Empowering Women Farmers Through Climate Information Services

Impact and Lessons from Mobile-Based Adaptation Tools for Women Farmers in Kenya

Sauti East Africa - July 2025

Sauti.

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LIST OF ABBREVIATIONS

Abbreviation	Full Meaning
CIS	Climate Information Services
IKI	International Climate Initiative
KII	Key Informant Interview
SMS	Short Message Service
USSD	Unstructured Supplementary Service Data
IVR	Interactive Voice Response
NGO	Non-Governmental Organization
M&E	Monitoring and Evaluation
CSA	Climate-Smart Agriculture
KES	Kenyan Shilling

EXECUTIVE SUMMARY

Women smallholder farmers are the backbone of Kenya's agricultural productivity and food security, yet they remain disproportionately affected by structural challenges, limited land rights, financial exclusion, and restricted access to climate-smart agricultural information. These vulnerabilities are exacerbated by escalating climate shocks, including droughts, floods, and pest outbreaks, which directly threaten yields, incomes, and household resilience.

To address these challenges, the project titled *"Equitable Access to Climate-Related Information and Adaptation Tools for Women Farmers in Kenya"* was implemented by Sauti East Africa with support from the International Climate Initiative (IKI) Small Grants Programme. The project focused on increasing women's access to timely, actionable climate and agricultural information using inclusive mobile-based platforms such as Unstructured Supplementary Service Data (USSD), Short Message Service (SMS), and WhatsApp, specifically designed for low-literacy and low-connectivity environments.

Implementation prioritized equity and accessibility from design to delivery. Content was delivered in multiple local languages, including English and Swahili, and mobile platforms (USSD/SMS) were designed for non-smartphone, low-literacy users while WhatsApp remained relevant for digitally literate users with smartphones. Peer learning, refresher training workshops, and local agricultural extension support further ensured that older and less digitally literate women were not left behind. Over a two-year period, the project trained 567 women community leaders in digital access and decision-making tools, across four climate-vulnerable counties; Vihiga, Homa Bay, Uasin Gishu, and Busia.

In total, 16,596 women accessed the mobile climate information platforms, making up 49% of all users (34,210) as of May 2025. Additionally, 57.8% of new users reported integrating climate change adaptation strategies in their farming or business practices. A mixed-methods endline evaluation, comprising a panel survey and key informant interviews, was conducted to assess the project's impact on women users of the platform. Results showed statistically significant improvements across multiple outcome areas, summarized below:

Climate Resilience & Adaptation	
Climate preparedness practices increased	The average number of preparedness actions rose from 2.05 to 2.94 per respondent ($p < 0.001$), with 91.1% using frequent weather monitoring and 89.7% actioning early alerts.

Adoption of climate adaptation strategies more than doubled	Women used an average of 2.59 adaptation strategies at endline, up from 1.35 ($p < 0.001$). Most frequent adaptation strategies included: implementing crop rotation or intercropping strategies, investing in soil conservation measures, and switching to drought-resistant crop varieties.
Information Access & Decision-Making	
Accessibility to mobile climate services expanded	USSD usage rose from 23.0% to 69.3%, and SMS access increased from 6.0% to 73.4%.
Mobile phones became the primary source of information	Preference for mobile access increased from 38% to 90%, overtaking radio, Television (TV), and extension services.
Confidence and decision-making improved	Women reported confidence in accessing agricultural services rose from 3.46 to 3.83, and decision-making agency increased from 3.67 to 3.94 ($p < 0.001$).
Market Engagement & Livelihoods	
Incomes rose in parallel with market access	Average monthly farming income increased from Kenyan Shillings (KES) 10,286 to KES 12,338. The proportion of women identifying new buyers increased from 43.3% to 54.7% ($p < 0.001$).
Digital market engagement grew significantly	WhatsApp use to find buyers increased from 11.0% to 22.9%, and USSD for trade use rose from 1.0% to 5.4%.

We extrapolate our impact results to our project reach below. All extrapolations satisfy a minimum statistical power of 90% to our recorded reach of 34,210 users:

Impact	**Proportion of reach with any improvement**	**Estimated number of small-holder farmers impacted**	**Estimated number of women small-holder farmers impacted by the project**
Platforms Accessibility Score	56.4%	19,306	9,366
Monthly revenue from farming (KES)	52.3%	17,905	8,686
Identification of new buyers	31.3%	10,703	5,192

Market Intel Score	49.1%	16,805	8,152
Preparedness Activities	62.0%	21,206	10,288
Coping Practices	62.9%	21,506	10,433
Access to Information Score	55.3%	18,906	9,171
Decision-making score	49.4%	16,905	8,201

These improvements demonstrate the potential of inclusive, mobile-based platforms to close information gaps and improve resilience, confidence, and economic outcomes for women in agriculture.

Strategic Recommendations

- Expand low-tech platforms like USSD, SMS, and Interactive Voice Response (IVR) to reach low-literacy and offline users.
- Support digital literacy through refresher trainings and peer learning via cooperatives and WhatsApp groups.
- Co-create localized content with women farmers to ensure relevance and trust.
- Enhance mobile market access with buyer linkages, price alerts, and transport tips.
- Institutionalize CIS platforms within county extension systems and partner with telcos to improve connectivity and access.

Conclusion

The project's outcomes affirm that inclusive, accessible, mobile-first climate information services, when reinforced by human support systems and tailored to local needs, can catalyze meaningful progress in resilience, livelihoods, and gender equity. This model offers a scalable, cost-effective, and impact-driven pathway to transform how vulnerable women farmers access, use, and benefit from climate-smart agricultural information. With sustained investment and cross-sector collaboration, the model provides a replicable blueprint for climate adaptation efforts in similarly affected regions across Sub-Saharan Africa.

1. INTRODUCTION

Smallholder women farmers in Kenya play a vital role in national food security and agricultural production. However, they face persistent structural barriers, including limited land ownership, inadequate access to inputs and finance, and minimal exposure to timely and actionable climate information. These constraints are further compounded by the effects of climate change, including increased frequency of droughts, floods, and pest outbreaks, which collectively threaten productivity, income stability, and resilience.

Kenya's rural regions are particularly vulnerable to the impacts of climate variability. With over 70% of the rural population dependent on agriculture, and with agronomic service delivery already facing challenges, the growing intensity of climate change increases the threat to sustainable food systems. Women are disproportionately affected, due to both economic marginalization and a digital gender divide that limits their access to timely and localized climate-smart information.

Access to gender-responsive climate information services (CIS) is critical to supporting women farmers in adopting climate-smart agriculture (CSA) practices. When tailored to women's needs and delivered through inclusive platforms, CIS can improve decision-making, strengthen climate preparedness, and enhance socio-economic outcomes. This project was designed to address these challenges by leveraging low-cost, accessible mobile technologies, specifically USSD and SMS-based platforms to deliver real-time, relevant agricultural and climate information to women smallholder farmers. The platform content included weather forecasts, seasonal climate alerts, agro-climatic strategies, input supplier lists, market prices, and access to climate finance opportunities. The information was made accessible through multilingual and mobile-friendly formats, with no cost to users.

1.1. Target Groups and Project Reach

The project targeted low-income and vulnerable women working in Kenya's agricultural sector, especially in counties representing the country's food-producing regions. Direct implementation was carried out in Vihiga, Homa Bay, Uasin Gishu, and Busia Counties. Direct beneficiaries included 567 women trained on the use of the USSD/WhatsApp platforms, while broader outreach activities extended the platform's reach to more than 15,000 women farmers through SMS pushes and social media engagement.

1.2. Project Phases and Key Activities

The project was implemented over four phases from early 2023 to mid-2025. Below is a summary of major activities conducted in each phase. A full breakdown is available in **Annex 1**:

- **Q1–Q2 (2023):** Stakeholder mapping; climate information needs assessment; recruitment of an Monitoring and Evaluation (M&E) expert; analysis and publication of the needs assessment report
- **Q3–Q4 (2024):** Development and population of new agricultural and climate content on USSD platform; stakeholder engagement with county governments; deployment of baseline survey; field training of 269 women; outreach to 2,938 women
- **Q5–Q6 (2024):** Endline data collection involving 349 out of 400 baseline participants; training of an additional cohort, bringing total trained to 567 women; continued outreach reaching 7,484 women
- **Q7–Q8 (2025):** Final outreach and project closure activities; over 15,000 women reached through SMS campaigns; updates to WhatsApp platform to enhance smartphone user experience; final analysis and reporting

2. EVALUATION OBJECTIVES

This endline evaluation assesses the outcomes of improved access to CIS on the knowledge, practices, and resilience of smallholder women farmers in Kenya. The assessment builds on a 2024 quantitative baseline survey and integrates both quantitative and qualitative data collected during the project's final phase across four counties.

A mixed-methods approach was adopted to capture both the measurable impact of the intervention and the underlying causal pathways. Quantitative data were gathered through structured endline surveys, while qualitative insights were drawn from KIIs with agricultural extension officers. This combination allowed for a robust analysis of not only what changed, but also how and why these changes occurred, offering a deeper understanding of women's experiences with CIS platforms

Specifically, the study aims to:

- Assess the extent of access to CIS among women farmers at the end of the project period.
- Evaluate how women use CIS and their perceptions of its relevance and usefulness for farm-level decision-making.
- Examine the influence of CIS on agricultural productivity, income diversification, and climate adaptation.

- Identify the barriers and enabling factors that affect sustained use of CSA practices informed by CIS.
- Gather user and institutional feedback on mobile-based information delivery systems, including perceived effectiveness and areas for improvement.
- Provide actionable recommendations for policymakers, development partners, and digital service providers on enhancing the reach and gender responsiveness of CIS platforms.

3. METHODOLOGY

3.1. Overview

This endline study used a mixed-methods approach to assess changes in access to and use of agricultural and climate information among women farmers and traders. It compares endline data with a 2024 baseline, focusing on key outcomes related to information access, farming practices, and resilience. The evaluation design did not include a control group, but tracked a longitudinal cohort of women trained during the project period.

A total of 567 women received training under the CIS project. Of these, 400 were interviewed at baseline, and 349 (87%) were successfully re-interviewed at endline, representing a 13% attrition rate. For our population of women expected to be impacted by the project (16,596), our margin of error at the 95% confidence level is expected to be ±4.6%. This longitudinal structure supports a comparative analysis of impact.

3.2. Study Sites and Participants

The evaluation was conducted in:

- Vihiga County
- Busia County
- Homa Bay County
- Uasin Gishu County

These locations were selected based on their inclusion in both the training intervention and the baseline study. They reflect a mix of agro-ecological zones and farming systems.

Table 1: Distribution of Survey Participants by County

County	Baseline n=400	Endline n=349
Vihiga	82	71
Busia	129	111
Homa Bay	75	62
Uasin Gishu	114	105
Total	400	349
Total Attrition	_	13%

3.3. Data Collection Methods

To comprehensively evaluate the impact of the project and explore both outcomes and mechanisms of change, the study adopted a mixed-methods approach, combining quantitative and qualitative techniques. Each method served a distinct but complementary purpose:

- The quantitative survey measured changes in key indicators between baseline and endline to assess impact outcomes, such as improved access to information, changes in farming practices, and livelihood gains.
- The qualitative component, conducted through Key Informant Interviews (KIIs), sought to unpack the causal logic, exploring how and why changes occurred, including contextual and institutional enablers or barriers influencing women's adoption of CIS tools.

This dual approach ensured that the evaluation not only quantified change but also captured the nuanced processes that underpinned behavior and system-level transformation.

3.3.1. Quantitative Data Collection

Structured phone-based surveys were conducted in May 2025 using the Kobo Collect platform. The survey tool was adapted from the baseline questionnaire to ensure consistency in core indicators.

Key themes included:

- Access to agricultural and climate information (sources, accessibility, language, format)
- Adoption of climate-smart practices (e.g., drought-tolerant crops, water management)
- Livelihood outcomes (income, market linkages, supplier access)
- Confidence in decision-making and participation in farmer training or cooperatives

- Climate resilience and adaptation (preparedness for climate-related risks, use of early warnings, diversified income strategies)
- Barriers and enablers to the use of climate and agricultural information
- Feedback on mobile-based information delivery services

Four trained enumerators from Sauti East Africa conducted the survey. Responses were uploaded securely, reviewed for consistency, and prepared for analysis using Stata software. Quantitative analysis included pre-post statistical analyses to estimate the direction and magnitude of impact changes in key indicators

Sample Size Attrition and Limitations

Between baseline and endline, the sample size decreased from 400 to 349 respondents. This represents an attrition rate of 13%, attributed to unreachable phone numbers, respondent mobility and changes in phone ownership or household contact details

While this attrition is within acceptable limits for longitudinal phone-based studies, it introduces a potential limitation in representativeness. Nonetheless, a comparison of demographic characteristics (see Annex 2) indicates that the endline sample remained geographically and socioeconomically comparable to the baseline.

Indicators of Interest

Each indicator of interest, described more fully below, was analyzed using a quantitative pre-post treatment estimator to quantify the size of the intervention's impact. The baseline/endline data was structured as a panel dataset with traders serving as the cross-sectional identifier. The estimator specification was adapted to each indicator, but as a starting point, the specification for each analysis is:

$$y_{it} = \beta_0 + \beta_1 D_t + \beta_2 C_{it} + \alpha_i + \lambda_t + \epsilon$$

Where:

- y_t is the participants (*i*) outcome score at observation time *t*;
- D_t is a variable that takes on the value 1 if the individual has successfully completed the workshop training at observation time *t*, and zero otherwise;
- C_{it} represents the control variables of the individual's (i) transaction at time t;
- α_i is the fixed effect common to the individual;
- λ_i is a time effect common to the population sample at observation time t;

    - ϵ is a time-varying error and is assumed to be distributed independently of all λ_t
- β_0 is the intercept term and represents the baseline or initial number of broker errors resulting in penalty assessments, assuming C_t is equal to zero.
- β_1 is the coefficient of interest and represents the interaction effect of the program on the impact indicator.
- β_2 is the coefficient on the control variables and represents the effect of the control variables on the individual's outcome variable.

Control variables included: MaritalStatus, regional location, education level, youth (<35), smartphone access

We focus on the following outcome indicators.

Table: Indicators of Interest

Indicator	What It Measures	How It's Calculated
Platforms Accessibility Score	Ease of accessing and using mobile platforms for climate/agriculture info	Combined ratings of language, format, affordability, user-friendliness, reliability, and reach
Average Monthly Revenue	Monthly income earned from farming or related trade	Self-reported income from participants, averaged across responses
New Buyer Identification	Whether participants found new buyers for farm inputs or produce	Yes (1) or No (0) question asked over a 6-month recall period
Market Intelligence Score	Use of market tools and strategies to improve selling or sourcing	1 point for each method used: market research, online tools, distributors, digital sales (max score = 4)
Information Relevance	Whether women felt the info met their needs as farmers	A single yes/no question on the perceived usefulness of information
Preparedness Activities	Steps taken to prepare for climate-related risks	Count of preparedness actions taken (e.g., early planning, weather tracking)
Coping Practices	Changes made in farming to adapt to climate change	Count of coping or adaptation strategies adopted
Access to Information Score	Ease and confidence in accessing services and opportunities	Average rating (1–5) across areas like finance, inputs, extension services, and training info

Decision-Making Score	Ability to make informed farming and resource decisions	Average rating (1–5) on improvements in decision-making across farming strategies, land, and resources

3.3.2. Qualitative Data Collection and Analysis

To complement the quantitative findings and deepen understanding of how and why observed changes occurred, the study employed Key Informant Interviews (KIIs) with County Agricultural Extension Officers.

- A total of five key informant interviews were conducted in April 2025 by trained researchers via phone.
- Interviews followed a semi-structured guide that included themes such as: access to climate information, observed behavior change, mobile platform effectiveness, and recommendations for improvement.
- Interviews were audio-recorded (with consent), transcribed, and analyzed using thematic analysis to extract recurring patterns and explanatory narratives.
- Quotes from respondents were used directly and contextually to ensure accurate representation of views

Key insights from these interviews were aligned with the survey themes to triangulate findings, clarify causality, and highlight the role of institutional and systemic factors in shaping women's access and responsiveness to CIS platforms. *A summary of the qualitative respondents is presented in (Annex 5) to provide contextual clarity and ensure transparency.*

3.4. Ethical Considerations

All participants gave verbal informed consent prior to participation. The study followed ethical standards including:

- Transparency about the purpose of the evaluation
- Voluntary participation and right to withdraw
- Confidentiality and secure storage of data
- Anonymization of all responses in reporting

Participants were compensated with a small airtime token as appreciation for their time.

4. DEMOGRAPHIC AND SOCIOECONOMIC PROFILE OF WOMEN SMALLHOLDER FARMERS

This section presents a summary of the key characteristics of the women smallholder farmers surveyed (n = 400), as part of the quantitative component of this evaluation. The summaries briefly describe covariates such as age, education, marital status, income sources, and land and phone ownership, which are relevant for interpreting the project's outcomes. Comparative distributions between baseline and endline samples are presented in (Annex 2), and covariate differences were found to be negligible, confirming the suitability of the baseline group for longitudinal comparison.

4.1. County Distribution:

Respondents were from Homa Bay (18.8%), Busia (32.3%), Uasin Gishu (28.5%), and Vihiga (20.5%).

4.2. Age Distribution:

The results show that the majority of respondents (44.8%) were aged 18–39, followed by those aged 40–49 (26.8%). Respondents aged 50–59 made up 20.3%, while 7.8% were between 60–69 years. There was minimal representation of respondents above 70 years, accounting for only 0.5% of the sample.

4.3. Marital Status:

Most respondents were married and living with their spouse (52.0%), while 20.0% were single.

4.4. Education:

This data reveals that the majority of participants (44.3%) have completed secondary education, followed by 29.5% with a college or higher qualification. A quarter of the participants (25.8%) have completed primary education, while a small percentage (0.5%) have no formal education.

4.5. Land Ownership:

69.0% of the respondents reported that they owned the land they farmed, though this likely reflects household and spousal access rather than formal legal ownership, and should be interpreted with caution. Additionally, 98.3% reported no physical disability.

4.6. Source of Income:

This data reveals that a large majority of participants (76.0%) derive their income from agriculture or agribusiness. A smaller percentage of participants rely on other types of business (12.5%), while 7.3% are employed. Family remittances account for 4.5% of the income sources, and a minimal 0.3% identified other unspecified sources of income.

4.7. Nature and Scale of Farming:

A larger proportion of the people surveyed are farming on land they do not own, which could indicate a reliance on lease agreements, renting, or using communal or family land. Conversely, a smaller proportion (31.3%) own the land they farm.

5. RESULTS

By the end of the project in May 2025, the platform had reached 34,210 users, of which 49% (16,596) self-reported as women. This surpassed initial outreach targets and demonstrates strong demand among women smallholder farmers for accessible, simplified climate-related information. Continuous use of the platform was used as a proxy to estimate the extent to which farmers integrated climate adaptation information into their agricultural and business practices. As of May 2025, 57.8% of new users consistently accessed climate-related content such as weather forecasts, pest and disease updates, soil health tips, and adaptation techniques. We use these figures of reach to extrapolate the assessed impact in each subsection.

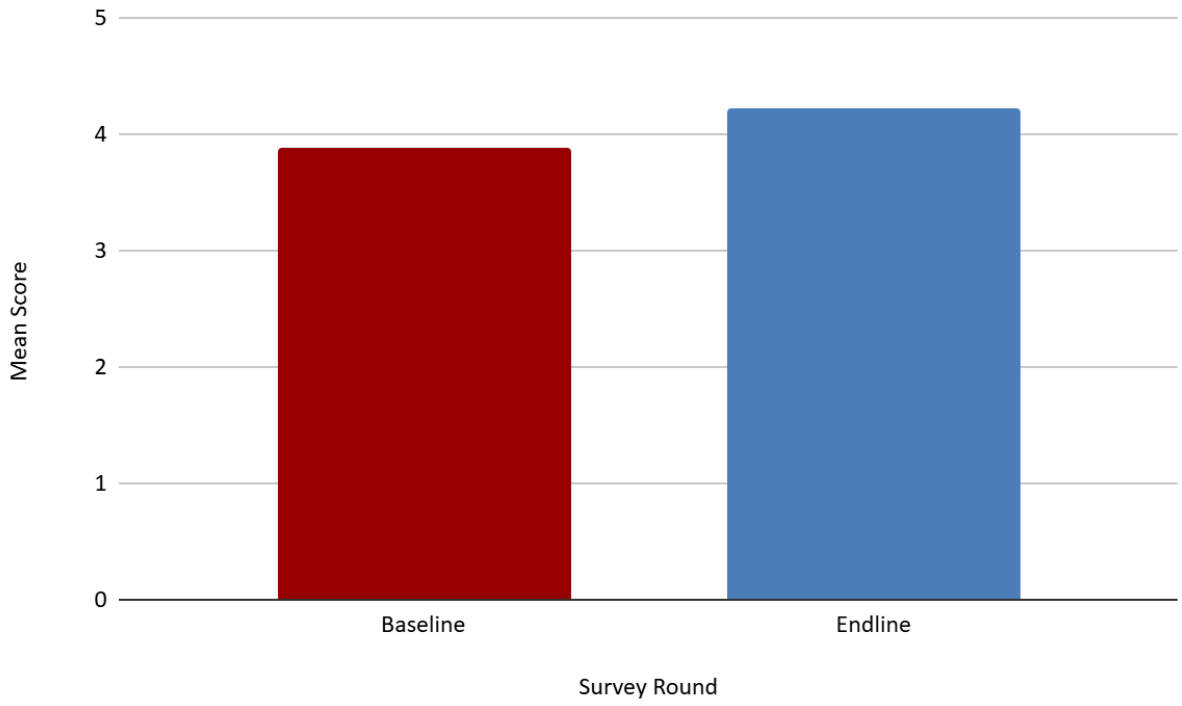
5.1. Access to Climate and Agricultural Information

This section presents findings on women farmers' access to climate and agricultural information. It includes changes in accessibility scores, preferred sources and platforms, and perceived usefulness of information formats over the project period. Indicators were measured

across source reliability, language clarity, affordability, and gender responsiveness. These were summarized using composite scores.

Table: Platform Accessibility Score (Baseline vs. Endline)

Survey Round	Mean Score (out of 5)	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	3.89	0.031	124.03	<0.001	[3.83, 3.95]
Endline	4.22	0.034	124.23	<0.001	[4.15, 4.28]



The mean accessibility score increased significantly from 3.89 at baseline to 4.22 at endline, suggesting substantial improvements in how women perceived the availability, ease of use, affordability, and relevance of climate and agricultural information platforms. The Platform Accessibility Score improved for 56.4% of participants, representing an estimated 19,306 smallholder farmers, including approximately 9,366 women. These improvements were largely attributed to mobile-based tools such as USSD, WhatsApp, and SMS.

Respondents described how these technologies enabled timely, localized updates and improved decision-making. As one officer put it:

> "*Sauti is real-time. It's quick. The information comes directly to the phone... they don't have to wait for the next radio program or for an officer to visit*." — Agricultural Technologist, Homa Bay

Platforms that supported Swahili language and didn't require internet access not only improved accessibility for low-literacy or remote users, but also enabled women to act on information quickly and confidently:

> "*They receive updates about expected rainfall... that single message influences what type of seed they will buy and plant*." — Sub-County Agricultural Officer, Vihiga

Despite these improvements, informants noted limitations for users with visual impairments and emphasized the need for voice-based services like IVR.

5.2. Access to Inputs and Extension Services

This subsection evaluates women's perceived access to essential agricultural resources, including finance, farm inputs (e.g., quality seeds and fertilizers), extension services, and training opportunities. These inputs are crucial for promoting climate adaptation and sustainable livelihoods.

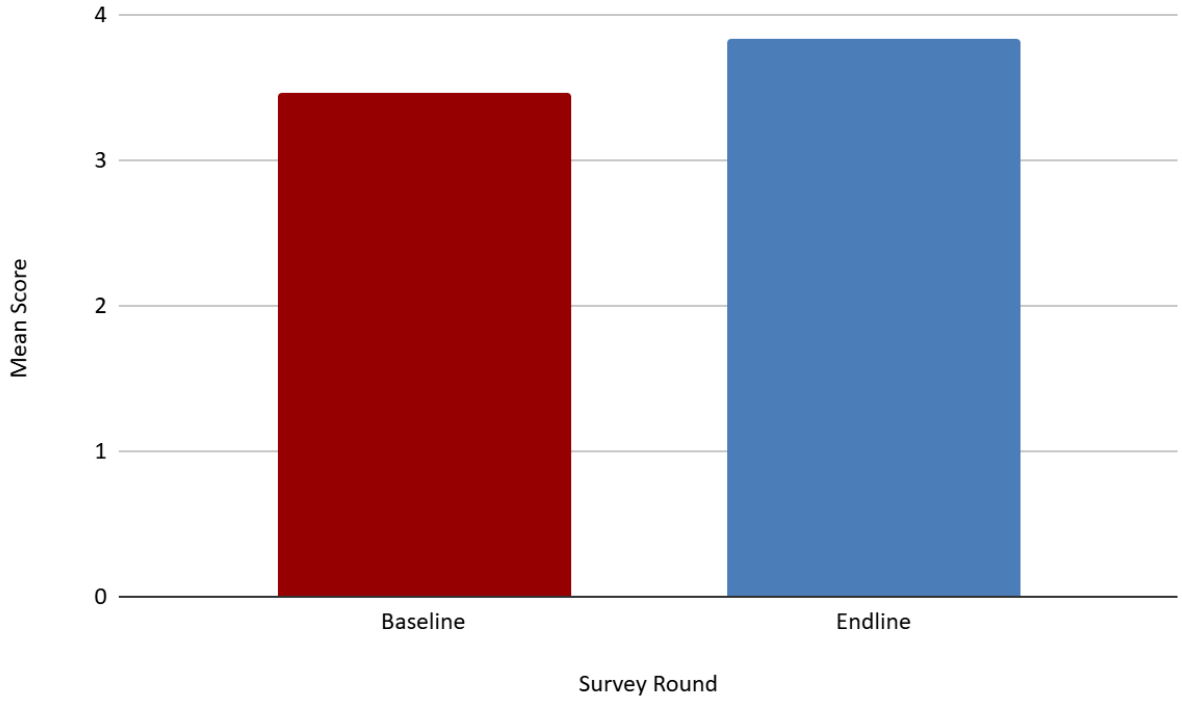
Quantitative data collected through composite scoring assessed both ease and confidence in accessing agricultural services. Women rated, on a scale of 1–5, their experience in the following areas:

- Ease of accessing finance opportunities
- Confidence in accessing finance
- Ease of obtaining farm inputs (seeds, fertilizers, pesticides)
- Ease of accessing extension services
- Confidence in utilizing extension services
- Ease of identifying farmer training opportunities
- Confidence in joining trainings

These were combined into an overall **Access to Information Score**.

Table: General Access to Agricultural Information (Composite Score, max = 5)

Survey Round	Mean Score	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	3.46	0.040	86.41	<0.001	[3.38, 3.54]
Endline	3.83	0.043	88.49	<0.001	[3.75, 3.92]



There was a significant improvement in women's confidence and ease in accessing agricultural services, from a score of 3.46 at baseline to 3.83 at endline. Overall, 55.3% of participants showed improvement, translating to an estimated 18,906 smallholder farmers, of whom approximately 9,171 were women. Agricultural officers observed that digital reminders and USSD-based tools encouraged women to actively seek support.

> "*Access to extension services has really improved because women now know whom to call or visit for advice. The digital prompts pushed them to act.*" — Agricultural Officer, Vihiga County

> "*There are still affordability issues with fertilizers, but more women now know about subsidies or government support programmes. That wasn't the case earlier.*" — Technical Agronomist, Uasin Gishu County

However, challenges persist, particularly in hard-to-reach regions and among women not linked to formal groups:

> "*Some women still rely on neighbours or informal advice. We need to expand the reach of trained officers and ensure consistent follow-up.*" — Agricultural Technologist, Homa Bay

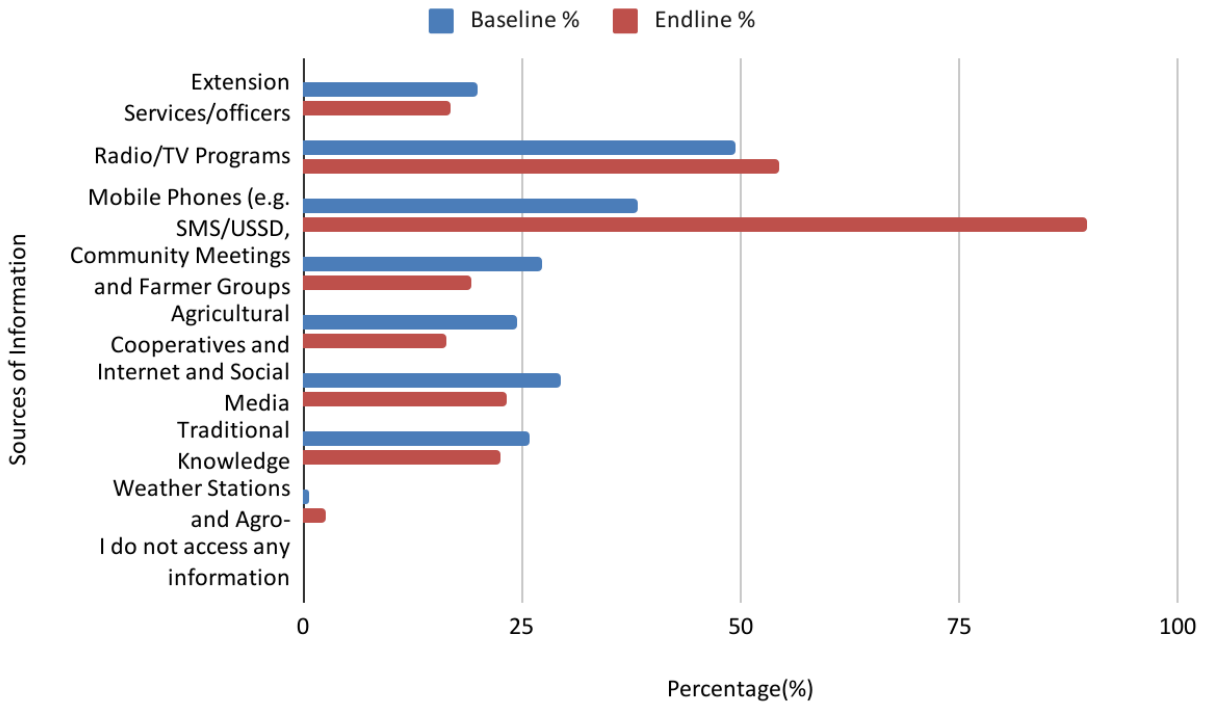
5.2.1. Sources of Agricultural and Climate Information

Participants were asked to identify the sources they most frequently relied on for climate and agricultural information. These included formal and informal channels such as extension services, media programs, mobile platforms, traditional knowledge, and community-based groups.

Table : Sources of Climate and Agricultural Information (Baseline vs. Endline)

Information Source	Baseline (%)	Endline (%)
Extension Services/Officers	20	17
Radio/TV Programs	50	54
Mobile Phones (e.g. SMS/USSD, WhatsApp, etc.)	38	90
Community Meetings and Farmer Groups	27	19
Agricultural Cooperatives and NGOs	25	16
Internet and Social Media	30	23
Traditional Knowledge	26	23
Weather Stations and Agro-meteorological Services	1	3
I Do Not Access Any Information	0	0

Figure : Bar Chart – Sources of Agricultural and Climate Information (Baseline vs. Endline)



Between baseline and endline, mobile phones saw the most increase as a preferred source of climate and agricultural information, rising from 38% to 90%. This shift reflects both broader mobile phone access and improvements in content delivery via SMS, USSD, and WhatsApp.

Radio/TV programs remained consistently popular (50% to 54%), while reliance on extension services declined slightly (from 20% to 17%), possibly due to improved access to digital alternatives. Community meetings, cooperatives, and internet/social media also saw modest declines, potentially indicating a migration toward more direct, on-demand digital sources.

The use of weather stations increased slightly, but remains minimal. No respondents in either survey round reported having no access to any form of information.

Mobile phones became the most dominant source of agricultural information, with USSD, SMS, and WhatsApp platforms cited for their immediacy, low cost, and contextual relevance. Among these, Sauti emerged as a widely used example, especially in the project counties, though other tools, such as government SMS alerts and NGO-run USSD services, were also referenced during the study.

> "*The information is provided in real time... everything is streamlined and accessible in one place.*" — Technical Agronomist, Uasin Gishu

"*They can check prices, weather, even legal tips. That's not something radio offers.*" — Agricultural Technologist, Homa Bay

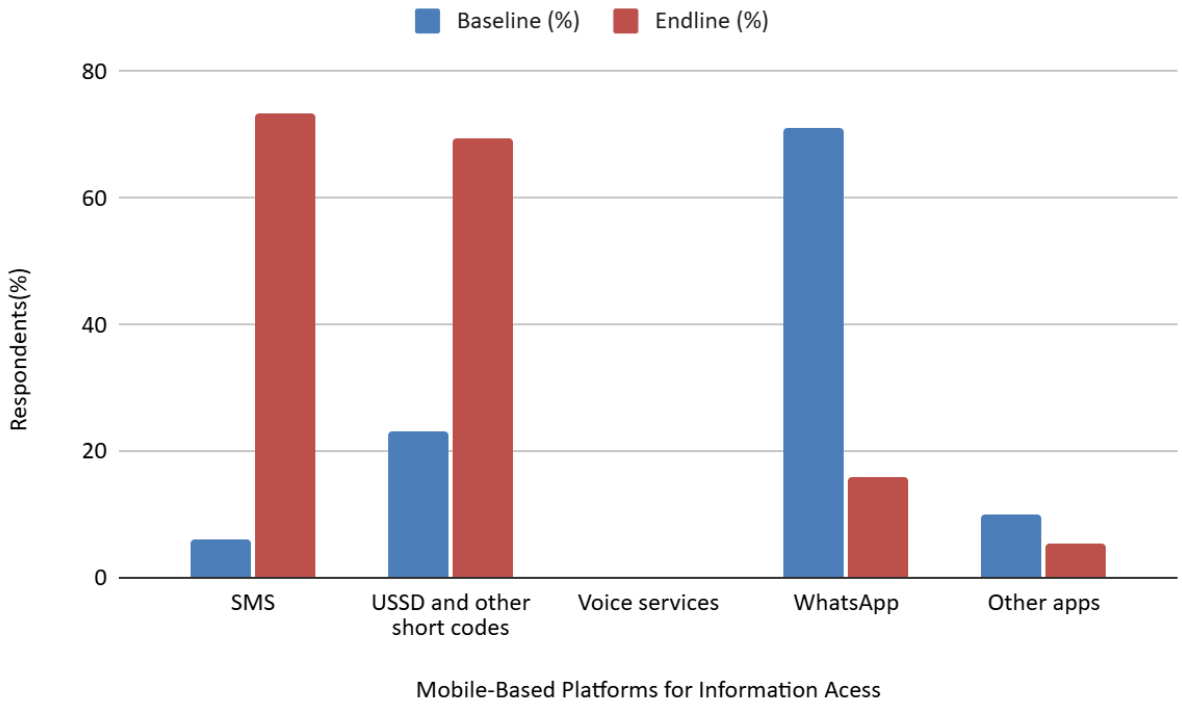
5.2.1.1. Use of Mobile-Based Platforms

This subsection analyzes the use of mobile-based platforms by women farmers to access climate and agricultural information. Respondents were asked which platforms they regularly used, including SMS, USSD short codes, WhatsApp, voice services, and other mobile applications.

Table : Mobile-Based Platforms – Usage Comparison (Baseline vs. Endline)

Platform	Baseline (%)	Endline (%)
SMS	6.0	73.4
USSD and other short codes	23.0	69.3
Voice services	–	0.0
WhatsApp	71.0	16.0
Other apps	10.0	5.4

Figure: Bar Chart – Use of Mobile-Based Platforms for Information Access



The data show a substantial shift in how women access digital agricultural and climate information. SMS usage increased dramatically from 6.0% at baseline to 73.4% at endline, and USSD usage rose from 23.0% to 69.3%, suggesting broader adoption of simple, accessible platforms. This shift was consistent with testimonies from agricultural officers who noted that tools like Sauti's USSD service were especially valued because they worked on basic phones and did not require mobile data or internet access.

> "*Some women may not have smartphones, but Sauti reaches them through groups and shared messages.*" —Agricultural Extension Officer, Vihiga

> "*It's not enough to wait for an officer or radio update, Sauti gives them direct access when they need it.*" — Ward Agricultural Officer, Vihiga

The sharp decline in reported WhatsApp usage, from 71.0% to 16.0%, likely reflects improved differentiation between platforms in the endline survey, as well as persistent barriers such as data costs and smartphone access. This suggests a stronger shift toward low-data tools like USSD and SMS, which may have become women's preferred platforms for accessing agricultural content.

> "*The menu structure is easy to understand... I'd rate it an 8 out of 10 for usability.*"
> — Technical Agronomist, Uasin Gishu

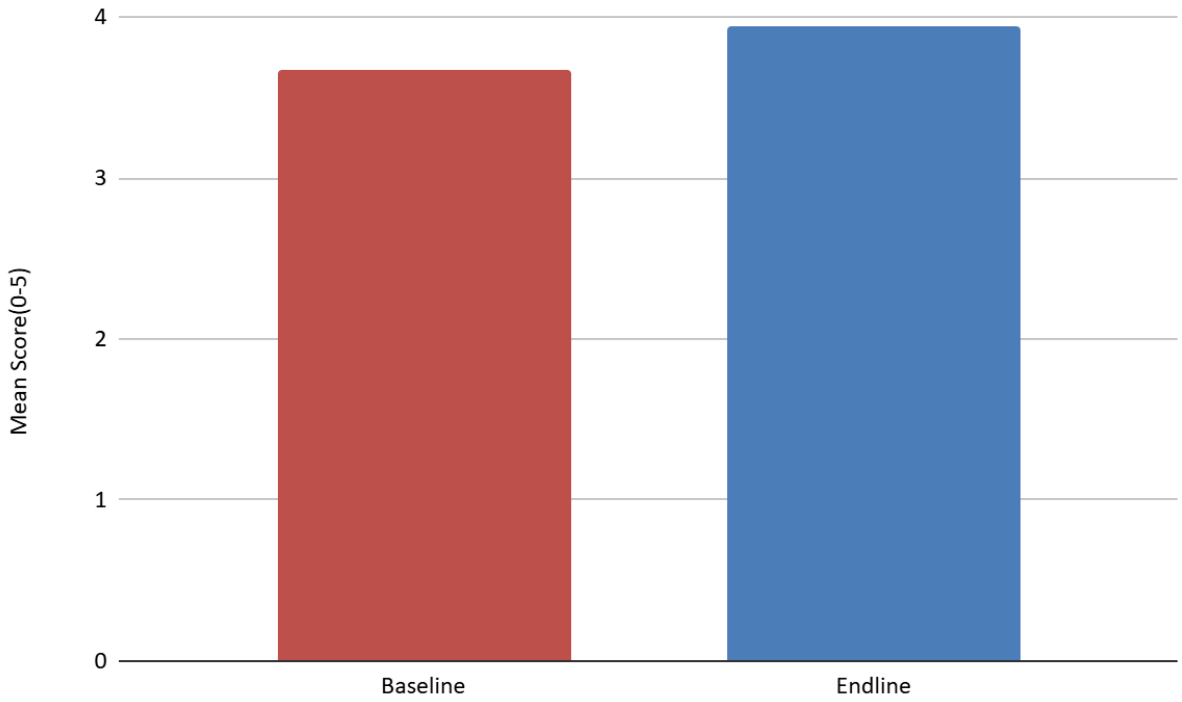
5.3. Improved Decision-Making

This section examines how access to agricultural and climate information influenced women's ability to participate in key farm-level decision-making processes. Respondents were asked to rate how much the information they accessed in the past six months improved their capacity to make decisions related to farming strategies, land management, and resource allocation on the farm

A composite Decision-Making Score (max = 5) was calculated based on these three indicators

Decision-Making Capacity Score (Baseline vs. Endline)

Survey Round	Mean Score	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	3.67	0.047	77.81	<0.001	[3.58, 3.76]
Endline	3.94	0.051	77.23	<0.001	[3.84, 4.04]



Women farmers' self-reported ability to contribute to critical on-farm decision-making

processes, such as what crops to grow, how to manage land, and how to allocate resources improved significantly, rising from a score of 3.67 at baseline to 3.94 at endline ($p < 0.001$). According to the results, 49.4% of platform users experienced improved decision-making capacity, which translates to an estimated 16,905 smallholder farmers, of whom approximately 8,201 were women. Agricultural officers confirmed that access to real-time, region-specific information helped women shift from intuition-based choices to informed, evidence-based practices.

> "*They are applying these practices on their farms... the knowledge directly contributes to boosting productivity*." — Ward Agricultural Officer, Vihiga

> "*If they receive information that there will be no rain, they delay planting or choose drought-resistant crops*." — Technical Agronomist, Uasin Gishu

Women used information to guide planting calendars, adapt crop choices, and adopt climate-smart techniques such as integrated pest management and water harvesting. Importantly, officers observed that women were highly proactive in applying the information, often more so than their male counterparts.

> "*Women are very aggressive and hardworking... once you've given the information, they take it up immediately*." — Technical Agronomist, Uasin Gishu

5.4. Livelihood and Market Engagement

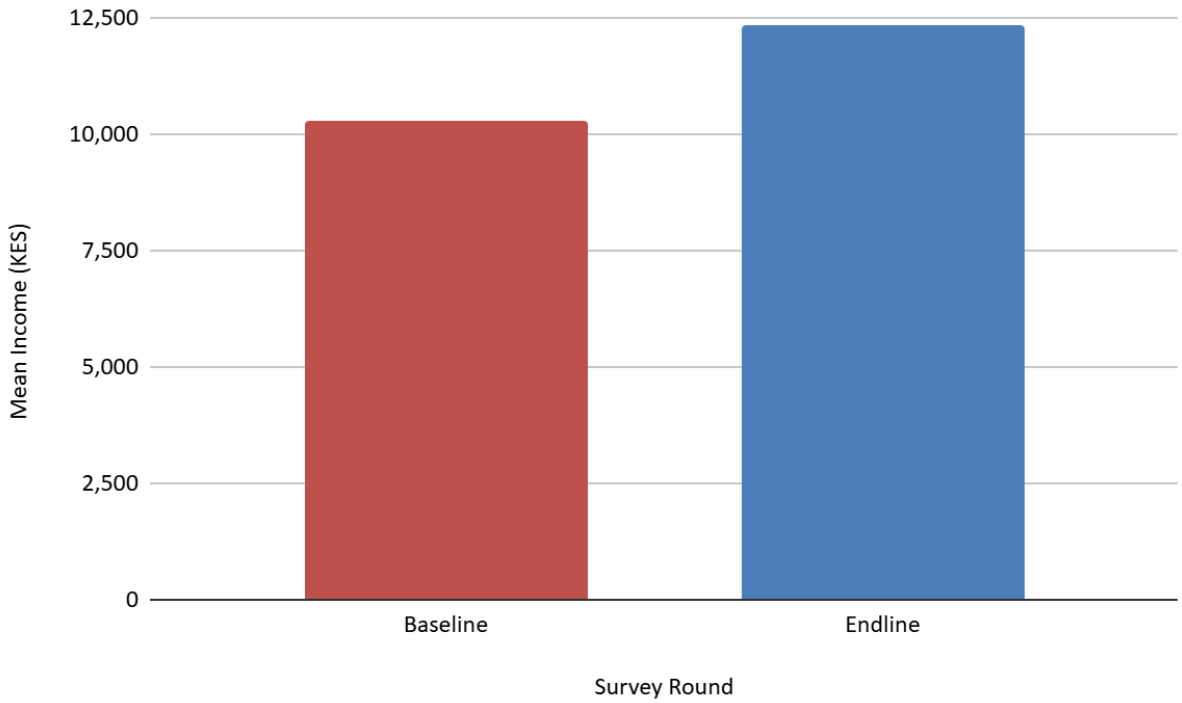
This section explores the extent to which access to climate and agricultural information influenced women's income-generating activities and market participation, including income trends, digital marketing practices, and new supplier or buyer linkages

5.4.1. Changes in Income Levels

To measure the impact of improved access to climate and agricultural information on women's economic outcomes, respondents reported their average monthly income from farming or trading. Margin estimates calculated using the delta method were used to compare baseline and endline income levels.

Table: Average Monthly Income (KES) – Baseline vs. Endline

Survey Round	Mean Income (KES)	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	10,286	661	15.56	<0.001	[8,990; 11,582]
Endline	12,338	635	19.43	<0.001	[11,094; 13,583]



The reported average monthly income from farming and trade increased from KES 10,286 at baseline to KES 12,338 at endline. An estimated 56.2% of participants, equivalent to 19,257 women farmers and traders, experienced improved monthly incomes, as captured in the outcome variable tracking economic changes. This statistically significant increase was consistent with insights from agricultural officers, who observed greater market orientation among women, partly driven by better access to price and demand data.

> "*Now, they can access market information and even sell their products directly through Sauti or other platforms.*" — Technical Agronomist, Uasin Gishu

> "*Before the planting season begins, they check market prices and decide what crops are more profitable.*" — Extension Officer, Vihiga

Women used Sauti and similar platforms to identify new buyers, time their sales, and avoid growing crops likely to oversaturate the market. Some officers noted that this shift reduced post-harvest losses and opened new income streams.

> "*They now know where to source certain produce or inputs more affordably… and where and when to sell crops for better prices*." — Extension Officer, Vihiga

> "*Let's say there's a bean shortage in Bomet… this can influence what a woman decides to grow and sell*." — Technical Agronomist, Uasin Gishu

Officers also cited real-world examples of women using income gains to invest in education, home improvement, and even micro-enterprise.

> "*Many are now able to pay school fees, invest in their households, and even create employment*." — Ward Agricultural Officer, Vihiga

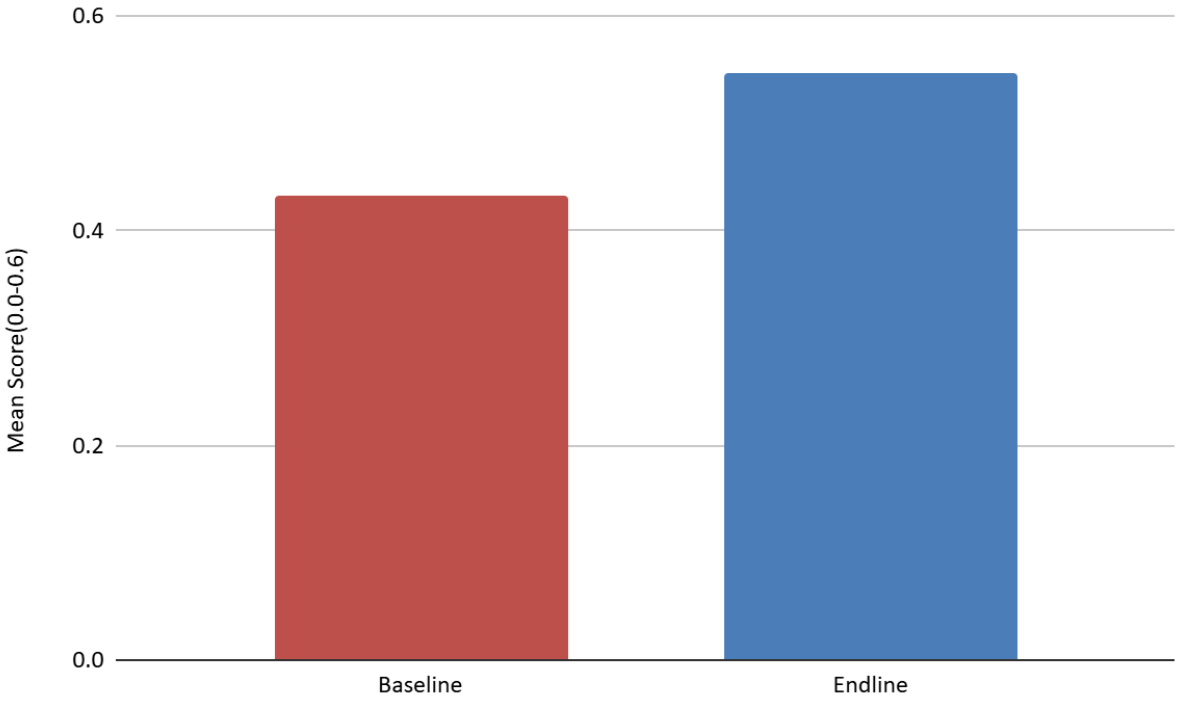
> *Note: Values are self-reported and represent estimated monthly revenue or income from primary income-generating activities.*

5.4.2. New Buyer Identification

This subsection assesses whether women were able to identify new buyers for their farm produce or inputs within the past six months. This indicator helps determine whether increased access to information translated into improved market engagement.

Table: Proportion of Respondents Who Identified New Buyers (Baseline vs. Endline)

Survey Round	Proportion (Mean Score)	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	0.433	0.027	16.20	<0.001	[0.380, 0.485]
Endline	0.547	0.029	18.92	<0.001	[0.490, 0.603]



The proportion of women who reported identifying at least one new buyer in the previous six months rose from 43.3% at baseline to 54.7% at endline, a statistically significant improvement ($p < 0.001$). An estimated 31.3% of respondents, representing approximately 10,703 smallholder farmers and 5,192 women, experienced improvements in their ability to identify new buyers. Agricultural officers confirmed that mobile-based platforms, especially USSD tools like Sauti and WhatsApp group interactions, were instrumental in linking women with new buyers and input suppliers.

> "*They now know where to source certain produce or inputs more affordably… and where and when to sell crops for better prices*." — Extension Officer, Vihiga

> "*Women now access market information and can sell their products directly through Sauti… It's improved their income*." — Ward Agricultural Officer, Vihiga

> "*Farmers are using platforms like Facebook and WhatsApp groups to share information, advertise their produce, and even identify buyers directly. You'll find some of them taking pictures of their crops, say, bunches of bananas, vegetables, or eggs, and posting them on Facebook groups that are focused on farming or trading*."—Sub-County Agricultural Officer, Vihiga

Many women reportedly relied on mobile alerts to understand market trends and identify high-demand crops, enabling them to adjust production plans and build buyer relationships more strategically.

> "*Let's say there's a bean shortage in Bomet… this can influence what a woman decides to grow and sell.*" — Technical Agronomist, Uasin Gishu

> "*They can check prices, weather, even legal tips. That's not something radio offers.*" — Agricultural Technologist, Homa Bay

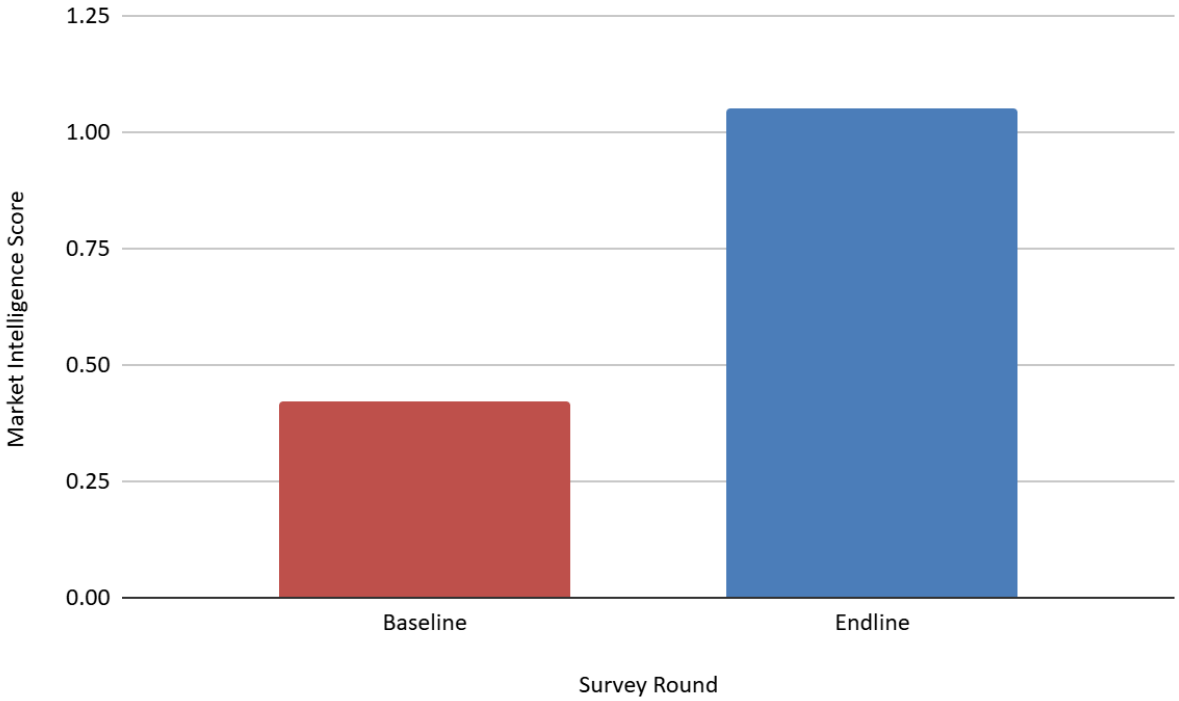
5.4.3. Market Intelligence Score

To assess how women engage with markets more strategically, respondents were asked whether they used any of the following four strategies: market research, online platforms, aggregators/distributors, or export/digital channels.

Each strategy received a score of 1, resulting in a composite market intelligence score (maximum = 4). This indicator reflects both digital literacy and proactive market engagement.

Market Intelligence Score (Baseline vs. Endline)

Survey Round	Mean Score	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	0.42	0.048	8.77	<0.001	[0.33, 0.52]
Endline	1.05	0.052	20.12	<0.001	[0.95, 1.16]



The average Market Intelligence Score more than doubled, rising from 0.42 at baseline to 1.05 at endline ($p < 0.001$). Approximately 49.1% of participants, an estimated 16,805 smallholder farmers including 8,152 women, showed improvements in their Market Intel Score. This increase indicates that more women were using digital tools and formal strategies to engage with markets.

Qualitative feedback of agricultural officers observed that more women were conducting informal price benchmarking, exploring digital marketplaces, and adjusting sales tactics based on market signals.

> "*Before the planting season begins, they check market prices and decide what crops are more profitable*." — Extension Officer, Vihiga

> "*Now, they can access market information and even sell their products directly through Sauti or other platforms*." — Technical Agronomist, Uasin Gishu

Women also gained the confidence to bypass middlemen and approach buyers or input dealers directly. This shift from passive selling to proactive marketing was especially evident in Uasin Gishu and Homa Bay counties, where officers described women coordinating bulk sales or changing production choices based on projected demand.

> "*They know if everyone is planting the same thing, and can decide to grow something else to avoid oversaturation.*" — Technical Agronomist, Uasin Gishu

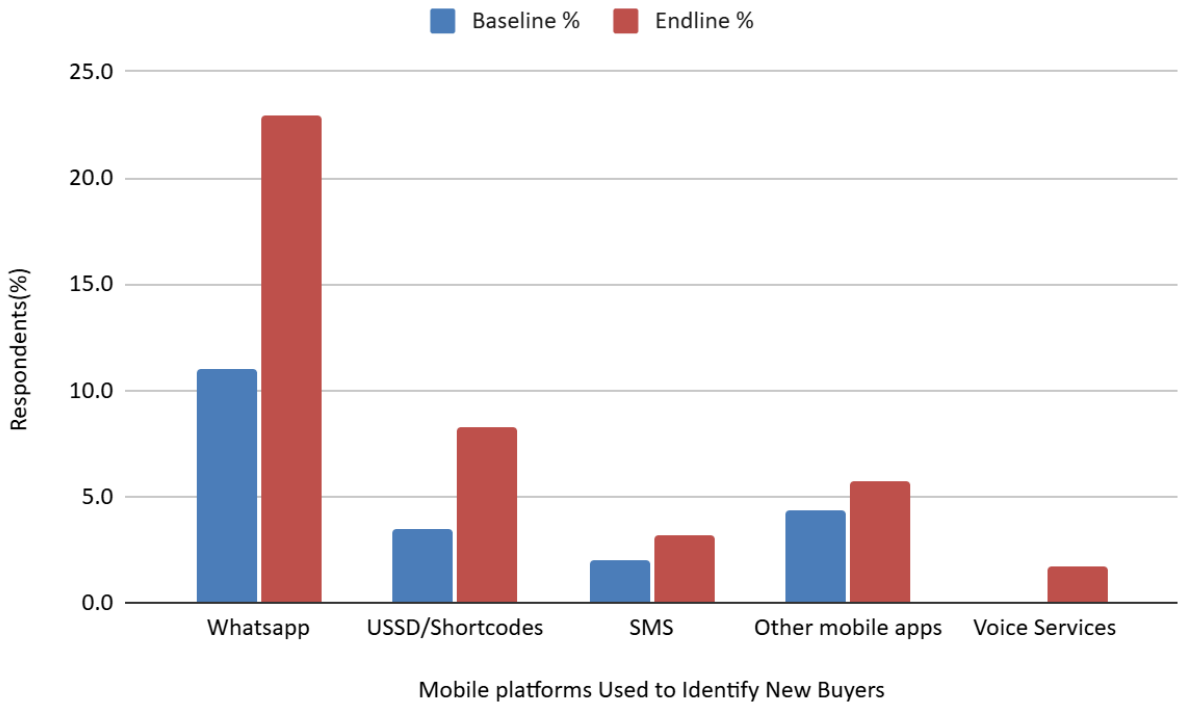
5.4.4. Use of Online Platforms to Reach New Markets

This subsection explores the use of mobile and online platforms among women farmers to identify new market opportunities. The data reflect only respondents who reported using mobile phones to find new buyers.

Table: Platforms Used to Reach New Buyers via Mobile (Baseline vs. Endline)

Platform	Baseline (%)	Endline (%)
WhatsApp	11.0	22.9
USSD/Shortcodes	3.5	8.3
SMS	2.0	3.2
Other mobile apps	4.3	5.7
Voice Services	0.0	1.7

Figure : Bar Chart – Use of Mobile Platforms to Reach Markets (Baseline vs. Endline)



Between baseline and endline, the proportion of women using WhatsApp to connect with new buyers more than doubled from 11.0% to 22.9%. Respondents and agricultural officers reported that WhatsApp served as a vital communication tool, enabling women to share images of their produce, negotiate prices, and coordinate transactions with distant buyers.

> "*They now use WhatsApp to share photos of their produce and negotiate prices with buyers from outside the county, something they couldn't do before.*" – Agricultural Technologist Officer, Homa Bay

USSD code usage for market access also increased from 3.5% to 8.3%. Women found USSD particularly useful for checking prices and gathering buyer contact details, especially when internet access was limited or when using basic feature phones.

> "*USSD codes have helped women compare prices before transporting goods to the market. It's quick and doesn't need data or airtime.*" – Technical Agronomist, Uasin Gishu

Although SMS use rose modestly (from 2.0% to 3.2%), and voice services remained low (1.7% at endline), the increase across all mobile options reflects a broader trend toward mobile-assisted market exploration. Officers noted that even small increases in mobile

engagement marked a significant shift in how women navigated trading environments, particularly in regions where formal market access had previously been constrained.

5.4.5. New Supplier Identification

Women farmers were asked how they identified the majority of their new agricultural input suppliers. Between baseline and endline, several notable shifts were observed, indicating growing diversification in sourcing strategies.

Table: How respondents identify new suppliers (Baseline Vs. Endline)

Method	Baseline (%)	Endline (%)
Market Research	22.0	46.4
Networking and Collaboration	44.0	54.4
Attending Trade Shows and Exhibitions	0.5	0.3
Engaging with Extension Services	7.0	6.9
Utilizing Online Platforms	4.3	11.8
Collaborating with Aggregators and Distributors	18.3	21.8
Exploring Export Opportunities (via agencies, associations, government programs)	11.8	1.1
Other (specify)	0.0	18.9
Not Applicable (Not in business/agriculture)	20.5	5.2

The most substantial increases were seen in Market Research (from 22.0% to 46.4%) and Utilizing Online Platforms (from 4.3% to 11.8%), suggesting a growing reliance on digital tools and proactive sourcing. Networking and Collaboration remained the most commonly cited method, increasing modestly from 44.0% to 54.4%.

Use of Online/Mobile Platforms to Reach New Sellers

Platform	Baseline (%)	Endline (%)
WhatsApp	1.5	9.5

USSD/Shortcodes	1.0	5.4
Voice	0.3	0.6
SMS	0.8	0.6
Other Mobile Apps	1.5	3.2

WhatsApp showed the highest growth, with usage increasing from 1.5% to 9.5%, while USSD use rose from 1.0% to 5.4%. These gains suggest that more women farmers are leveraging mobile tools to explore price options, locate input providers, and reduce dependency on local intermediaries. However, uptake of voice services and SMS for this purpose remained stagnant, likely due to functionality limitations or user preference for visual/text-based channels.

Key informants confirmed that digital tools, especially WhatsApp groups and USSD platforms, have enabled women to directly reach input sellers or learn about suppliers through peer-to-peer networks and community channels.

> *"Some suppliers advertise through local radio stations... Others place advertisements at strategic locations like the chief's office, local marketplaces, and on community billboards where farmers frequently pass by." — Extension Officer, Vihiga County*

> *"We collaborate with seed and fertilizer companies that often establish demonstration plots within the community. This helps expose farmers to new technologies."*
> — Sub-County Agricultural Officer, Vihiga County

Women have also started sharing supplier information within WhatsApp groups, often exchanging photos of input labels, asking for recommendations, or notifying others about promotions.

> *"They now have access to real-time market information... It helps them avoid being exploited."* — Extension Officer, Vihiga County

> *"Sauti Africa provides farmers with real-time information, especially on market prices and availability of various commodities... It also helps farmers know where they can sell their produce."* — Extension Officer, Vihiga County

While this trend is promising, many women, especially in remote areas or with limited digital skills, still rely on informal networks or physical observation to identify suppliers. Informants emphasized the need to scale up digital awareness and ensure input advisory is included alongside weather and market information.

5.5. Climate Resilience and Adaptation

This section explores how access to agricultural and climate information influenced women's preparedness, adaptation, and resilience to climate-related risks such as droughts, floods, and pest outbreaks.

5.5.1. Perceived Preparedness for Climate-Related Risks

Access to mobile-delivered climate information significantly enhanced women's ability to anticipate and prepare for environmental shocks. The average number of preparedness practices adopted rose from 2.05 at baseline to 2.94 at endline ($p < 0.001$). Preparedness activities improved for 62.0% of participants, representing an estimated 21,206 smallholder farmers, including 10,288 women, highlighting a substantial increase in proactive planning and risk management practices in response to climate-related threats.

Table: Average Number of Climate Preparedness Practices (Baseline vs. Endline)

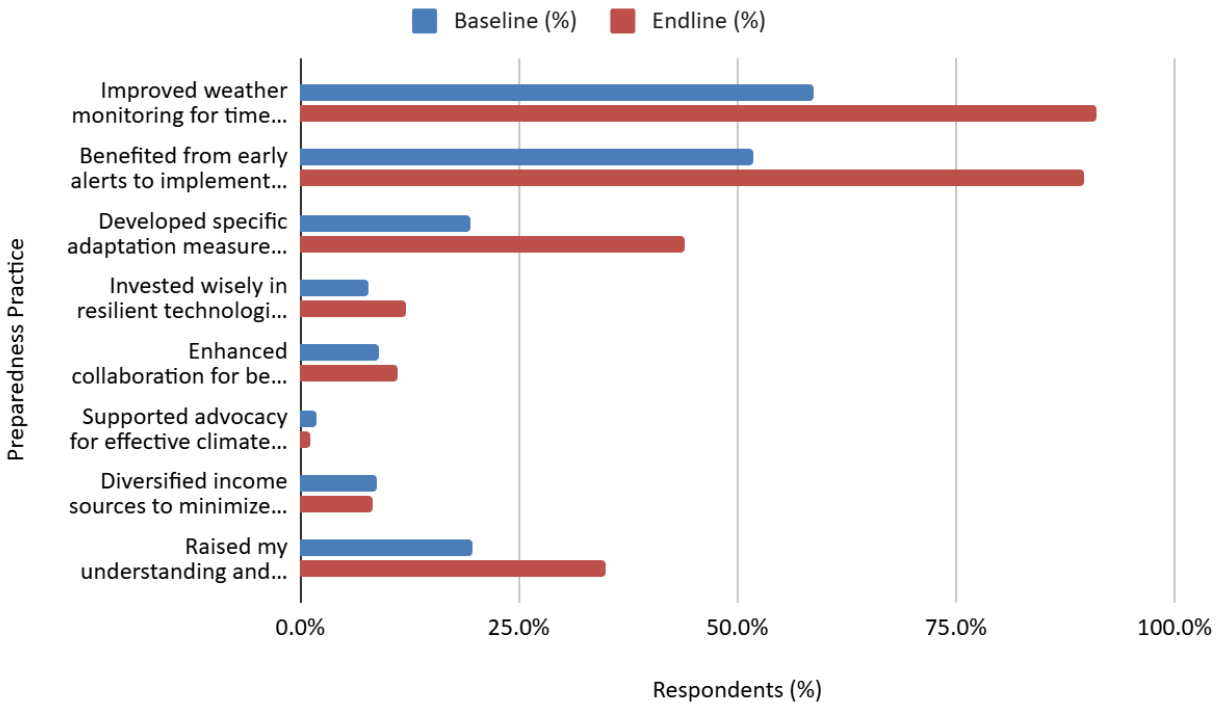
Survey Round	Mean Score	Standard Error (SE)	z-score	p-value	95% Confidence Interval
Baseline	2.05	0.049	41.41	<0.001	[1.95, 2.14]
Endline	2.94	0.053	55.02	<0.001	[2.84, 3.05]

A more detailed breakdown of individual preparedness practices shows that women most commonly relied on improved weather monitoring and early alerts. For example, 91.1% reported improved weather monitoring by endline (up from 58.8%), while 89.7% had benefited from early alerts (up from 51.8%).

Table: Specific Climate Preparedness Practices (Baseline vs. Endline)

Practice	Baseline (%)	Endline (%)

Improved weather monitoring for timely action	58.8%	91.1%
Benefited from early alerts to implement preventive steps	51.8%	89.7%
Developed specific adaptation measures for my farm's needs	19.5%	44.1%
Invested wisely in resilient technologies and structures	7.8%	12.0%
Enhanced collaboration for better access to resources and information	9.0%	11.2%
Supported advocacy for effective climate adaptation policies	1.8%	1.1%
Diversified income sources to minimize climate-related risks	8.8%	8.3%
Raised my understanding and commitment to sustainable farming	19.8%	35.0%



Officers consistently reported that mobile platforms enabled women to transition from reactive to proactive planning:

> *"They now interpret weather updates differently; they use it to plan, conserve, and protect their crops before the rains fail or pests arrive."* — Agricultural Technologist, Homa Bay County

Adaptation was particularly visible in planting behaviors and crop choice. Many women began selecting drought-tolerant crops and delaying planting when rainfall was uncertain:

> *"If they receive information that there will be no rain... they delay planting or choose drought-resistant crops."* — Technical Agronomist, Uasin Gishu County

There were also reports of women adopting low-cost structural solutions such as water pans, terraces, and soil conservation measures, though uptake remained modest due to financial constraints:

> *"They now plan better; choosing the crop variety that fits the season, and avoiding losses from mismatched timing."* — Technical Agronomist, Uasin Gishu County

> *"More are experimenting with sack farming and backyard gardens to reduce water use."* — Agricultural Officer, Vihiga County

Nonetheless, certain areas such as collaboration, advocacy, and income diversification showed little to no improvement. These were likely constrained by systemic barriers such as limited group-based programming or lack of institutional support:

> *"Many know what to do, but lack the means, especially for irrigation and storage. That's where support is needed."* — Agricultural Technologist, Homa Bay County

> *"Even if women want to get involved in decision-making or climate policy, they rarely get the opportunity or platform to do so."* — Ward Agricultural Officer, Vihiga County

5.6. Adoption of Climate Adaptation Strategies

Access to timely and relevant climate information plays a critical role in enabling farmers and agribusiness actors to adopt practices that mitigate climate-related risks. The question assessed the extent to which respondents modified their farming or livelihood strategies in response to climate information received. The findings reflect both quantitative changes in the number of strategies adopted and qualitative shifts in the types of strategies utilized.

Table: Average Number of Adaptation Strategies Adopted

Respondents were asked to indicate which adaptation strategies they had implemented as a result of climate information. The results show a statistically significant increase in the average number of strategies adopted between baseline and endline:

Time Point	Mean Strategies	Standard Error	95% Confidence Interval	Significance
Baseline	1.35	0.061	[1.23 – 1.47]	$p < 0.001$
Endline	2.59	0.066	[2.46 – 2.72]	

The number of climate adaptation strategies adopted by women more than doubled between baseline and endline, rising from an average of 1.35 to 2.59 strategies per respondent ($p < 0.001$). Coping practices improved for 62.9% of participants, an estimated 21,506 smallholder

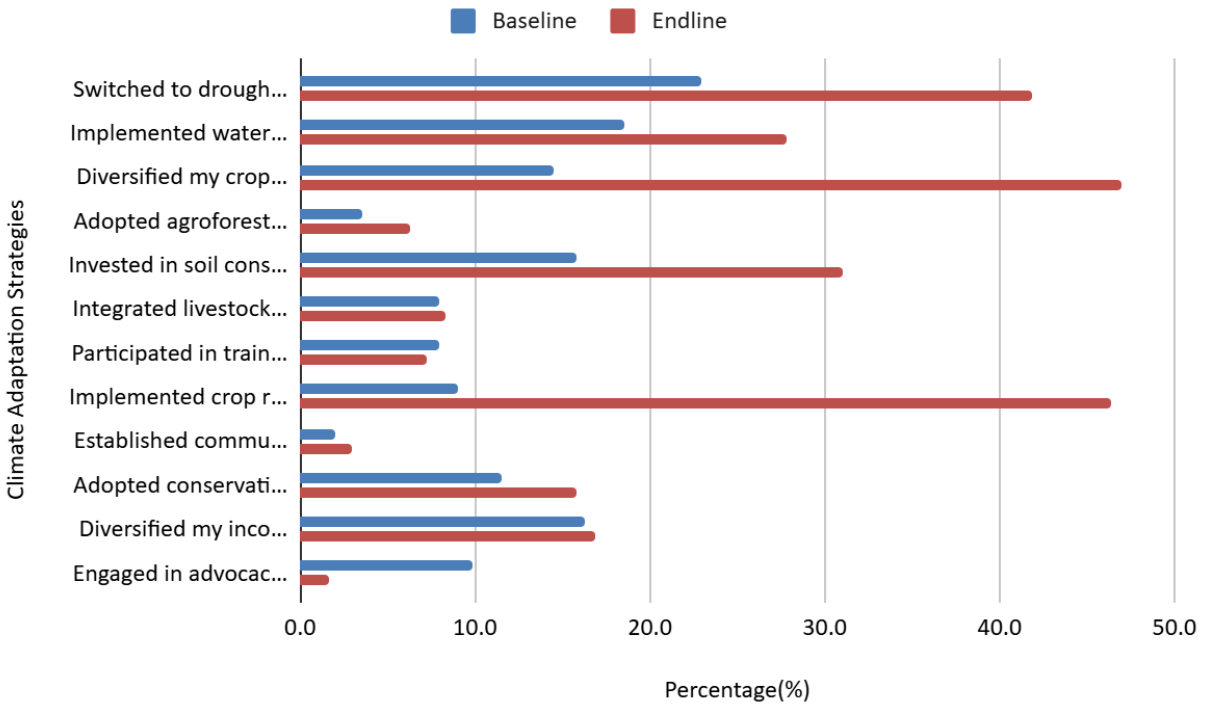
farmers, including 10,433 women, indicating a strong uptake of informed strategies in response to climate risks.

5.6.1. Changes in Specific Adaptation Practices

A closer look at individual adaptation strategies reveals notable improvements in adoption rates, particularly for practices that directly enhance productivity and resilience in the face of climate shocks.

Table : Adoption of Climate Adaptation Strategies (Baseline vs. Endline)

Adaptation Strategy	Baseline (%)	Endline (%)
Switched to drought-resistant crop varieties	23.0	41.8
Implemented water-saving irrigation techniques	18.5	27.8
Diversified my crop production	14.5	47.0
Adopted agroforestry practices	3.5	6.3
Invested in soil conservation measures	15.8	31.0
Integrated livestock into my farming system	8.0	8.3
Participated in training workshops or capacity-building programs	8.0	7.2
Implemented crop rotation or intercropping strategies	9.0	46.4
Established community-based climate adaptation initiatives	2.0	2.9
Adopted conservation agriculture practices	11.5	15.8
Diversified income-generating activities beyond agriculture	16.3	16.9
Engaged in advocacy and policy dialogue	9.8	1.7



Adoption of climate-smart practices increased significantly over the project period, with more women integrating information into on-farm decisions. At baseline, only 23% of women reported using drought-resistant crop varieties. By endline, this figure had risen to 41.8%, indicating a 19-point improvement. Use of crop rotation or intercropping increased dramatically from 9% to 46.4%, suggesting that more women were practicing soil health management and planting diversification.

Similarly, crop diversification rose from 14.5% to 47%, while the proportion of women investing in soil conservation measures more than doubled from 15.8% to 31%. Adoption of water-saving irrigation techniques improved from 18.5% to 27.8%, and uptake of conservation agriculture increased from 11.5% to 15.8%.

"*They now plan better; choosing the crop variety that fits the season, and avoiding losses from mismatched timing*." – Technical Agronomist, Uasin Gishu County

"*More are experimenting with sack farming and backyard gardens to reduce water use*." – Agricultural Officer, Vihiga County

However, some strategies showed limited or no progress. Integration of livestock into farming systems remained virtually unchanged (from 8.0% to 8.3%), and participation in formal training workshops or capacity-building programs slightly declined (from 8.0% to 7.2%). This decline

may suggest that women, now equipped with timely and accessible information via mobile platforms, felt less need to attend physical workshops. Notably, engagement in advocacy or policy dialogue dropped sharply from 9.8% to 1.7%, indicating a reduced emphasis on collective or institutional-level influence.

5.7. Participation in Climate Training and Community Initiatives

This subsection explores how access to agricultural and climate information influenced women's participation in climate-smart agriculture trainings, capacity-building sessions, and community-based initiatives. Respondents were asked whether the information they received enabled them to take part in such activities.

Table: Participation in Training and Climate-Related Community Activities (Baseline vs. Endline)

Response Option	Baseline (%)	Endline (%)
Yes, I've actively participated	53.3	30.9
Partially, with some limitations	19.8	45.3
Unaware of such opportunities	24.5	21.8
No, the programs were not applicable to me	2.0	0.6
No, but due to lack of interest	0.5	1.4

Between baseline and endline, the percentage of women who reported full participation in training declined significantly, from 53.3% at baseline to 30.9% at endline. At the same time, partial engagement rose from 19.8% to 45.3%. This shift indicates that while more women were at least somewhat exposed to trainings, fewer were able to participate fully, likely due to barriers such as distance, time constraints, caregiving responsibilities, or lack of transport.

The proportion of respondents who were unaware of such opportunities remained relatively stable, dropping only slightly from 24.5% to 21.8%. This suggests that outreach may have improved, but access challenges persisted.

Interviews with agricultural officers confirmed these dynamics. One officer noted that while training availability had improved, logistical limitations still excluded many women:

> *"The only cost the farmer might incur is transportation to the venue, especially if it's not within walking distance. For women, particularly those without a steady source of income, this can be a barrier. Sometimes they will choose to skip the training simply because they cannot afford the fare to get there."* — Sub-County Agricultural Officer, Vihiga County

Others explained that while women valued trainings, they preferred formats that were more flexible and localized:

> **"***The best trainings are those conducted within the community or through farmer groups. Women prefer trainings at demonstration plots closer to their homes***."**— Sub-County Agricultural Officer, Vihiga County

> *"The one-day trainings that are conducted far from their villages are not as effective for women. Many have responsibilities at home and cannot travel."* — Naomi Kandie, Uasin Gishu County

5.8. Barriers and Enablers to the Use of Climate and Agricultural Information

This section outlines the key factors that influenced women's ability to access, use, and benefit from CIS across Vihiga, Homa Bay, Uasin Gishu, and Busia counties. Drawing from both quantitative trends and qualitative feedback from agricultural officers, it highlights the constraints that limited uptake as well as the facilitators that enabled success.

Despite improvements in access and digital engagement, several challenges continued to hinder full adoption and impact:

- **Limited Digital Literacy**
  While platforms like USSD and WhatsApp were widely adopted, many women, particularly older farmers, struggled with navigation and needed ongoing support to engage confidently with digital content.
- **Infrastructure Constraints**
  Weak network coverage in remote and rural areas disrupted timely access to updates, particularly during critical agricultural windows like planting or harvest.
- **Financial Barriers to Implementation**
  Even when equipped with the right information, many women lacked the resources to

act ,especially when it came to investing in irrigation, drought-resistant seeds, or improved storage.

- **Language and Accessibility Gaps**
  The absence of voice-based features such as Interactive Voice Response (IVR) excluded users with low literacy or visual impairments.

Several factors contributed to successful uptake and use of CIS platforms among women farmers:

- **Accessible Mobile Platforms**
  The use of SMS, USSD, and WhatsApp enabled real-time, low-cost access to critical information, including weather alerts, market prices, and supplier contacts.

- **Extension Officer Engagement**
  Support from local agricultural officers was instrumental in training, trust-building, and troubleshooting. This hybrid model of digital and face-to-face engagement helped bridge gaps in understanding.
- **Peer Networks and Social Learning**
  Participation in farmer groups and WhatsApp communities enhanced information sharing, especially for those with limited digital skills.
- **Training and Ongoing Sensitization**
  Regular exposure to training sessions helped women become more familiar with digital platforms and increased trust in the quality and relevance of the information.
- **Locally Relevant and Timely Content**
  Women were more likely to continue using platforms that provided actionable, location-specific updates on market and weather conditions.

6. DISCUSSION

This section analyzes findings from the endline survey and KIIs to assess how mobile-based CIS influenced women farmers' access to information, agricultural practices, and resilience in Vihiga, Homa Bay, Uasin Gishu, and Busia counties. It compares changes since the 2024 baseline and highlights key thematic outcomes and areas needing continued support.

6.1. Demographic and Socioeconomic Profile of Women Smallholder Farmers

The demographic composition of the baseline sample (n = 400) was broadly representative of the rural smallholder women targeted by the intervention. Most respondents were within the economically active age range (18–49), with over 70% having attained at least secondary education. This profile suggests a population well-positioned to benefit from digital interventions, particularly when platforms are designed with varying literacy and device access in mind.

The high proportion of married women and those primarily engaged in agriculture or agribusiness (76%) underscores the relevance of climate and market information to their livelihood strategies. That 69% reported farming on land they "own" suggests potential influence over production decisions, though this likely reflects household-level or informal access rather than formal title, an important consideration for programming related to inputs or subsidies.

Despite widespread access to mobile phones, disparities in digital confidence and use remain linked to age and education. Older respondents and those with primary education or below may require ongoing support, even if they own devices. These demographic insights support the decision to prioritize low-bandwidth platforms like USSD and SMS, which are more inclusive for low-literacy users.

The inclusion of this demographic group also highlights the intersection of gender and technology in agricultural resilience. To maximize uptake and impact, future interventions should not only tailor content linguistically and contextually but also integrate delivery models that reflect women's caregiving responsibilities, time constraints, and preferences for peer-led learning environments.

Comparative data from (Annex 2) further confirm that these demographic patterns remained consistent between baseline and endline, validating the longitudinal design and strengthening confidence in the attribution of observed changes to the intervention.

6.2 Access to Climate and Agricultural Information

The significant rise in USSD and SMS usage among women farmers, from 23.0% to 69.3% and 6.0% to 73.4%, respectively, points to a clear shift toward simple, low-bandwidth tools as the preferred mode of receiving agricultural information. This shift is not just quantitative; it reflects

a broader behavioral change in how women access, trust, and act upon digital content. Platforms like Sauti, which offer USSD and SMS access, emerged as dominant due to their compatibility with basic phones and minimal data requirements.

Interestingly, the sharp decline in reported WhatsApp usage (from 71.0% to 16.0%) complicates the assumption that smartphone-based tools would continue gaining traction. This may reflect more accurate platform differentiation in the endline survey or continued barriers related to smartphone ownership and data affordability.

Platform accessibility was further reflected in the increased composite score for access-related dimensions, which rose from 3.89 at baseline to 4.22 at endline. This composite score was based on participants' perceptions of language inclusivity, information format, affordability, user-friendliness for women, reliability, and challenges experienced in remote areas. The improvement in the platform's accessibility score (56.4%) underscores the project's success in reducing digital barriers for women smallholder farmers. With an estimated 19,306 users impacted, 9,366 of them women, platform inclusivity efforts, especially through USSD and WhatsApp, proved vital in ensuring equitable access to information for those with limited digital literacy or connectivity. The improvement indicates that women found the information platforms more usable and relevant over time.

Although the absence of voice-based services such as IVR was mentioned by one key informant, this perspective alone is not sufficient to draw broader conclusions about its demand or impact. Nonetheless, it highlights a potential gap for future inclusion of audio-based services to accommodate low-literacy or visually impaired users.

While Sauti was the most frequently cited platform in both survey and interview responses, it is important to recognize that the evaluation did not explicitly ask participants to name all service providers they used. As such, the visibility of other platforms may have been limited, suggesting a need for future evaluations to disaggregate platform preferences more clearly to avoid attribution bias.

Overall, the data point to a strong consolidation around mobile tools that are affordable, easy to navigate, and provide timely and actionable information. These preferences should inform future program design and investment in inclusive, mobile-based agricultural information systems.

6.3. Climate Preparedness and Adaptation

A total of 62.0% of women farmers (21,206 individuals, including 10,288 women) demonstrated improved preparedness, aligning with the increase in the average number of practices adopted, from 2.05 to 2.9, reflecting growing awareness and confidence in managing environmental shocks. The most commonly adopted practices included improved weather monitoring and acting on early alerts, reported by over 89% of respondents.

The rise in adoption of specific adaptation strategies, such as crop diversification, soil conservation, and the use of drought-tolerant varieties, signals a move from information access to applied action. In particular, the uptake of crop rotation or intercropping practices increased fivefold, while use of diversified crop types more than tripled. These behavioral shifts suggest that mobile-based information platforms helped convert climate knowledge into concrete on-farm decisions.

However, not all adaptation areas showed progress. Integration of livestock into farming systems remained largely static, and participation in formal training programs saw a marginal decline. This drop may indicate that real-time access to digital information reduced the need for physical workshops, a hypothesis supported by findings in Section 5 . Furthermore, engagement in advocacy or policy dialogue decreased significantly, pointing to persistent barriers in institutional participation or collective action.

Overall, the data affirm that personalized, timely, and accessible information can substantially improve individual preparedness and farm-level adaptation. Yet, long-term resilience will require addressing gaps in systemic engagement and ensuring support for higher-level coordination, especially in policy and institutional domains.

6.4. Access to Agricultural Inputs, Financial Services, and Extension Support

Access to agricultural inputs, financial services, and extension support improved substantially during the project period, reflecting the effectiveness of digital tools in closing information gaps. Endline data showed marked increases in ease of accessing information about seeds, fertilizers, credit opportunities, and farmer training. This improvement suggests that mobile platforms served as an effective channel for reaching women with practical, service-oriented information.

Several underlying mechanisms contributed to these gains. First, digital prompts, particularly through USSD, provided timely reminders about available services, enabling women to seek help or prepare documentation in advance. Secondly, increased awareness of government

subsidies and available support services empowered more women to act on opportunities they may have previously ignored or misunderstood.

However, systemic and geographic inequalities continue to shape access outcomes. Affordability of inputs remains a challenge, especially in remote areas or for women with limited group affiliations. Some women also faced difficulty in acting on the information without external support, particularly for credit application or accessing subsidized products.

Taken together, the results underscore the role of mobile-based information in facilitating access, while also highlighting the need for complementary in-person support and targeted follow-up, especially for vulnerable subgroups. Future efforts should prioritize not only information delivery but also linkages to actual services, subsidies, and public programs that enable women to act on what they learn.

6.5. Market Access and Trade Readiness

Access to markets and trade opportunities improved meaningfully over the project period, driven by greater use of mobile platforms for price intelligence, buyer engagement, and logistical coordination. Survey data revealed a notable increase in the proportion of women identifying new buyers, from 43.3% at baseline to 54.7% at endline, similarly, 31.3% of users (approximately 10,703 women) identified new buyers by endline, up from 5,192 at baseline suggesting growing trade readiness and digital engagement.

USSD usage for market access grew from 1.0% to 5.4%, while WhatsApp use more than doubled from 11.0% to 22.9%. These tools enabled women to compare prices across markets, arrange deliveries, and share product information remotely. Mobile phones thus served not just as information hubs but also as negotiation and coordination tools.

Monthly income from farming activities rose from KES 10,286 at baseline to KES 12,338 at endline. Based on extrapolation to the project's recorded reach of 34,210 users, this represents a 52.3% increase, with average monthly revenue rising from KES 8,686 to KES 17,905. This income increase, though modest, likely reflects improved decision-making around pricing and buyer selection. Additionally, the use of digital tools to identify suppliers increased, signaling greater upstream integration in agricultural value chains. Women reported relying more on online research, aggregator directories, and peer recommendations shared via mobile platforms.

These trends suggest that mobile technology is helping close the information gap between women farmers and broader market systems. Digital access empowered users to act with

greater confidence, reduce reliance on intermediaries, and build direct trading relationships. While barriers remain, especially around digital literacy and infrastructure, these findings underscore the transformative role of simple, accessible mobile tools in strengthening rural women's market engagement.

6.6. Training, Learning, and Institutional Support

Training and institutional support played an enabling role in the uptake of mobile platforms and the application of climate-smart information. While participation in formal training workshops showed a slight decline, from 8.0% at baseline to 7.2% at endline, this shift may not necessarily signal reduced interest, but rather a transformation in how women learn and access information. As mobile content became more accessible, particularly via USSD and SMS, women increasingly relied on real-time tools, peer networks, and community-based learning rather than in-person sessions.

This change highlights an important evolution in capacity building. Women were able to absorb and apply information without needing to attend time-consuming and sometimes inaccessible physical workshops. The rise of peer learning, particularly through women's groups, cooperative WhatsApp forums, and informal digital mentorship, emerged as a cost-effective, scalable model for ongoing knowledge sharing. These models respected women's time constraints and household responsibilities, making learning more continuous and embedded in daily life.

However, the data also reveal persisting gaps in digital literacy and usability, especially for older users or those less confident with mobile navigation. This underscores the need for structured refresher trainings and human-centered support. Agricultural officers emphasized that even as women adopt digital tools, sustained guidance through lead farmers, extension officers, or local digital champions is necessary to maintain momentum and ensure correct application of information.

For long-term impact, integrating digital learning into county-level extension frameworks, alongside community-based demonstrations and mobile-based training modules, will be essential. This hybrid approach balances the reach of technology with the depth of interpersonal support.

6.7. Barriers and Enablers to Use of Climate and Agricultural Information

While the project significantly expanded women's digital access to agricultural and climate information, several structural and systemic barriers persisted. Digital literacy remained a key challenge, particularly for older women, who often struggled to navigate USSD menus or interpret SMS content without assistance. This highlights the ongoing need for refresher training and peer learning to ensure consistent use of mobile tools beyond initial onboarding.

Affordability also posed a barrier, not only in terms of accessing smartphones and mobile data, but also in acting on the information received. Many women lacked the financial means to implement recommended practices such as irrigation, agroforestry, or improved storage techniques, limiting the full realization of CIS benefits.

Conversely, several enablers played a critical role in supporting adoption and continued use. Community-based support systems, particularly agricultural extension officers and farmer group networks, served as trusted intermediaries who helped translate digital information into actionable practices. The effectiveness of SMS and USSD platforms also reinforced the value of low-cost, offline tools in reaching women with limited connectivity or digital experience.

Taken together, these findings emphasize that inclusive digital delivery is necessary but not sufficient. Sustained impact depends on a broader ecosystem of support, combining simple mobile tools with trusted human networks, responsive institutions, and policies that address affordability and infrastructure gaps.

7. RECOMMENDATIONS

Building on the observed improvements in access, use, and outcomes of climate and CIS, this section outlines practical recommendations for enhancing the design, delivery, and sustainability of such platforms for women farmers in Kenya. These recommendations are informed by both statistical trends and insights from key informant interviews across Vihiga, Homa Bay, Uasin Gishu, and Busia counties.

1. **Inclusive Platform Design Is Essential for Reaching Marginalized Users**

Platforms like USSD and SMS significantly increased access to climate and agricultural information among women farmers in rural areas. Use of USSD rose from 23.0% to 69.3%, and

SMS from 6.0% to 73.4% between baseline and endline. These platforms were preferred due to their compatibility with basic phones and low data requirements.

To ensure broader inclusivity, future CIS programs should:

- Maintain and enhance non-internet platforms like USSD and SMS
- Simplify platform navigation to accommodate users with limited digital literacy
- Explore voice-based features only where evidence suggests a need among users with low literacy or visual impairments

2. **Peer Learning and Refresher Trainings Improve Platform Use and Retention**

Despite improvements in platform uptake, many women, particularly older or less educated, struggled with digital navigation. This limited their ability to act on the information they received. Agricultural officers noted that peer-to-peer learning and refresher sessions improved confidence and retention.

Programs should:

- Provide periodic refresher training sessions on USSD and WhatsApp usage
- Promote informal, group-based learning through cooperatives or WhatsApp groups
- Support local digital champions or extension officers to offer real-time support

3. **Localized, Co-Created Content Boosts Relevance and Trust**

Women were more likely to act on information when it was timely, relevant to their context, and co-developed with local actors. Where content was designed without user input, uptake was lower.

Future programs should:

- Co-create seasonal and market-relevant content with women farmers
- Prioritize real-time updates on climate, prices, and pest outbreaks
- Expand agro-input verification and safe usage guidelines

4. **Mobile Tools Are Unlocking New Market Opportunities**

Use of WhatsApp to identify new buyers rose from 11.0% to 22.9%, and USSD from 3.5% to 8.3%. Women used these platforms to share photos, compare prices, and coordinate transport.

To deepen digital market engagement, implementers should:

- Strengthen mobile-based buyer-seller linkages
- Embed price tracking and logistics tips in CIS platforms
- Offer trade advisories on emerging crop demand

5. **Sustainability Requires Institutional Integration and Infrastructure Investment**

Systemic challenges such as poor connectivity, device costs, and limited follow-up restrict impact at scale. While mobile tools improved information flow, lasting change depends on institutional support and resource access.

Programs should:

- Embed CIS into county agriculture programs and extension planning
- Partner with telcos for network expansion and solar charging access
- Regularly monitor gendered usage patterns and satisfaction

8. CONCLUSION

This endline evaluation demonstrates that mobile-based CIS, when designed to be inclusive, localized, and user-friendly, can significantly improve the adaptive capacity, decision-making, and economic resilience of women smallholder farmers in Kenya. Across Vihiga, Homa Bay, Uasin Gishu, and Busia counties, women reported notable gains in access to timely agricultural and climate information, adoption of climate-smart practices, and digital market engagement.

Findings from the longitudinal survey and key informant interviews reveal that platforms such as USSD and SMS are especially effective in reaching low-literacy and offline users. The substantial increase in the use of these tools highlights the value of low-bandwidth technologies in bridging the digital divide. At the same time, challenges such as limited smartphone access, digital literacy gaps, and structural financial constraints remain key barriers to maximizing the potential of CIS platforms.

The evaluation underscores the importance of combining mobile tools with peer learning, refresher trainings, extension support, and co-created content to foster trust and sustained use. While digital tools alone can catalyze change, their greatest impact occurs when embedded within an ecosystem of human support and responsive institutions.

As the project closes, its approach offers a replicable model for inclusive digital extension services that promote climate resilience and gender equity. Future programs should build on these insights, scaling what works while addressing the persistent barriers that continue to limit access and participation for the most marginalized women farmers.

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9. ANNEXES

Annex 1: Detailed Quarterly Breakdown of Activities

Quarter	Detailed Activities
Q1+Q2 2023	-Conducted climate-related information needs assessment in five counties (Homa Bay, Trans Nzoia, Uasin Gishu, Nakuru, and Vihiga) - Used SMS/USSD and phone interviews with 225 respondents - Conducted 8 Key Informant Interviews with climate and agriculture experts - Produced and published the Needs Analysis Report on Sauti's website - M&E expert recruitment and contracting completed
Q3+Q4 2024	-Developed and programmed new climate and agricultural content on the USSD platform, including: fertilizer/pesticide use, soil conservation, agroforestry, irrigation, poultry and livestock farming, water harvesting, waste management - Partnered with county governments and extension services - Conducted training for 101 women in Vihiga county - Baseline survey launched in Vihiga, Uasin Gishu, and Homa Bay - Ongoing outreach initiated with 2,938 women farmers accessing climate information
Q5+Q6 2024	- Trained 298 additional women in Busia and Uasin Gishu (cumulative 567) - Completed baseline survey (400 respondents) via physical and phone interviews - Continued outreach reaching 7,484 women - Data analysis and reporting activities initiated to evaluate platform use and impacts -Baseline report finalized
Q7+Q8 2025	- Final outreach conducted through SMS campaigns and social media, reaching 15,000+ women - Updated WhatsApp interface and content for smartphone users - Endline data collection conducted across all implementation counties - Drafted final report and closed project activities including digital archiving and final M&E checks

Annex 2: Demographic Characteristics of Survey Participants

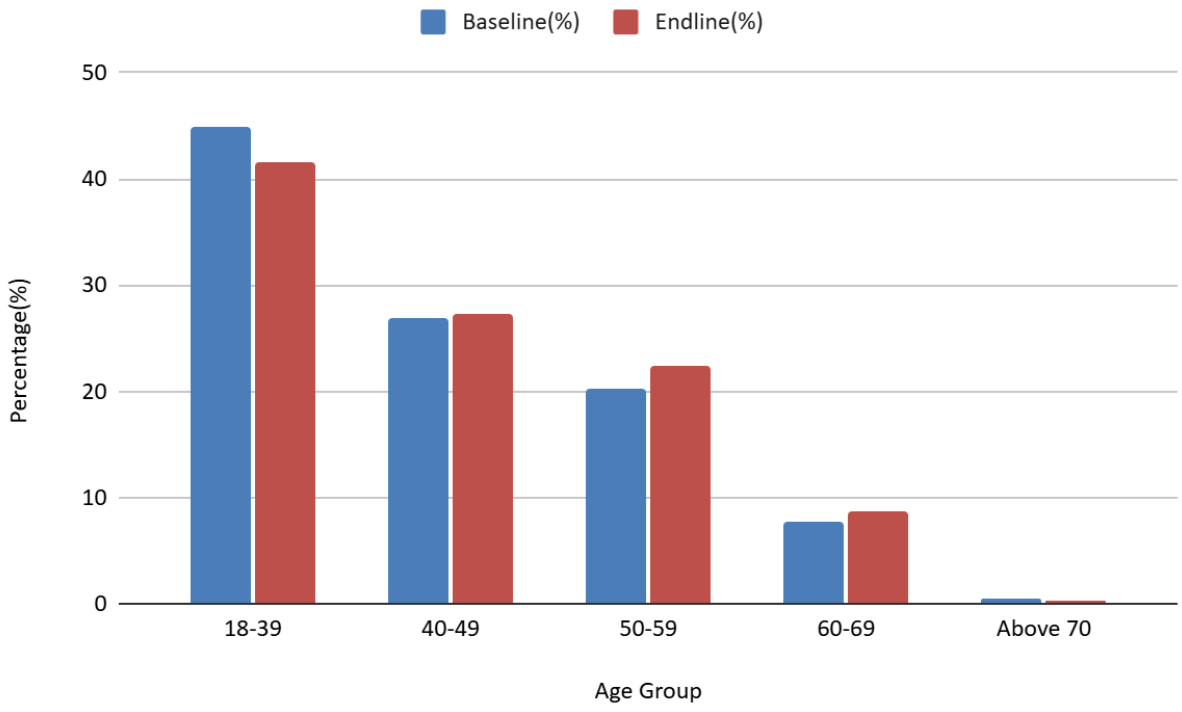
Age Distribution

How old are you?

Table 1: Age distribution of participants((Baseline vs.Endline)

Age Group	Baseline(%), n=400	Endline(%), n=349
18-39	44.8	41.5
40-49	26.8	27.2
50-59	20.3	22.4
60-69	7.8	8.6
Above 70	0.5	0.3
Total	**100.0**	**100.0**

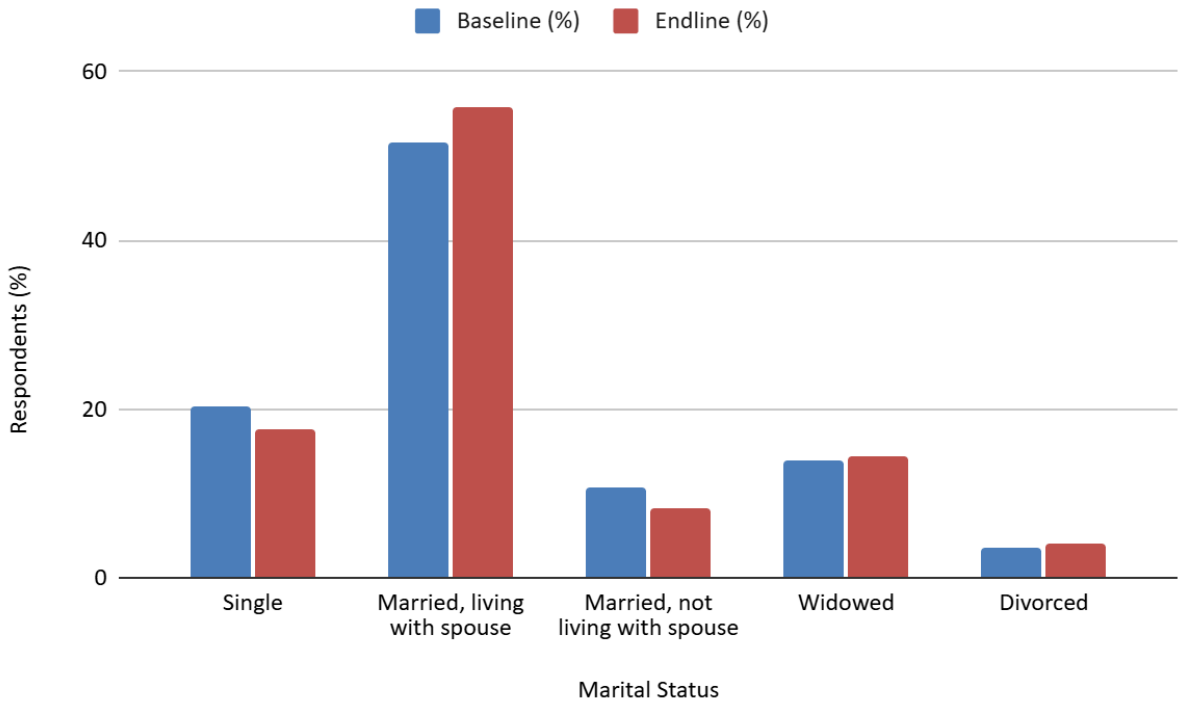
Figure 1: Bar chart comparing baseline and endline age distributions.



Marital Status

What is your marital status

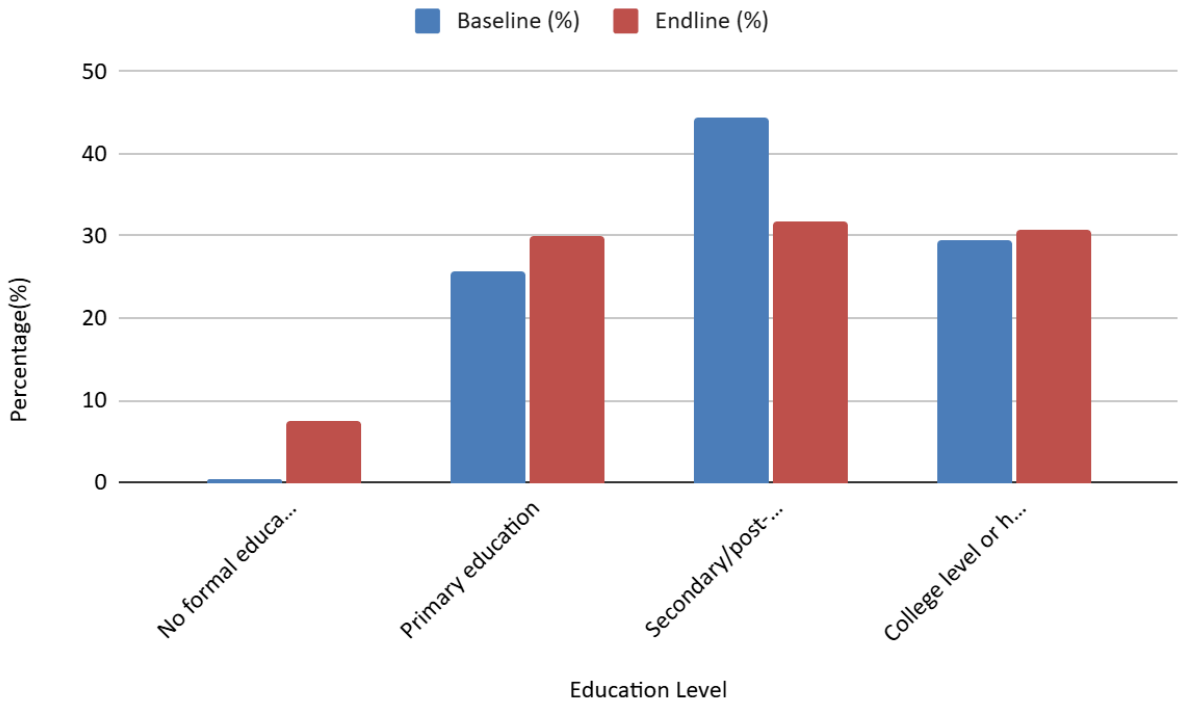
Figure 2: Marital Status of Participants (Baseline vs.Endline)



Education Level

What is the highest level of education you have completed?

Figure 3: Education Level of Participants(Baseline vs. Endline



Physical Disability

Do you have any physical disability? What kind of physical disability do you have?

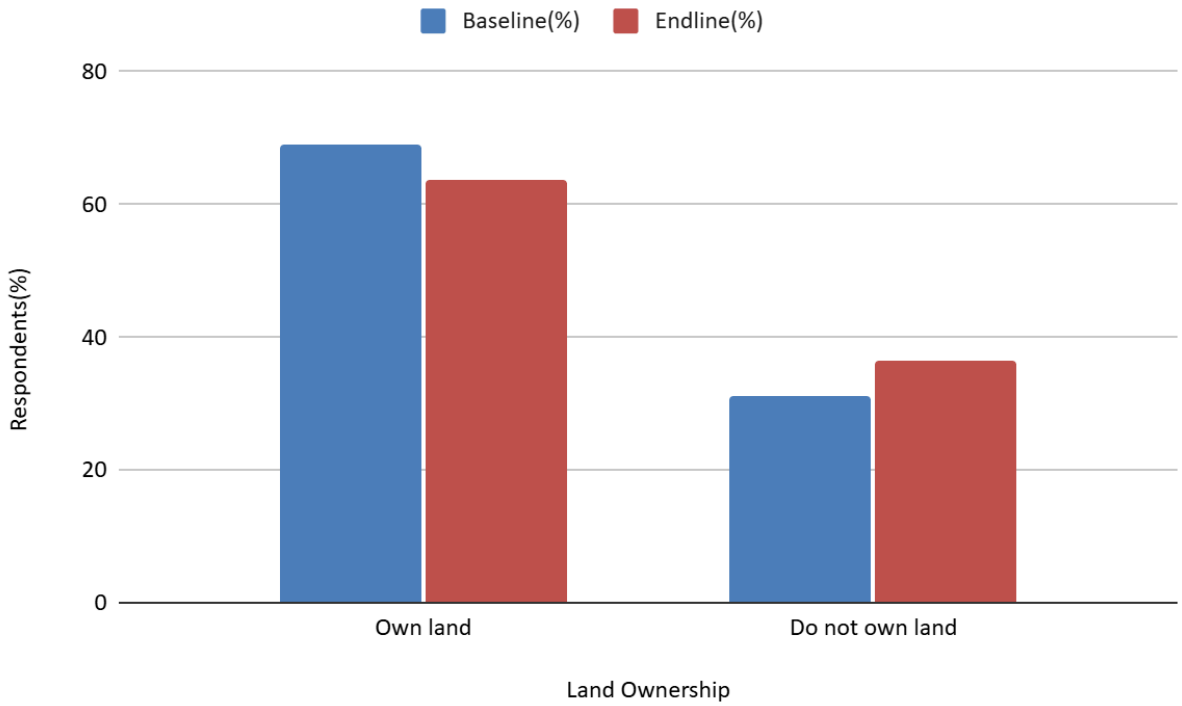
Table 2: Physical Disability Status of Participants (Baseline vs. Endline)

Disability Status	Baseline (%)	Endline (%)
Yes	1.75	2.6
No	98.25	97.4
Total	**100.0**	**100.0**

Land Ownership

Do you own the farm where you currently live on or cultivate?

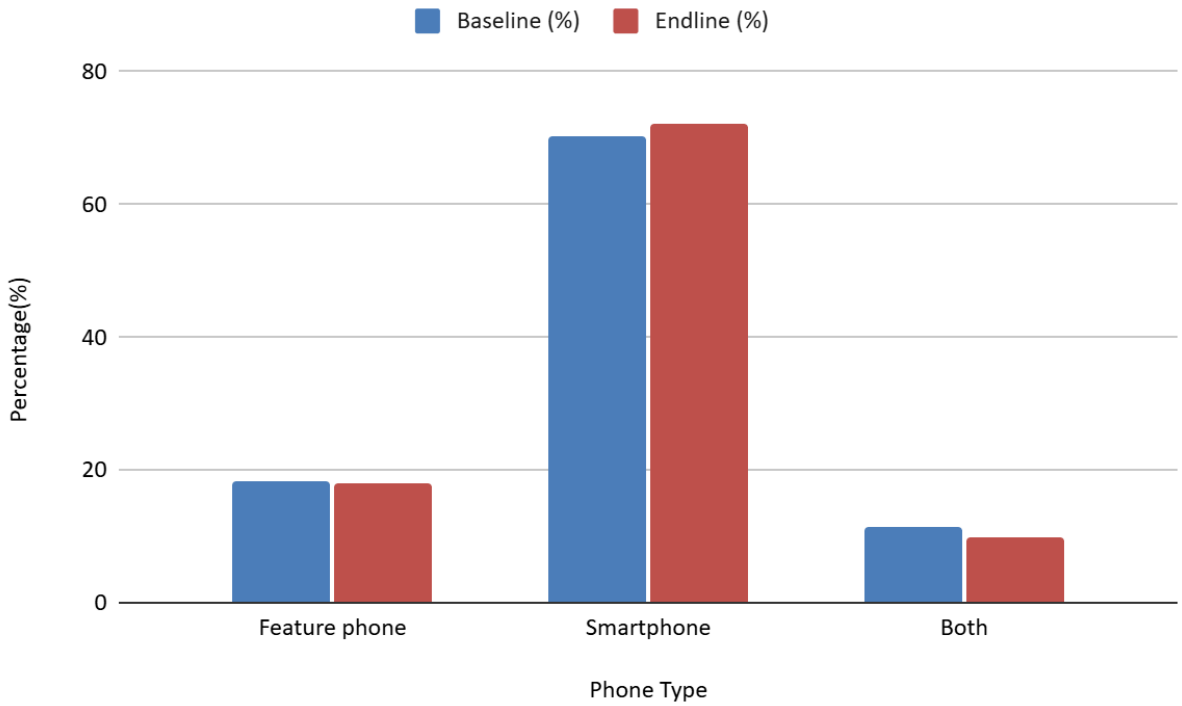
Figure 4: Land Ownership(Baseline vs Endline)



Phone Access

Do you own or have access to a phone? What kind of phone?

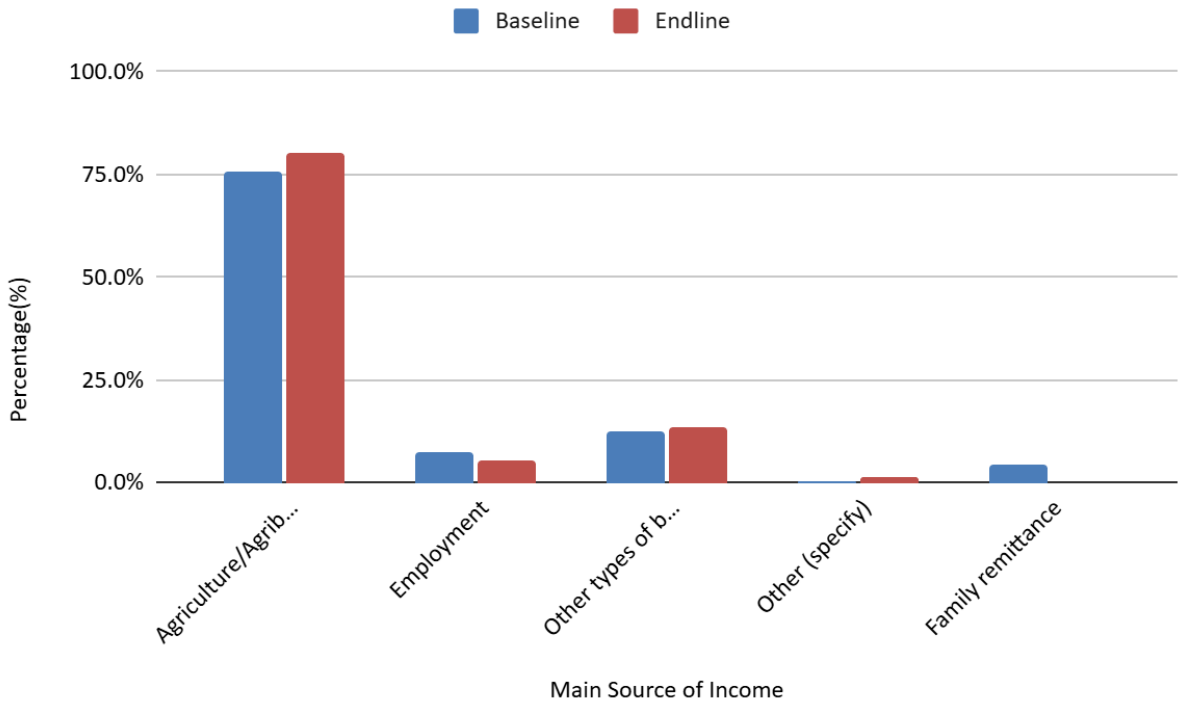
Figure 5: Phone Access of Participants (Baseline vs. Endline)



Main Source of Income

Currently, what is your main source of income? Specify your other source of income

Figure 6 : Main Source of Income Among Respondents (Baseline vs. Endline)



Annex 3: Quantitative Questionnaire on Women Farmers' Access to Agricultural and Climate Information

Note: The baseline and endline questionnaires followed the same structure and wording, with only minor changes to 2–3 response options. Therefore, only the endline questionnaire is included in full below for reference

Section	Questions
Respondents Details	• Respondent's County from the Respondents List • Sub County • Gender • How old are you? • What is your marital status? • What is the highest level of education you have completed? • Do you have any physical disability? • What kind of physical disability do you have? • Do you own the farm where you currently live or cultivate?
Access to	• Do you own or have access to a phone?

Climate and Agricultural Information	• What kind of phone? • What sources do you primarily rely on to obtain information about climate patterns and agricultural practices? (Extension services, radio/TV, mobile phones, community meetings, NGOs, internet/social media, traditional knowledge, weather stations, none) • What mobile based platforms are you currently using to access climate and agricultural information? (SMS, USSD, WhatsApp, Voice services, Other apps) • Specify the service providers: • On a scale of 1-5, how accessible do you find the sources of information in terms of: language, format, affordability, women-friendliness, reliability, challenges in remote areas?
Market and Business Information	• Currently, what is your main source of income? • Specify your "other" source of income: • How many months did you do this work in the last 6 months? • What is the average monthly revenue (in KSH) generated through this activity? • How do you identify the majority of your new buyers/markets? (Market research, networking, trade shows, extension, online platforms, collaborating with aggregators, export opportunities, other, not in business) • Specify the online platforms you are using: (SMS, USSD, WhatsApp, Other apps) • Please specify the "other ways" of identifying new buyers/customers: • In the past 6 months, did you identify any new buyers for your farm inputs? • How did you identify the majority of your new buyers for farm inputs? (Same options as above) • How do you identify the majority of your new suppliers? (Same options as above) • In the past 6 months, did you identify any new suppliers?
Impact and Use of Climate and Agricultural Information	• How often do you access climate and agricultural information? • Do you feel that the available climate and agricultural information adequately address your needs and challenges? (Yes/No) • In what ways has the climate information helped you anticipate and prepare for climate risks? (Multiple options: weather monitoring, early alerts, adaptation measures, investing in resilient tech, collaboration, advocacy, income diversification, nothing) • What changes have you made to your farming or livelihood strategies based on climate information? (Drought-resistant crops,

	water-saving irrigation, crop diversification, agroforestry, soil conservation, livestock, training, crop rotation, community initiatives, conservation agriculture, other income, advocacy, none) ● On a scale of 1-5, how easy is it to get information about: finance opportunities, farm inputs, extension services, training opportunities? ● How confident are you that you have enough information to access these services? (Scale 1-5) ● Has access to climate/agriculture info enabled you to participate in training or community initiatives? ● How has access to information affected your engagement with cooperatives, markets, or value chains? ● On a scale of 1-5, how much has recent information improved your decision-making in farming strategies, land management, and resource allocation?
Community Participation	● Have you participated in discussions on climate and agriculture with other women farmers in your community recently? (Options) ○ Yes, through local meetings and community events ○ No, due to limited access to platforms or networks ○ Yes, but looking for more structured and frequent opportunities ○ Yes, through online platforms and social media groups ○ Yes, actively in farmer groups, cooperatives, or women's associations ○ Not sure about the interest among others

Annex 4: Qualitative Interview Guide for Women Farmers' Experiences and Perspectives

Section	Question
Introduction and Verbal Consent	● Name of Respondent: ● Title: ● Location: ● Date of Interview: ● Consent Statement: ○ Thank you for agreeing to speak with us. Before we begin, I'd like to briefly explain the purpose of this interview. We are conducting a survey to understand how women farmers access and use agricultural and climate information, which will help improve support programs. Your participation is voluntary, and

	you can choose to stop at any time or skip any questions you're uncomfortable with. ● Do you agree to take part in this interview?" (Yes/No) ● If yes, proceed with the questions. If no, thank them and respectfully end the interview
Background Information	● Could you please tell me a bit about yourself? (Name, Age, Education level, Job and role, Experience working with women farmers/traders) ● What is the main source of income for the women you work with? ● Do they mostly own or rent the land they farm? ● What challenges do they face with land access or ownership?
Access and Use of Agricultural and Climate Information	● What are the main sources of agricultural and climate information for the women you work with? Why are those sources more popular? (Probe for: Extension services, radio/TV, phone-based platforms, social media, traditional knowledge, etc.) ● Can you describe the mobile platforms or technologies they use to access such information? ● How do they find these sources of information in terms of: language used, format and usability, cost, reliability, whether they feel tailored for women like them ● What are some challenges they face in accessing this useful information?
Use of (Sauti) Information and Livelihood Practices	● How do they usually use the agricultural/climate information they receive? Could you give some examples? ● Have they made any changes in their farming or livelihood strategies because of the information? If so, what kind of changes? ● How do they usually identify new suppliers or inputs for their farms? ● In the past 6 months, have they identified any new markets or buyers for their products? If yes, please describe how they were able to identify these markets or buyers.
Impact of Information Access (Resilience, Adaptation, and Preparedness)	● How frequently do they access agricultural and climate information? ● Do you feel that the information they receive addresses their capacity to adapt, prepare, and be resilient as women farmers? Please elaborate. ● Has the information helped them to: Prepare for droughts, floods, or pests?Make changes like adopting drought-resistant crops or new irrigation methods?Diversify their income or improve yields? ● How would you rate their current access to: Quality seeds, Fertilizers, Credit, Extension services (ask for reasons behind their rating)

Final Reflections	• Overall, what would you say has been the biggest benefit of women farmers accessing agricultural and climate information? • How would your community improve if everyone was using the information provided by Sauti? (probe for climate, trade, market, legal & anti-corruption, climate-smart agriculture info, etc.) • What gaps still exist in the information or support they receive? • What suggestions do you have for improving access to helpful, timely, and gender-sensitive information for women farmers?

Annex 5: Summary of Qualitative Respondents (Key Informant Interviews)

County	Gender	Position/Title
Vihiga	Female	Agricultural Extension Officer
Vihiga	Female	Ward Agricultural Officer
Vihiga	Female	Sub-County Agricultural Officer
Homa Bay	Female	Agricultural Technologist
Uasin Gishu	Female	Technical Agronomist