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Tradition Meets Innovation: Preferences for Climate Strategies Among Cocoa Farmers in Obuasi Municipality, Ghana

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Abstract:

The purpose of the study was to compare the traditional and modern adaptation strategies employed by cocoa farmers in response to climate variability in the Obuasi Municipality. A qualitative approach was employed, involving in-depth interviews using a purposive sampling technique to select twenty (20) cocoa farmers and five (5) key informants. The findings revealed that farmers use a blend of traditional strategies, such as shade management, crop diversification, and local weather indicators, as well as modern strategies, including pruning, artificial irrigation, and agrochemical applications. While modern methods were often seen as more effective, traditional methods remained widely preferred for their affordability, accessibility, and cultural embeddedness. Factors influencing the choice of strategies included gender, Education, financial capacity, land ownership, and access to extension services. Notably, the study found that combining both traditional and modern methods provided the most promising adaptation pathway, especially when supported by training, government interventions, and community-based platforms. The study has implications for agricultural extension services, policymakers, and NGOs by demonstrating the need to promote inclusive, participatory, and locally adaptable interventions. Strengthening locally grounded yet scientifically informed adaptation systems can enhance cocoa sector resilience to climate change while safeguarding cultural knowledge and farmer agency.

Keywords: Adaptation strategies, Climate change, Innovation, Preferences, Traditional practices.

1. Introduction

Climate change has emerged as one of the most pressing challenges to agricultural production worldwide, exerting significant pressure on both crop yields and rural livelihoods. In the tropics, perennial cash crops such as cocoa (*Theobroma cacao* L.) are particularly vulnerable due to their sensitivity to temperature fluctuations, rainfall variability, and pest infestations (Ameyaw et al., 2018; Tham-Agyekum et al., 2024). In recent decades, cocoa-growing regions have experienced increasingly unpredictable rainfall patterns, rising average temperatures, and greater incidences of diseases and pests. These climatic shifts threaten not only the economic viability of cocoa production but also the sustainability of rural economies that depend heavily on it. Ghana, the world's second-largest cocoa producer, has not been spared these challenges. The cocoa sector contributes significantly to Ghana's GDP, foreign exchange earnings, and employment, yet it faces mounting risks from climate-induced stresses (Attiogbé et al., 2024).

Ghanaian cocoa farmers have relied on a range of traditional, locally derived adaptation strategies to mitigate environmental stresses (Adu-Boahen, 2023). Such practices include shade management, intercropping with food crops, mulching, and the application of organic fertilisers. These approaches are deeply embedded in local knowledge systems, passed down through generations, and adapted to the ecological and socio-economic contexts of rural communities (Denkyirah et al., 2017). In recent years, however, the increasing availability of modern agricultural technologies and the introduction of climate-smart agricultural policies have expanded the portfolio of potential adaptation strategies available to farmers. These modern approaches include the adoption of irrigation systems, improved and drought-tolerant cocoa varieties, mobile-based weather advisory services, and precision agriculture techniques (Tham-Agyekum et al., 2024; Apuri et al., 2025).

Globally, empirical evidence reveals a diverse spectrum of adaptation preferences among farmers, shaped by a complex interplay of socio-economic, cultural, institutional, and environmental factors. For instance, in Indonesia, farmers with greater access to credit and agricultural extension services have been found to adopt modern strategies more readily than those without such support (Abdulai, 2018). In Brazil, however, traditional adaptation methods such as agroforestry have been shown to outperform modern irrigation in conserving soil moisture and reducing crop heat stress (Schroth et al., 2016). In Nigeria, despite productivity gains linked to modern practices, many cocoa farmers continue to prefer traditional methods due to their affordability and alignment with cultural values (Famakinwa et al., 2023; Obaniyi et al., 2019). In Cameroon, a hybrid approach that combines traditional measures like shade tree retention with modern irrigation has been reported to enhance resilience to climatic extremes (Cédric et al., 2025).

In Ghana, adaptation choices are also influenced by farmers' socio-demographic characteristics, access to resources, and perceptions of risk. Adu-Boahen (2023) found that older cocoa farmers in the Ashanti Region tended to favour traditional strategies, often due to scepticism about modern technologies, while younger farmers demonstrated greater openness to innovation. In Western Ghana, although modern strategies such as irrigation and improved varieties have been shown to improve yields, their adoption remains constrained by poor access to finance, inadequate extension services, and knowledge gaps (Batung, 2021; Mwinkom et al., 2023).

Over the past decade, a gradual evolution in cocoa farmers' adaptive responses to climate change has been observed. Initially, adaptation was dominated by low-cost, locally accessible practices such as mixed cropping, crop rotation, and agroforestry. However, increasing emphasis has been placed on climate-smart technologies, including advanced irrigation systems, mobile weather applications, and genetically improved, drought-tolerant cocoa varieties (Denkyirah et al., 2017). Despite the benefits, uptake of these modern innovations remains limited due to their high costs, lack of technical training, and the enduring cultural significance of traditional methods (Adu-Boahen, 2023).

The institutional context further shapes adaptation preferences. The Ghana Cocoa Board (COCOBOD), the statutory body overseeing cocoa production, marketing, and pricing, plays a pivotal role in introducing new technologies and inputs to farmers (Ollendorf, 2024). While government programmes such as the Cocoa Rehabilitation Programme and Climate-Smart Cocoa projects have introduced improved seedlings, drip irrigation, and agroforestry

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packages, their effectiveness is contingent upon farmer acceptance and sustained use. At the same time, structural challenges—such as deforestation, soil degradation, and competition for land from mining—compound climate-related risks, especially in districts like Obuasi (Owusu, 2022).

The Obuasi Municipality presents a particularly interesting case for examining adaptation preferences due to its unique socio-ecological context. While sharing many climatic challenges with other cocoa-growing regions, Obuasi also faces land degradation from small-scale mining, competition for arable land, and specific microclimatic conditions that influence farming decisions (Tham-Agyekum et al., 2023). Yet, many Ghana-based adaptation studies have focused on the Ashanti and Western cocoa regions (Ameyaw et al., 2018), leaving areas such as Obuasi underrepresented in scholarly literature. This geographic gap limits the applicability of policy recommendations to all cocoa-growing contexts.

Existing studies on cocoa adaptation have provided valuable insights into the types of strategies farmers employ (Bunn et al., 2019; Anning et al, 2022), as well as the socio-economic and institutional factors influencing adoption (Afriyie-Kraft et al., 2020; Obaniyi et al., 2019; Schroth et al., 2016). However, much of the literature relies on either broad-scale quantitative surveys that may overlook nuanced individual experiences or qualitative approaches that lack representativeness (Guodaar et al., 2021). Moreover, while the efficacy of both traditional and modern adaptation measures has been documented, there is less understanding of farmers' explicit preferences and the motivations underpinning them. This knowledge gap is critical, as adaptation preferences shape the likelihood of sustained adoption and the eventual success of policy interventions.

An important unresolved issue in climate adaptation discourse is the persistent disconnect between top-down policy advocacy for modern, climate-smart practices and farmers' real-world decisions. Substantial investments have been made in promoting modern adaptation technologies in Ghana, yet adoption rates remain low (Owusu, 2022). Understanding why farmers continue to rely on traditional methods, despite the availability of scientifically validated alternatives, can help bridge this gap. This is not merely a matter of technical efficiency; it also touches on the socio-cultural legitimacy of agricultural innovations and the perceived trade-offs between economic risk, cultural continuity, and environmental sustainability.

Furthermore, debates persist regarding the role of traditional ecological knowledge in the context of rapidly changing climatic conditions. Some scholars argue that traditional practices are inherently adaptive and provide resilience against environmental shocks, while others contend that these methods may be insufficient in addressing the unprecedented challenges posed by climate change (Apraku et al., 2021; Bekuma et al, 2023). A growing body of literature suggests that integrated approaches blending traditional and modern practices offer the most promising pathway to sustainable adaptation (Cédric et al., 2025). Yet, the balance between these two modes of adaptation remains largely underexplored in empirical research, particularly in Ghana's under-studied cocoa districts.

This study addresses these gaps by examining cocoa farmers' preferences for traditional and modern climate adaptation strategies in the Obuasi Municipality. Using a qualitative research design, it captures the lived experiences, perceptions, and decision-making processes of farmers to generate a nuanced understanding of adaptation preferences. By focusing on an under-researched geographic area, the study contributes to a more complete national picture of cocoa adaptation strategies. Moreover, it provides actionable insights for policymakers, development agencies, and extension services seeking to design context-appropriate interventions that align with farmers' values, resources, and long-term sustainability goals.

The main objective of the study was to examine cocoa farmers' preferences for traditional and modern climate adaptation strategies in Obuasi municipality. The specific objectives of the study were: to identify the traditional and modern climate adaptation strategies used by cocoa farmers in Obuasi Municipality, to examine cocoa farmers' perceptions of traditional and modern adaptation strategies, to assess the extent to which cocoa farmers prefer traditional adaptation strategies and modern strategies, to analyse the factors influencing cocoa farmers' preferences for traditional and modern adaptation strategies, to evaluate the perceived effectiveness of traditional and modern adaptation strategies.

2. Research methodology

2.1. Research design

This study adopted a qualitative research design, which prioritises depth of understanding, exploration of meanings, and the contextual interpretation of lived experiences rather than statistical generalisation (Pervin & Mokhtar, 2022). The study employed an explanatory and descriptive research approach because climate adaptation strategies among cocoa farmers have not been extensively studied in the Obuasi Municipality. The descriptive aspect helps to systematically document and analyse farmers' preferences for traditional and modern adaptation strategies, their perceptions, and the factors influencing their choices (Fuyane, 2021). A qualitative methodology was appropriate for this research because it allows an in-depth understanding of farmers' perspectives, beliefs, and motivations regarding climate adaptation. Unlike quantitative studies, which rely on numerical data, qualitative research provides richer insights into how farmers make decisions and why they prefer certain strategies over others (Peterson, 2019).

2.2. Study area

The study was conducted in the Obuasi municipality in the Ashanti region of Ghana. Approximately 19% of the working population in the Obuasi Municipality is engaged in mining, though agriculture remains the dominant employment sector with about 62% of residents involved in it (Osman et al., 2021). The municipality's climate is classified as tropical rainforest, characterized by two main rainy seasons and a dry season, which makes it highly susceptible to climate variability. Figure 1 shows a map of the Obuasi Municipal Area.

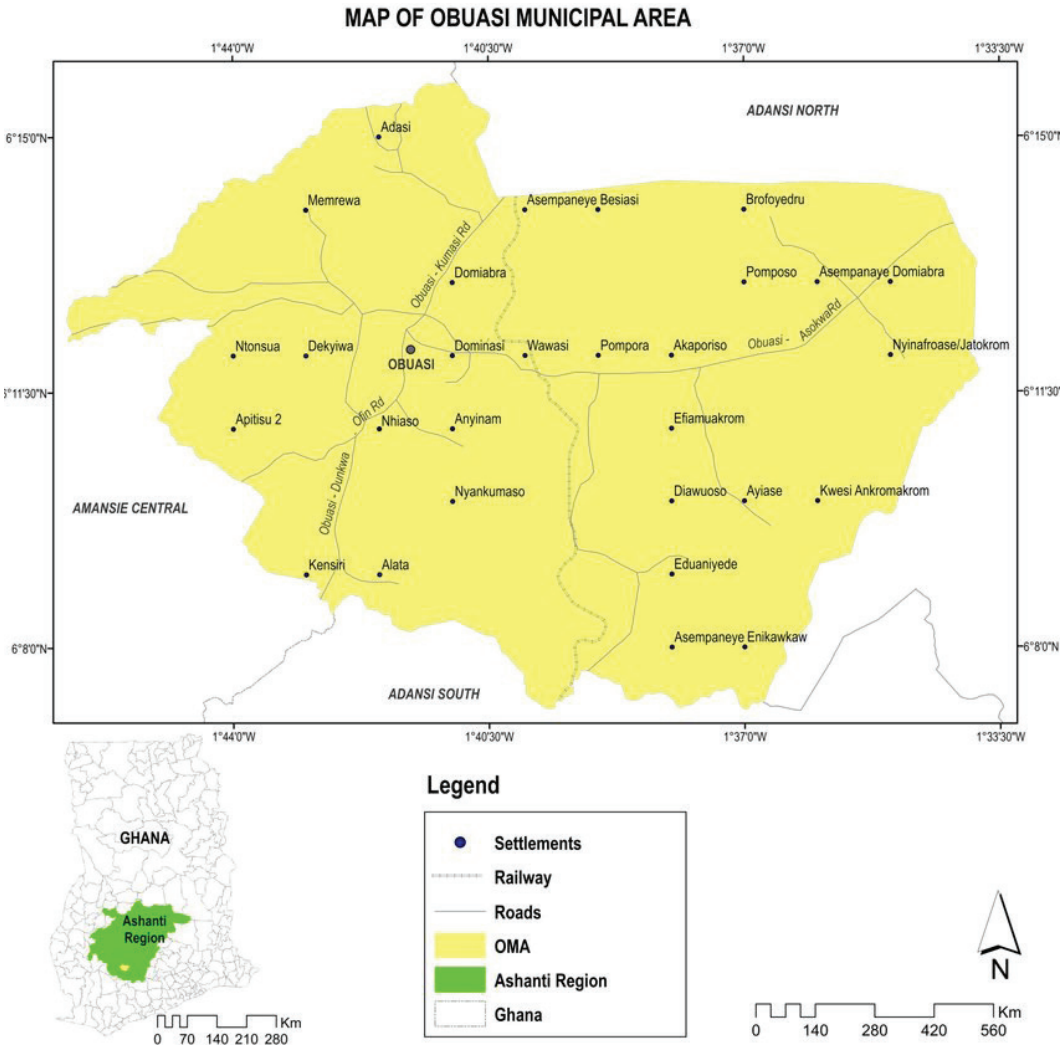

Figure 1: Map of Obuasi Municipal

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2.3. Sampling

Purposive sampling was used to select participants with relevant knowledge and experience. Inclusion criteria required farmers to have at least five years of cocoa farming experience and to actively use either traditional or modern adaptation strategies (Kubiciel-Lodzińska, 2021). In total, 25 respondents, including 20 farmers and five (5) key informants (agricultural extension officers and climate adaptation specialists), were interviewed. The sample size was guided by the principle of data saturation, which was reached when no new themes emerged after repeated interviews (Cassell & Bishop, 2019; van Leeuwen et al., 2020; Tavory, 2020).

While the sample may appear small when compared to quantitative studies, such sizes are well established in qualitative research traditions. The study's aim was not to provide statistically representative conclusions, but rather to uncover diverse perspectives, preferences, and influencing factors shaping adaptation strategies. To strengthen the credibility and trustworthiness of the findings, the study applied methodological strategies such as triangulation of data sources (farmers and key informants), member checking, and thematic coding consistency. These steps enhanced the reliability of the data, ensuring that the conclusions drawn are robust and grounded in participants' lived experiences.

2.4. Data collection and analysis

Data were collected through semi-structured interviews, key informant interviews, and observations. The interview guides explored farmers' adaptation practices, perceptions, and influencing factors, while the key informant guide focused on policy implementation and institutional support. Interviews lasted 30 45 minutes, were conducted in English and Twi, and were audio-recorded with consent. A short pilot test was conducted to refine the instruments. All interviews and discussions were recorded with participant consent. Where writing recoding was difficult, the audios were later transcribed for thematic analysis. The use of multiple instruments ensured data triangulation to enhance the reliability and validity of the findings (Santos et al., 2020). Coding was conducted manually, guided by the study objectives. Emerging codes were grouped into broader themes related to adaptation strategies, perceptions, influencing factors, and effectiveness. Themes were reviewed for consistency, and illustrative quotes were used to represent participant voices. Credibility was enhanced through triangulation of farmer and key informant perspectives and member checking with a subset of participants.

Table 1: Interview themes and number of questions

Theme/Domain	Focus of Questions	No. of Questions (Farmers)	No. of Questions (Key Informants)
Background Information	Age, gender, Education, household composition, years in cocoa farming/professional role	5	3
Perceptions of Climate Change	Awareness of changing rainfall/temperature patterns, observed impacts on cocoa production, and gendered impacts	6	4
Traditional Adaptation Strategies	Shade tree planting, mulching, intercropping, indigenous weather signs, and cultural knowledge transfer	5	3
Modern Adaptation Strategies	Hybrid seedlings, irrigation, pesticides/fungicides, agroforestry, weather-based planning	6	5
Preferences	Reasons for choosing traditional vs modern, generational differences, affordability, and cultural attachment	4	3
Influencing Factors	Economic, social, institutional, gender, Education, extension services	5	5
Perceived Effectiveness	Strengths and weaknesses of traditional, modern, and integrated practices; conditions of effectiveness	5	5
Policy and Institutional Support	Role of COCOBOD, CHED, NGOs, government policies, and challenges in programme delivery	3	6
Future Outlook	Farmers' expectations about climate trends and adaptation pathways	2	2

Table 1 summarises the themes and the number of questions used in the semi-structured interviews. Farmer interviews comprised 41 questions across nine themes, while key informant interviews included 36 questions tailored to policy and institutional dimensions. The thematic focus on both traditional and modern adaptation strategies, as well as perceptions, preferences, and influencing factors, ensured that data collection was aligned with the study objectives.

3. Results and discussion

Table 2: Demographic table for participants

Category	Farmers (n = 20)	Key Informants (n = 5)
Gender	Male: 14 (70%) Female: 6 (30%)	Male: 4 (80%) Female: 1 (20%)
Age (years)	30–39: 3(15%) 40–49: 7 (35%) 50–59: 6 (30%) 60+: 4 (20%)	30–39: 2 (40%) 40–49: 3 (60%)
Education Level	No formal education: 4 (20%) Primary/JHS: 8 (40%) SHS: 5 (25%) Tertiary: 3 (15%)	SHS: 1 (20%) Tertiary: 4 (80%)
Farming/Professional Experience	5–9 years: 6 (30%) 10–19 years: 9 (45%) 20+ years: 5 (25%)	5–14 years: 3 (60%) 15+ years: 2 (40%)

Source: Field Data, 2025

Table 2 presents the demographic profile of the study participants. Among the 20 cocoa farmers interviewed, the majority were male (70%) and aged between 40 and 59 years (65%). Education levels varied, with 20% having no formal education, while 15% had attained tertiary Education. Farming experience ranged from 5 to over 20 years. The five key informants, drawn from extension services and climate adaptation programmes, were predominantly male (80%) and had substantial professional experience, with most (60%) having worked between 5 and 14 years.

3.1. Identify traditional and modern climate adaptation strategies

Table 3: Adoption of traditional vs. Modern adaptation strategies (Farmers, n = 20)

Traditional Strategies	Frequency	Percentage (%)	Modern Strategies	Frequency	Percentage (%)
Planting shade trees	15	75%	Improved hybrid seedlings	8	40%
Timing activities by indigenous weather signs	12	60%	Artificial irrigation (pumps, watering)	4	20%
Mulching with local materials	10	50%	Agrochemical use (fungicides, insecticides)	9	45%
Intercropping (cassava, plantain, yam with cocoa)	14	70%	Agroforestry with certified shade trees	6	30%
Burning grass before planting (declining)	5	25%	Weather-based planning using forecasts	7	35%

Source: Field Data, 2025

The majority of farmers reported using traditional strategies, particularly shade tree planting (75%) and intercropping (70%). Reliance on indigenous weather signs (60%) and mulching (50%) also remained widespread. This shows that the common traditional strategies used by farmers are the planting of shade trees, timing farm activities based on indigenous weather indicators,

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mulching with locally available plant materials, and intercropping with food crops to conserve soil moisture and diversify income. A middle-aged male farmer explained, *"My father always told me to watch the wind and the sky before clearing land. Even now, I don't start planting until the old signs tell me rain will come."* Similarly, an experienced female farmer shared how family knowledge influences her practice: *"I learnt from my grandmother that planting plantain trees near young cocoa helps them to survive long dry spells. I still do that today."* These accounts echo findings from Antwi-Agyei et al. (2023), who highlight the continued relevance of traditional ecological knowledge in Ghana's smallholder adaptation systems. Some older techniques have even become counterproductive. Another farmer reflected: *"We used to burn grass before planting to add ash to the soil, but now the sun is too hot, it just dries everything up faster."* Codjoe et al. (2013) agree with this assertion and noted that rising temperatures and unpredictable rainfall have rendered some traditional land preparation methods less effective.

By contrast, fewer farmers had adopted modern strategies such as irrigation (20%) or certified shade trees (30%). Agrochemical use (45%) and hybrid seedlings (40%) were more common, often linked to NGO or extension support. The participants reported some awareness of modern adaptation strategies, primarily introduced through agricultural extension services, non-governmental organisations (NGOs), or cocoa-related development projects. A male farmer described his introduction to improved seedlings: *"An extension officer gave me a new variety of cocoa that can survive the dry season better and produce more yield. I planted them two years ago."* Another male farmer noted: *"We were trained to use improved seedlings and fertiliser at certain times to reduce losses from drought."* Such findings are similar to those of Danso-Abbeam et al. (2019), who argued that modern adaptation technologies are increasingly disseminated via Ghana's extension systems, particularly in cocoa-growing regions. Adoption levels varied, in that some farmers incorporated agroforestry practices by planting certified shade trees such as *Terminalia superba* and *Milicia excelsa* alongside cocoa. A farmer remarked, *"We were told to space out the cocoa and plant shade trees to reduce heat stress. It helps, especially during harmattan."* Others also adopted small-scale irrigation. As a farmer explained, *"I have a small water pump now. It's not enough, but during dry spells, I use it on the younger trees. It makes a difference."* Support for these strategies often came from the Cocoa Health and Extension Division (Ghana Cocoa Board) and NGOs such as Solidaridad. Confidence in using modern strategies was mixed. Younger and more educated farmers tended to be more comfortable with technological methods, whereas older or less-educated farmers felt less confident. As one male farmer said, *"I know how to use some chemicals, but with irrigation or machines, I get confused. No one teaches us properly."* This confirms findings of studies such as Srivastava et al. (2025) and Jiri et al. (2016), who found that Education and quality extension support increase farmers' confidence in adopting modern adaptation measures.

3.2. Perceptions of climate change

Table 4: Perceptions of climate change (Farmers, n = 20)

Perception of Change	Frequency	Percentage (%)
Rainfall increasingly erratic	20	100%
Longer dry spells	18	90%
Rising temperatures	15	75%
Shift in the onset of the rainy season	17	85%
More pest/disease outbreaks	14	70%
Declining yields	16	80%

Source: Field Data, 2025

All farmers unanimously perceived rainfall as increasingly erratic, while 90% reported longer dry spells. A large proportion also noted a shift in the onset of the rainy season (85%), rising temperatures (75%), and declining yields (80%). Over two-thirds (70%) associated these climatic changes with higher pest and disease incidence, consistent with scientific studies linking cocoa vulnerability to climatic variability. There was unanimous agreement that rainfall has become increasingly erratic, dry seasons are longer, temperatures are rising, and the onset of the rainy season has shifted unpredictably. A cocoa farmer with over three decades of experience, recalled: *"The rains no longer come as they used to. We used to expect them in March and September, but now it is unpredictable. This confuses our planting and spraying schedules."* The findings of Asante and Amuakwa-Mensah (2015) and Antwi-Agyei et al. (2021) agree that climate change has altered rainfall distribution

in Ghana, thereby affecting the reliability of rain-fed agriculture. A 45-year-old farmer managing a 3-acre cocoa farm, lamented the intensification of dry spells: *"The sun is so harsh now. My cocoa trees look like they are burning, especially during the harmattan. We didn't experience this kind of heat before."* According to Schroth et al. (2016), temperatures exceeding 26°C can negatively affect cocoa tree flowering and pod development, leading to yield reductions.

Several farmers reported that these climatic changes have led to a noticeable decline in yields, heightened pest and disease pressure, and increased production costs. A middle-aged farmer from the northern outskirts of the municipality, described the growing challenge of pest control: *"I now spend more on pesticides because the black pod disease is getting worse with all this rain and humidity."* Such accounts reinforce an earlier study that have linked climatic variability with higher incidence of cocoa pests and diseases (Bunn et al., 2019).

The economic consequences were also a recurring theme. One farmer reflected on the financial strain: *"We don't earn like before. Some of us are thinking of leaving cocoa farming altogether."* Declining incomes not only compromise household welfare but also undermine farmers' ability to reinvest in their farms, perpetuating a cycle of vulnerability. A notable observation from the interviews was that most farmers saw these climate changes as permanent rather than temporary. A farmer with intergenerational farming knowledge asserted, *"This is not something that will go away. We must find a way to live with it. Our fathers did not face this."* Deressa et al. (2009) also noted that farmers' recognition of climate change as a long-term phenomenon often motivates proactive adaptation.

The gendered nature of these impacts was also evident in the narratives of female farmers. Another female farmer highlighted the increased domestic burden: *"We women now walk longer distances to fetch water for our homes and farms. The streams are drying up."* Doss (2018) noted that climate change frequently deepens existing gender inequalities, particularly in rural contexts where women rely heavily on natural resources. Climate stressors were also found to be reshaping household roles and responsibilities. One male farmer observed, *"I now have to help more at home because my wife is also stressed from farm work. The weather has made everything harder."* Carr and Thompson (2014) agree that climate-related pressures can lead to shifts in household labour distribution, often increasing the workload for both men and women.

The key informants provided broader contextual insights. They all reported noticeable shifts in rainfall patterns, with delayed onset and shorter but more intense rains. One extension officer with over a decade of experience observed: *"We no longer see the predictable March–July rains. Sometimes, the rains delay until June, and even when they come, they are too intense and short-lived."* This is supported by Kimengsi and Tosam (2013), who identified erratic rainfall and temperature extremes as major threats to Ghana's cocoa production zones. According to the climate adaptation specialist, prolonged dry spells have reduced pod development and increased pest pressure, particularly capsid infestations, while excessive rains have heightened the prevalence of black pod disease. She also noted the spread of the swollen shoot virus due to farmers unknowingly exchanging infected planting material. Gendered impacts were also highlighted. A cocoa extension officer explained that women, who often manage smaller plots and rely more on off-farm income, are disproportionately affected by delayed rains: *"Men can still hire labour and irrigate, but many women can't afford that."* This aligns with studies by Kuhn et al. (2023) and Kissi and Herzig (2024), who documented gendered vulnerabilities in African agriculture. The consensus among informants was that farmers face multiple climate-induced challenges, including drought, excessive rainfall, interseasonal dry spells, windstorms, and pest and disease outbreaks, that require both traditional and modern strategies.

3.3. Preferences

Table 5: Preferences for adaptation strategies (Farmers, n = 20)

Preference	Frequency	Percentage (%)
Traditional methods	10	50%
Modern methods	6	30%
Hybrid (mix of both)	4	20%

Source: Field Data, 2025

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About 50% of the farmers preferred traditional strategies, citing affordability, accessibility, and cultural familiarity. Modern methods appealed to 30% of respondents, especially younger and more educated farmers, who valued higher yields and resilience. A smaller group (20%) advocated hybrid approaches, combining mulching and intercropping with fertiliser use or hybrid seedlings. The data show that preferences among the cocoa farmers varied considerably, though a notable leaning towards traditional methods emerged in several accounts. Many respondents expressed a strong attachment to the practices they had grown up with, citing their affordability, accessibility, and cultural familiarity. For instance, a young female farmer with five years of experience explained: "*The old ways are what I grew up with; mulching, intercropping, and observing the skies. They are natural, safe, and I don't have to depend on anyone.*" Similarly, a farmer with nearly two decades of cocoa farming experience remarked, "*I still trust the traditional methods more. The new ones are good, but they cost money, and sometimes they don't work as well because the weather keeps changing.*" Such sentiments align with earlier studies by Fosu-Mensah et al. (2012) and Asante and Amuakwa-Mensah (2015), which found that although modern climate adaptation strategies are becoming increasingly available in Ghana. They claimed that many farmers still rely heavily on traditional practices because of their familiarity, affordability, and locally proven effectiveness.

Other farmers, however, expressed a clear preference for modern methods, particularly those offering higher yields and better resilience during extreme weather events. A younger farmer, for example, explained: "*I prefer the new ways, especially the improved seedlings and irrigation. They are more reliable during extreme weather.*" The perceived attractiveness of one method over another often depended on factors such as cost, availability, perceived effectiveness, and ease of use. As one middle-aged farmer noted, "*Modern methods are good, but they are expensive and hard to get. Traditional methods like planting yams or cassava beside cocoa still help the soil and prevent loss.*" In contrast, another farmer argued that modern methods provided faster returns: "*With improved seedlings, I saw more pods in just three years. I never got that from the old ones.*" These views are consistent with Nelson and Agbey (2005), who contend that economic factors and expected yields heavily influence farmers' choices, particularly among younger or more market-oriented producers.

Shifts in preferences over time were also evident. For example, one experienced farmer recounted: "*I used to rely only on traditional ways, but after the floods in 2021, I started using fertilizer and planting hybrid cocoa. I can't depend on the weather anymore.*" This shows how extreme weather events and changing climatic patterns are prompting farmers to re-evaluate their adaptation strategies (Antwi-Agyei et al., 2014). Nonetheless, some participants remained loyal to traditional approaches despite the changing climate. As one young female farmer explained, "*The changes are scary, but I still use what I know. It's safer and doesn't spoil the soil.*"

A recurring theme across interviews was that older farmers tended to favour traditional methods, whereas younger or more educated farmers leaned towards modern strategies. One farmer observed: "*Most of the older folks in the village still use traditional ways. They say it's how they survived droughts before. But the youth want to try the new ones.*" Deressa et al. (2011) also argued that age and Education significantly influence openness to adopting new agricultural technologies.

Despite these differences, there was a widespread recognition of the potential benefits of combining both traditional and modern approaches. Many farmers viewed integrated practices as a way to enhance resilience while maintaining soil health and cultural practices. One experienced female farmer explained: "*I think using both is better. The traditional methods help preserve the land, and the modern ones increase yield.*" Another farmer added, "*We don't have to choose one. Even the extension officers say we should mix them.*" This perspective reflects the "hybrid knowledge systems" concept described by Nyantakyi-Frimpong and Bezner-Kerr (2015), which emphasizes the integration of indigenous knowledge and scientific innovation as a robust adaptation strategy.

3.4. Influencing factors

Table 6: Factors influencing adoption (Farmers, n = 20)

Influencing Factor	Frequency	Percentage (%)
Financial capacity/cost	14	70%
Institutional support (extension, NGOs, cooperatives)	9	45%
Social/gender roles	6	30%
Education/literacy	7	35%
Peer/family influence	5	25%

Source: Field Data, 2025

Economic constraints were the most cited barrier, with 70% of farmers emphasising limited financial resources. Institutional support was mentioned by 45%, often tied to access to seedlings or training. Education influenced 35% of farmers, while 30% highlighted gender roles, noting that women faced additional barriers due to land and labour access. Peer and family influence was less commonly cited (25%), though it remained important in sustaining traditional practices. As one young farmer explained, *"Modern methods are good, but they need money, and not all of us can afford them."* This is consistent with Asante and Amuakwa-Mensah (2015), who highlighted that financial constraints significantly hinder rural farmers' ability to adopt innovative practices. The affordability of traditional methods, such as mulching or intercropping, often made them the default choice for farmers with limited capital.

Institutional support also played a substantial role in shaping adoption patterns. Access to cooperatives, NGOs, and agricultural information through media platforms was found to be a strong enabling factor. For instance, one farmer reported that listening to farming programmes on Adom FM and Ayekoo on UTV introduced him to shade management techniques, which he subsequently adopted. Another respondent credited his membership in a local cocoa farmers' association for providing him with training and access to improved seedlings. These experiences reflect the observations of Antwi-Agyei et al. (2014), who emphasized that extension services, farmer organizations, and other institutional networks are pivotal in facilitating the uptake of climate-resilient agricultural strategies.

Social dynamics, including gender roles and marital status, further shaped farmers' decisions. Some women faced barriers to adoption due to limited access to labour or land. For example, a widowed farmer explained that her inability to mobilize the labour needed for certain modern strategies made them impractical for her. In contrast, another respondent shared that her supportive husband enabled her to jointly experiment with both traditional and modern methods. Such gendered differences resonate with the findings of Jost et al. (2016), who noted that women's agricultural choices are often constrained by cultural norms, limited financial autonomy, and reduced access to productive resources.

Educational attainment was another significant determinant. Farmers with higher levels of formal Education or functional literacy expressed greater confidence in understanding and applying modern adaptation practices. They reported that their ability to read and interpret training manuals and extension materials made them more willing to try modern techniques. One participant stated, *"Because I can read and understand the manuals they give us, I try the modern methods."* This finding aligns with Jalloh et al. (2013), who observed that Education enhances farmers' climate change awareness and capacity to implement improved agricultural practices.

Extension officers corroborated many of these observations, identifying overlapping socio-economic, institutional, and policy-related factors that influence adoption. Education and awareness were repeatedly emphasized as critical enablers. As one key informant put it, *"Education opens the mind. A farmer who can read simple brochures or follow a radio program gains more than one who cannot."* According to Antwi-Agyei et al. (2021), Education is a cornerstone of climate resilience. KI5 admitted, *"Many communities are underserved. We do what we can, but with few staff, many farmers go months without direct support."*

Economic barriers were also underscored, particularly for women. They noted that many female farmers operate on borrowed land or small plots, excluding them from major financial schemes and limiting their ability to invest in modern strategies. At the institutional level, the Cocoa Health and Extension Division (CHED) and COCOBOD were recognized as key actors, yet policy inconsistencies and funding shortfalls often delayed or weakened programme implementation.

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While Ghana's National Climate-Smart Agriculture and Food Security Action Plan (2016–2020) supports farmer adaptation broadly, its grassroots execution has been uneven (Antwi-Agyei et al., 2021).

Local governance structures and farmer cooperatives emerged as important mediators, often providing more direct support than formal institutions. One respondent observed, *"In some communities, the farmer cooperatives are stronger than the formal institutions. They set norms and help farmers access support."* Such local-level structures play an important role in coordinating training, distributing inputs, and resolving land disputes.

3.5. The perceived effectiveness of traditional and modern adaptation strategies

Table 7: Perceived Effectiveness of Strategies (Farmers, n = 20)

Strategy Type	Frequency	Percentage (%)
Traditional (soil moisture, shade, intercropping)	13	65%
Modern (seedlings, irrigation, agrochemicals)	11	55%
Hybrid (combining both approaches)	9	45%

Source: Field Data, 2025

Traditional strategies were widely seen as effective for conserving soil and coping with short dry spells (65%). Modern strategies were credited with better disease and drought resistance (55%), though challenges with cost and technical knowledge reduced effectiveness for some. Nearly half the farmers (45%) recognised the strength of hybrid approaches, reflecting a growing view that integration of traditional and modern strategies provides the most resilience. The findings were consistent with Asare et al. (2021). Nonetheless, there was also recognition of their limitations, particularly in dealing with severe or increasingly unpredictable climate events. As one farmer observed, *"The rains do not come like before. The traditional ways cannot stop black pod disease."* This reflects a growing concern among farmers that traditional approaches alone may no longer be sufficient in the face of escalating climate pressures.

Modern strategies, in contrast, were viewed as more responsive to emerging threats such as disease outbreaks and prolonged droughts. Techniques like pesticide application, the use of disease-resistant cocoa varieties, and irrigation systems were credited with greater adaptability to recent climatic shifts. However, farmers noted that the effectiveness of these methods depended heavily on proper implementation, sustained support, and consistent use. For example, while pesticides were valued for managing black pod disease, some farmers struggled with determining the correct dosages or the appropriate timing of application, a challenge also documented by Partey et al. (2020). These constraints illustrate that access to knowledge and technical guidance is just as important as the tools themselves.

There was strong recognition of the benefits of integrating both traditional and modern approaches. Many farmers described hybrid strategies such as combining modern fertilizers with traditional mulching to improve soil health. This approach aligns with the "climate-smart agriculture" framework discussed by Bruinsma (2017), which advocates for the strategic blending of indigenous knowledge and scientific innovation to achieve resilience. Still, farmers repeatedly emphasized that the success of any method, traditional, modern, or hybrid, was strongly linked to the timeliness of interventions, access to relevant information, and economic viability. Delays in input delivery, inadequate financial resources, and lack of follow-up support were cited as key reasons why even proven strategies sometimes failed to deliver optimal results. Ultimately, while both sets of strategies were seen as valuable, their perceived effectiveness was multidimensional, shaped by the scale of climatic impacts, the farmer's socio-economic capacity, and the broader support ecosystem (Mertz et al., 2009).

Extension officers echoed the farmers' mixed but complementary assessments of traditional and modern strategies, offering nuanced insights into their strengths, weaknesses, and synergies. They noted that while traditional practices such as shade management, organic manure application, and crop diversification remain relevant, they are increasingly insufficient given the severity of current climatic shocks. *"The weather today is not what it used to be. Traditional practices alone can no longer withstand the intensity of droughts and erratic rainfall,"* one officer stated. Modern strategies such as the adoption of disease-resistant cocoa varieties, irrigation kits, and integrated pest management were viewed as better suited to recent challenges.

However, as one officer cautioned, these methods often falter when farmers lack the necessary tools, knowledge, or sustained support. The problem is compounded when expected results are not immediate, leading some farmers to abandon modern practices prematurely.

Extension officers stressed the value of complementarity between traditional and modern methods. One officer remarked, *"We find that traditional methods like composting work well with modern fertilizer application schedules. When blended properly, they enhance soil health and crop resilience."* Nevertheless, conflicts occasionally arose when the two systems offered contradictory recommendations, such as traditional tree-felling practices clashing with modern shade-tolerant cocoa promotion. Officers also noted weaknesses in the feedback loop between farmers and service providers. While cooperatives, community meetings, and field visits serve as primary feedback channels, one officer admitted that *"there's no formal mechanism to adjust programmes based on what we hear."*

4. Conclusion

This study examined cocoa farmers' preferences for traditional and modern climate adaptation strategies in Obuasi Municipality. Findings revealed that while traditional practices such as shade management, mulching, and indigenous weather forecasting remain central due to affordability and cultural familiarity, they are increasingly insufficient against more severe climatic shocks. Modern approaches, including improved seedlings, irrigation, and agrochemical use, were valued for their responsiveness to emerging threats but constrained by financial costs, technical knowledge gaps, and limited institutional support. A recurring theme was the recognition of hybrid approaches that integrate traditional and modern strategies as the most sustainable pathway to resilience. To achieve this, institutional actors such as the Cocoa Health and Extension Division, NGOs, and farmer cooperatives must strengthen climate adaptation support systems by improving access to finance, delivering timely inputs, enhancing extension coverage, and promoting context-specific training.

The study contributes to adaptation literature by highlighting how socio-economic characteristics, particularly Education, financial capacity, gender roles, and access to extension services, shape farmer preferences. It also underscores the role of cooperatives and grassroots institutions as critical mediators of adaptation support.

Several limitations must be acknowledged. The small, qualitative sample limits the generalisability of findings, and the study's geographic focus on Obuasi restricts wider applicability. In addition, the reliance on self-reported data may have introduced bias.

Consequently, it is recommended that policy interventions should prioritise gender-sensitive financial support, strengthen extension services, and promote participatory platforms that blend scientific knowledge with traditional practices. Furthermore, policymakers and researchers should establish a monitoring system combining farmer feedback, agro-ecological data, and impact metrics to refine and scale up effective strategies. Future research should employ mixed-method designs across multiple cocoa-growing regions to compare adaptation dynamics and assess the long-term effectiveness of hybrid approaches. Such measures will enhance the resilience of Ghana's cocoa sector while safeguarding farmer agency and cultural heritage.

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