialty coffee markets is another vital strategy. Cooperative structures should be strengthened to improve farmers' bargaining power, ensure fair pricing, and promote traceability in coffee production. Integrating smallholder farmers into specialty markets can enhance income while rewarding sustainable and high-quality coffee production. Incentives for quality certification and direct market access should also be institutionalized to ensure farmers benefit equitably from the value chain.

Agroforestry practices must be scaled to maintain biodiversity and foster environmental restoration. Promoting the intercropping of coffee with native tree species can serve as a dual-purpose strategy for conservation and productivity enhancement. These practices not only help preserve ecosystems but also create microclimates that enhance coffee quality. Investment in reforestation programs targeting degraded coffee-growing areas should be prioritized, supported by robust monitoring mechanisms to track progress.

Finally, addressing socio-economic factors, including gender disparities and access to education, will strengthen the resilience of coffee-growing communities. Women's empowerment initiatives and education programs for farmers on climate adaptation, biodiversity conservation, and market engagement can create a more inclusive and sustainable coffee value chain.

By integrating these strategies, the FOLUR Ethiopia project can effectively balance environmental sustainability with economic growth, ensuring the preservation of Ethiopia's unique biodiversity and the livelihoods of millions reliant on coffee production. This comprehensive approach is vital

for Ethiopia to maintain its global leadership in sustainable coffee production while combating the challenges of deforestation and climate change.

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