Smallholder Farmer's Determinant Factor for Use and Adoption Climate Information Services in Albania: A Case Study of Wheat Production in the South and East Regions of Albania

GJERMENI IRIDA, LEKA BLERTA
Department of Mathematic and Informatics,
Agricultural University of Tirana,
1025, Paisi Vodica, Tirana,
ALBANIA

Abstract: - Access to an Early Warning System (EWS) is crucial for mitigating farmers' risks associated with climate shocks. Early warning system sustainability is contingent upon users' needs and their willingness to pay for climate information. This study examines the demand and willingness to pay for climate information among market-oriented farmers, along with the factors influencing it. Data were collected via a structured survey involving 200 farmers. Contingent dichotomous choice dual boundary estimation measures willingness to pay (WTP), while double-bounded regression identifies the primary determinants of the stated WTP. The research indicated that 46.7% of participants expressed a willingness to pay for climate information services (CIS), including decadal climate information (10-DCI) at 44.6%, and seasonal climate forecasts (SCF) at 45% for daily climate information (1-DCI). The findings indicate that the average willingness to pay (WTP) was 22,521.43 Lek (22.5 Euro) for SCF, 21,338.78 Lek (21.3 Euro) for 10-DCI, and 24,142.46 Lek (24.1 Euro) for 1-DCI when using socioeconomic predictors. In contrast, the WTP was 21,608.06 Lek (21.6 Euro) for SCF, 23,632.19 Lek (23.6 Euro) for 10-DCI, and 22,596.27 Lek (22.6 Euro) for 1-DCI when utilizing farm characteristics predictors. The primary determinants of willingness to pay (WTP) include age, literacy level of the farm head, farm size, income from grain production, and experience with climate shocks. The findings contribute to the establishment of a viable early warning system and inform the design of its services based on the characteristics, needs, capacities, and preferences of the identified potential users.

Key-Words: - climate information services, determinant factors, Willingness to pay, agriculture, source of information, double bounded model.

Received: July 19, 2024. Revised: January 19, 2025. Accepted: March 7, 2025. Published: April 1, 2025.

1 Introduction

Numerous changes in the global climate over the past ten years have also resulted in varying dangers from weather hazards in Albania and every other country. Climate change will alter the frequency and severity of dangers. Implementing and utilizing an early warning system will be necessary for further hazards, [1]. For millennia, climate change has been a significant issue, and the majority of developed nations have actively participated in its mitigation as a first step, followed by appropriate actions. As a worldwide occurrence, climate change is a problem that impacts not only a nation's economic and social development but also human rights and social justice, [2]. The agricultural industry is particularly vulnerable to climate change due to its increased exposure to climatic factors such as temperature, wind, and precipitation, [3]. The significant degree of vulnerability in this sector makes the necessity for adaptation very clear. Numerous nations and research have provided ample evidence of the connections between climate change and farmer income, farmland access, agricultural performance, and production, [4], [5], [6], [7], [8] and [9]. Climate change affects the sustainability of smallholder farmers' livelihoods as well as household income, [10]. Unfavorable weather conditions directly lower farm earnings due to decreased crop yield and an increase in crop failures caused by extreme weather events. By increasing production costs and seasonal unemployment, climate change indirectly reduces farm revenues, [11], [12], [13], [14]. Agriculture employs many low-income households in Albania and contributes significantly to the country's GDP. Droughts or floods that impact agricultural yields, particularly the nation's two main food crops, maize and grain, are making the effects of climate change more apparent. In recent decades, there has been a close link between agricultural productivity and climate change. Despite this, farmers are finding it increasingly difficult to predict rainfall patterns, which is crucial for scheduling their production procedures. As a result, farmers experience production insecurity, [15]. Given how climate change is affecting Albanian agriculture, smallholder farmers will require support in the form of timely and accurate Climate Information Services (CIS) to guarantee that they have access to information on the hazards associated with climate change that could damage their ability to survive. In order to promote climate adaptation and increase resilience to climate shocks, it is crucial to incorporate weather and climate research into decision-making processes, [16]. Access to climate data typically creates the foundation for important decisions made by smallholder farmers related to their farming operations. For disaster management, agriculture, and food security decision-making, meteorological and short-term climate data at time frames of seasons, months, weeks, days, and hours are very important, according to previous studies, [17], [18]. Before the crop production season, farmers typically estimate rainfall patterns using traditional instruments based on local knowledge. These conventional seasonal climate forecasting systems function as an endogenous climatic information system that guides farmers in choosing the right crop varieties, planting dates, and parcel sizes. The moon, cloud, and wind are factors that act as indicators for these endogenous seasonal climate forecasts, [19]. However, according to [20], these endogenous forecasting tools have lost their accuracy due to climate change over the past few decades. This is because of things like changes in the length of rainy seasons, variations in the number of rainy days from year to year [21], and significant adjustments to the agricultural calendar brought about by changes in the quantity of seasonal rainfall and the start and end dates of production seasons, [22]. Visualizing the occurrence, intensity, and length of an extreme event, along with its timing and location, is a critical challenge in climate science. Another issue is determining if smallholder farmers are prepared to pay for climate information, [23]. Weather and climate services (WCS) refer to the timely creation, translation, and distribution of practical weather and short-term climate data in formats that can inform societal decision-making processes, [24]. The type of risks being managed, the geography of the sector, and the governmental structures are some of the crucial elements that affect the optimal delivery of climate services, [25], [26]. The rapid advancement of communications and atmospheric event observation, mapping, modeling, and prediction technologies has aided in the development of WCS, [27]. This significant technological advancement opens up new possibilities for incorporating WCS into immediate decision-making, [17]. The latest technological advancements in WCS are not benefiting the most vulnerable sectors, and the use of climate knowledge and information remains restricted, [28]. The World Meteorological Organization (WMO) launched the Global Framework for Climate Services (GFCS) initiative in 2012. Through observations and monitoring, research, modeling, prediction, capacity building, and user interface applications, the GFCS was established to offer and facilitate access to weather climate services for users with varying needs, [29]. Despite these efforts, consumers of WCS frequently worry that forecasts are hard to comprehend due to the disparate vocabulary used by various Weather Climate Services suppliers, [30], [31]. Prior research has only dimly emphasized the necessity of rapid and dependable weather climate services to improve Albania's resilience to climate shock. However, the lack of regular evaluations of users' requirements for WCS, particularly prediction timescales and lead times, contributes to the incomplete understanding of the Weather Climate Services ecosystem in Albania. Additionally, there aren't many assessments of how the provision of WCS can assist end users in Albania. WCS is regarded as a useful instrument for directing climate- and weather-related adaptation strategies and supporting agricultural development, particularly in nations that heavily rely on rain-fed agriculture, [32], [33], [34], and [35]. In order to increase the financial benefits of farming and reduce losses, WCS can assist farmers in making adaptive operational decisions, [36], [37], [38], [39], [40], [41] and [42]. Users, developers, and scientists must communicate in order to create WCS that is both dependable and tailored to the demands of users, [43].

2 Literature Review

According to [44] weather information architectures are made up of many subsystems, such as integrated risk evaluation and coordination and decision support systems, of which early warning is an essential part. The ability to create and distribute timely and relevant warning information to people who are in danger is known as an early warning system (EWS). Farmers using the information from EWS will need to plan ahead, take reasonable action, and move quickly enough to reduce the danger of failure or injury. The idea of EWS is therefore far broader than just sharing projections. Four components make up location-centered EWS: reaction capacity, monitoring, and warning services, risk knowledge, and warning dissemination and communication.

Numerous nations have created EWSs to assist decision-makers in assessing the consequences of recurrent extreme occurrences. The creation of EWSs has not, however, resulted in successful communication with end users, or farmers, according to a few studies [45], [46]. Theoretically, efficient EWS communication should raise farm households' financial well-being and agricultural systems' production. Farmers should find climate information more valuable when climate events become more frequent and severe due to climate change, [47]. In a perfect management situation, farm families would quickly embrace relevant warnings and implement suitable farm-level adaptation measures, [48]. Nonetheless, some farmers disregard early warning systems and make different choices in response to them, [49]. Research links farmers' hesitancy to use EWSs to their crisis management practices. Stated differently, the absence of a unified regional climate strategy, which necessitates strong surveillance, early warning, and information systems, affects risk assessment procedures, drought preparedness plans, and disaster response services.

EWS assumes that farmers desire to increase their productivity and profits. In addition to allowing local farmers to diversify and increase their income, this agricultural approach makes them less vulnerable to drought, which helps them become more resilient and adaptable to climatic events. However, farmers' adaptation strategies may be driven primarily by their aim to minimize climate risk and optimize financial gains, but they may also jeopardize benefits to society. To maintain agricultural sustainability, a strong adaptation strategy must balance social interests with financial and environmental benefits. Because their livelihoods are equally subject to a range of financial, physical, social, and natural elements, farmers will be keen to employ the early warning system to avert the negative effects of drought and financial limits. To understand how farmers respond in this respect, it is crucial to investigate the elements that promote and impede the adoption of EWSs.

Empirically, several studies have examined the factors influencing farmers' willingness to pay (WTP) for climate information but the results from these studies are mixed and inconsistent. These findings suggest that the factors influencing farmer's WTP are location and time specific, [50], [51], [52].

To address these research gaps, the main objective of this paper is to explore the demand of market-oriented farmers in Albania for an early warning information system.

The objectives of the topic are

- To assess farmers' preferences for weather agricultural information by type:
- To identify the characteristics of farmers who require agricultural information.
- Evaluate their willingness to pay (WTP) according to the type and attribute of agricultural information.
- Assess farmers' perceptions and beliefs about existing or potential sources of agricultural information by types of information.
- Provide recommendations for agricultural Information Systems demand and willingness to contribute to agriculture private information.

In some countries, the current study is focused on farmers' perceptions of designed and developed WCS as a decision-support tool. Despite the importance of WCS in Albania, very few studies have assessed farmers' willingness to invest in such services. Farmers' willingness to pay (WTP) for WCS is feasible to vary, depending on their socio-economic status of the farmer's and some motivational factors, [53], [54]. Linking these factors and their effect, along with the type of information that farmers would be willing to pay for, can lead to the development of an effective climate and weather climate information system, [55]. The main purpose of this study is derived in 2 main branches: to assess farmers' WTP for the Climate Information System (CIS)/ Early warning Climate system (EWCS) in the south and east regions in Albania and to identify factors that influence farmers' WTP for the Climate Information System (CIS)/ Early warning Climate system (EWCS).

The significance of having access to timely CIS for streamlined decision-making to address climate shocks has been documented by many previous studies that involve the works of [32], [33], [34], [56], [57], [58]. Moreover, several factors influence farmer's access to CIS, and willingness to pay for CIS. For example, [52] indicates that socioeconomic factors such as age, gender, education of the farm head, and the awareness of the farm head of CIS have greater effects on the farmer's access to, and willingness to pay for CIS. The findings suggested by [32] proved that access to and willingness to pay for CIS by farmers is affected by environmental and household factors. In several countries, these systems are crucial for climate change adaptation. In Albania, EWS is missing (except few local cases that failed to be maintained). For this type of system, feasibility is crucial and to increase feasibility a demand assessment and WTP is needed. No studies on estimating demand for EWS and WTP.

3 Material and Methods

3.1 Conceptual and Theoretical Framework

Values for non-market goods (e.g., climate information services that are not typically paid for by the public in an established market) can be estimated using the contingent valuation method (CVM), [4], [12], [27] [50], [52], [53], [54], [59], [60], [61].

We underpinned the CMV with four theories:

1. Theory of consumer behavior - farmers attempt to allocate their limited income among available goods and services to maximize their utility (satisfaction)
2. The theory of utility maximization posits that farmers aim to maximize their utility. However, each farmer possesses a distinct perception of utility and faces unique constraints, influencing their willingness to pay decisions based on their specific circumstances, [62].
3. Theory of risk aversion - Farmers' risk preference is risk-averse and is considered to be a consistent and unchanging psychological trait, [63]. The risk aversion behavior could affect farmers' decisions about the adoption and use of the available technology to deal with climate risks.
4. Conventional demand theory- an exogenous increase in price, holding other attributes constant, would shrink respondents' demand for improved EWS, [64].

Based on the four theories described above, the conceptual framework as below in Figure 1.

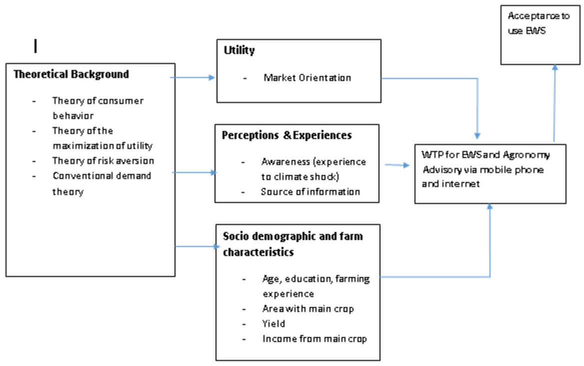

Fig. 1: Conceptual Framework

The choice of contingent valuation method is made because of its ease of design and execution, based on the capacity and educational level of the participating farmers, [4], [65].

Based on the literature there are various contingent valuation approaches:
- Single-bounded dichotomous choice (SBDC),
- Double-bounded dichotomous choice (DBDC)
- Open-ended format, [27].

This study employed DBDC due to the limited number of respondents and its superior ability to derive WTP estimates with compact confidence intervals, even with small sample sizes, [66]. The DBDC technique involves two sequential WTP questions, each of which can be responded to with either 'yes' or 'no'. Respondents are presented with a bid that indicates the payment necessary to access the EWCS in each question. In the event that the initial bid is declined, the next inquiry offers a reduced bid; conversely, an affirmative response leads to a higher bid, [67]. The double-bounded method, or interval data model, efficiently utilizes data to assess willingness to pay, based on the assumption of a singular valuation function underlying both responses, [68], [69].

Table 1 (Appendix) presents the bid level used in our study. The initial bids were 10,000, 15,000, 20,000, 25,000, 30,000, and 35,000 Lek (10, 15, 20, 25, 30, and 35 Euro) (the Lek is the Albanian currency). The subsequent bids were minus 5,000Lek (5Euro) the initial amount for respondents who answered 'no', and increased with 5,000Lek (5Euro) the initial amount for those who answered 'yes'. Consequently, the follow-up inferior or superior bids recline on which initial bid the respondent accepted.

The WTP bids were established randomly across the respondents. Approximately one-sixth of the sample started with a 10,000, 15,000, 20,000, 25,000, 30,000, and 35,000 Lek bid, respectively, to avoid starting points, [70]. Each participant was presented with an initial and a subsequent WTP question on the amount they would be willing to pay for EWCS. The ways these were given to the respondent are described below.

Question 1: Would you be willing to pay* ____________ old Lek per year for specific information provided by a special meteorological station for rainfall and temperatures two weeks in advance for the area where the wheat/corn plot is located? (yes/no)

Question 2: If YES to 1, would you be willing to pay ___________+Z old Lek….. (yes/no) Question 3: If No to 1, would you be willing to pay ___________-Z old Lek….. (yes/no)

The above questions delivered four possible outcomes:

• YY: Respondent agrees to both the initial bid and the subsequent bid
• YN: Respondent agrees the initial bid and refuses the subsequent bid
• NY: Respondent refuses the initial bid and agrees the subsequent bid
• NN: Respondent refuses both the initial bid and the subsequent bid

To yield the results, we utilize a double-bounded logit model. The feedback probabilities were provided as follows [66]:

$$P_i^{yy} = \frac{1}{(1 + e^{-(b+\delta upperBid)})} \quad (1)$$

$$P_i^{ny} = 1 - \frac{1}{(1 + e^{-(b+\delta lowBid)})} \quad (2)$$

$$P_i^{yn} = \frac{1}{(1 + e^{-(b+\delta upperBid)})} - \frac{1}{(1 + e^{-(b+\delta InitBid)})} \quad (3)$$

$$P_i^{nn} = \frac{1}{(1 + e^{-(b+\delta InitBid)})} - \frac{1}{(1 + e^{-(b+\delta LowBid)})} \quad (4)$$

To estimate the probability of a respondent being willing to pay for the EWCS, we used a double-bounded log-likelihood function:

$$l_{DoBO} = \sum l_i^{yy} \, lnp_i^{yy} + \sum l_i^{yn} \, lnp_i^{yn} + \sum l_i^{ny} \, lnp_i^{ny} + \sum l_i^{nn} \, lnp_i^{nn} \quad (5)$$

where i = 1, 2, …, 200 and Ii is the response category of the individual respondent ‘i’.

Mean WTP was estimated following, [67]:

$$\text{WTP} = \frac{\ln(1 + e^{b})}{|\omega|} \quad (6)$$

where $|\omega|$ is the absolute value of the bid coefficient.

The econometric analysis for the WTP used by some studied authors is shown in Table 2 (Appendix).

The conceptual framework allows us to arrive at the following hypothesis:

Hypothesis 1: Information is more readily available to younger farmers than to older ones, [71]. Since they are more knowledgeable, they need to require more climatic information than others. Younger farmers are more likely to report having a favorable WTP.

Hypothesis 2: Respondents with higher levels of education are anticipated to make decisions based on science. As a result, it is thought to positively impact farmers' willingness to pay for CIS, [52]. Farmers with higher levels of education are more likely to cover EWS.

Hypothesis 3: One tactic farmers typically use to sustain their overall output when their agricultural productivity per hectare is declining is to enlarge their farms, [56]. The likelihood of having a positive WTP is positively correlated with the amount of cultivated area.

Hypothesis 4: It is anticipated that market orientation will have a favorable impact on the willingness to pay for CIS. This is due to the fact that income is positively impacted by crop product sales, and income in turn has a beneficial impact on CIS's WTP, [52]. Farmers who sell their goods are more likely to have a beneficial impact on WTP.

Hypothesis 5: Farmers' acknowledged demand for climate information demonstrated their genuine awareness of the hazards that climate change poses to agricultural output, [72]. In order to prevent similar situations in the future, farmers who suffer from the adverse effects of weather and climate conditions will enroll in CIS, [73]. A farmer's willingness to pay for an EWS increases with their level of experience with climate change and their awareness of the significance of climate information.

Hypothesis 6: [74] found that farmers' unwillingness to pay for CIS is hampered by their lack of ICT understanding. Farmers' usage of agriculture information systems is influenced by their access to technology; the more accustomed they are to using technology, the more they utilize it.

Hypothesis 7: Since a decrease in farm income has been shown to affect farm households' consumption portfolios, it is crucial to evaluate the effects of climate change on farmers' profits and farmland value at the regional or local level, [10]. The WTP of farmers increases with the incomes that farms generate.

Hypothesis 8: Farmers' willingness to pay for CIS is negatively impacted by their farming experience. Because they depend on traditional climate knowledge to adjust to inter-annual climatic variability, more seasoned farmers are less inclined to pay for CIS, [75]. Farmers' willingness to pay for agriculture information systems is negatively impacted by their farming experience.

3.2 Study Area

The study was carried out in six municipalities in Belsh, Devoll, Divjake, Fier, Korce, and Lushnje. The Municipality was purposively selected, due to a report by the Institute of Statistics in Albania done in 2023 that identifies farmers in this area to be smallholder farmers mainly into rain-fed maize and grain production and characterized with erratic rainfall. From the data of the Institute of Statistics of Albania (INSTAT, 2023) for the year 2023, we can see that 33% of the cultivated area is occupied by cereal crops. The population of the Fier region, as projected by the 2023 Population and Housing Census, represents 10% of Albania's total population, with 58% of the population being rural, 55.8% employed in the agricultural sector and the Korca region represents 7% of Albania's total population, with 52% of the population being rural, 50.6% are employed in the agricultural sector (INSTAT, 2023). Fier region occupies about 23% of the total area in the country, and 92% of this area is utilized as agricultural area. Korca region occupies about 8% of the total area in the country, and 94% of this area is utilized as agricultural area (INSTAT, 2023). The average amount of annual precipitation in the Fier region is 963 mm and the Korca region is 813 mm, considered enough for a single farming season. The annual rainfall pattern is a little erratic at the beginning of the rainy season, starting in September, and intensifies as the season advances, raising rainfall levels to about 100-120mm sometimes.

3.3 Sampling Procedure and Data Collection

A multi-stage purposive sampling method was employed, targeting agricultural groups with the highest levels of production. Purposeful sampling is a technique commonly employed in qualitative research to identify and select information-rich cases, thereby optimizing the use of limited resources, [76]. This region includes 26 selected communities. In the second stage, the sample frame aimed to enumerate the farmers within each selected community. A random selection of respondents was made from each community using a systematic sampling technique based on the sample frame. A total of 200 maize and grain farmers were selected for this study. The data were collected through a structured questionnaire addressing the socio-economic characteristics of farmers, production factors and farm typology, perceptions of climate change, adaptations to climate change, and sources of information. Data collection was conducted through face-to-face interactions with the respondents. A farm household survey was conducted from July 2023 to September 2023 to evaluate farmers' willingness to pay for the Early Warning Climate System (EWCS), with a sample size of 200 respondents. Data were recorded in Excel and subsequently transferred to SPSS and Stata for analysis utilizing descriptive statistics and econometric modeling techniques as appropriate. The empirical average and median willingness to pay (WTP) were computed. The willingness to pay (WTP) is examined based on the primary characteristics of the sample using descriptive statistics and econometric modeling. The double-bounded model was utilized to assess the significance of zero values exceeding 5%.

4 Results and Discussion

4.1 The Socioeconomic Attributes of Farmers

The descriptive statistics of the characteristics of the respondents are displayed in Table 4.

Table 4. Descriptive statistics on the characteristics of respondents

Demographics	Frequency	Percent
Age		
20-29	4	2
30-39	42	21
40-49	37	18.5
50-59	45	22.5
60 and older	72	36
Gender		
Male	190	95
Female	10	5
Education		
No education	4	2
Primary	9	4.5
Secondary	121	60.5
Agricultural Post-Secondary	13	6.5
Post-Secondary	39	19.5
Tertiary	4	2
Agricultural Tertiary	10	5
Farming experience		
0-10	29	14.5
11-20	66	33
21-30	68	34
31-40	37	18.5

According to the findings, 95% of farms had a male head. Respondents over 60 made up the largest age group (36%). Additionally, the majority of those surveyed (60.5%) had only completed secondary school. In addition, we asked participants how many years they had been farming. The two most common age groups were 11–20 years old (33%), and 21–30 years old (34%). The average farm size was 146.9 dynym, with an average of 22 dynym owned and other rented, while the average household size was comparatively modest, with an average of 3 persons, including 2 active people per farm. Livestock was the primary secondary activity of farmers, accounting for 46% of all farmers.

4.2 Relevant Sources for the Distribution of Climate Information

According to the survey, over the past ten years, 85.5% of farmers have demonstrated awareness of climate facts. This included daily weather data, decadal weather forecasts (to identify dry spells, flood periods, days with high temperatures, and nights with high temperatures), and seasonal climate forecasts (to determine the duration, onset, and end of the rainy season).

Mobile weather apps and television were the main sources of climate information (Table 3, Appemdix). However, according to 73.5% of farmers, television was the primary medium used to convey daily climatic information.

Table 5 demonstrates that the best channels for disseminating climate information to a larger audience were television and mobile phones. Just 1% and 3% of farmers, respectively, said that using Extension Service Agents or gathering information from other farms could be the best way to reach more farmers.

Table 5.Adequate channels for climate information dissemination

Information Channel	Frequency	Percent	Cumulative Frequency
TV	164	82	82
Extension Service Agent	6	3	85
Mobile Phone	100	50	135
NPO	33	16.5	151.5
From Other Farmers	2	1	161

Figure 2 indicates that farmers utilizing the internet to obtain information about climatic conditions exhibit a greater propensity to respond favorably to the early weather forecasting system. The Chi-Square test was employed to examine the link between WTP and the information channel, yielding a p-value of 0.002, indicating a significant association between these variables and so supporting hypothesis 6.

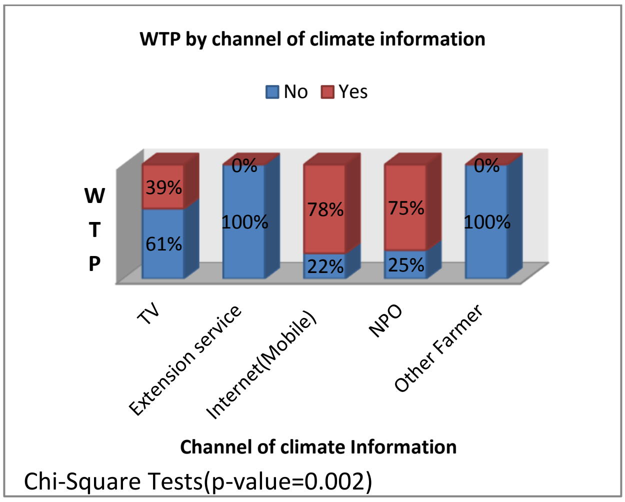

Fig. 2: Channel of dissemination

4.3 The Traits of the Farmer based on the Specific Climatic Information they Seek

Approximately 45.5% of farmers expressed willingness to pay for at least one type of CIS. Approximately 44.6% of farmers expressed a willingness to pay for the seasonal forecast. Forty-five percent pertains to the daily climate information. Approximately 46.7% expressed a willingness to pay for decadal climate information (Table 6).

Table 7 (Appendix) presents the descriptive statistics of willingness to pay in relation to farmers' characteristics. The willingness to pay was higher for women than for men across all the CIS. Insufficient Farmers aged 40 to 60 exhibited a greater willingness to pay for any Community Information System compared to their older counterparts. Farmers with farm sizes exceeding 4 hectares exhibited a greater willingness to pay for each Community Irrigation Scheme compared to those with less than 1 hectare or between 1 and 4 hectares. Farmers with a household size of fewer than four individuals exhibited a greater willingness to pay for all types of CIS compared to those with more than four members. Individuals with fewer than 15 years of farming experience exhibited a greater willingness to pay for each of the CIS. Farmers who are aware of climate change tend to invest more in all types of Climate Information Services (CIS). Educated farmers and market-oriented farmers exhibited a higher willingness to pay for each CIS. Farmers engaged in livestock as a primary secondary activity demonstrated a greater willingness to pay for seasonal forecasts, decadal, and daily climate information. Farmers derived over 50% of their income from agricultural activities, and those with yields exceeding 6 kv/dyn exhibited a greater willingness to pay for each type of CIS.

Table 6. Descriptive statistics for the willingness of farmers to pay for climate information

Statistics	Percent(%)	WTP(%)
Decadal Climate Information	84.5	46.7
Seasonal Climate Information	98.5	44.6
Daily Climate Information	86	45

4.4 Determinants of Willingness to Pay for Climate Information Services

The study utilized a double-bounded logit model to analyze the factors affecting farmers' willingness to pay for CIS. The dichotomous choice model with follow-up provides superior informational value relative to the simpler format of a single question or the Probit Model. The dependent variable is a binary indicator reflecting respondents' willingness to pay for CIS within the study area. The model incorporated six regressors. Table 8 and Table 9, in Appendix, present the estimated parameters and the effects of the hypothesized explanatory variables on willingness to pay for CIS. The chi-square results demonstrated that the likelihood ratio statistics were highly significant ($p <= 0.1$) for all six regressions, confirming the overall statistical significance of each model. Of the 9 variables analyzed, 5 to 9 were found to significantly influence the willingness to pay for CIS ($p < 0.05$ or $p < 0.01$). The findings from the double-bounded logit models are displayed in Appendix in Table 8 and Table 9. Model 1 includes variables such as farm size, market orientation, income from primary activities (grain), and yields. Model 2 includes independent variables such as household size, age, education, farming experience, and the farmer's awareness of weather changes.

The coefficient values (β) presented in Appendix in Table 8 and Table 9 illustrate the significance and marginal effects of the predictors on the probability of a respondent consenting to pay a monthly subscription fee for CIS. The tables display the average amount that farmers reported they were willing to pay, along with the associated confidence intervals. The coefficients in Model 1 related to farm characteristics, market orientation (βd = 39.59217, βs = 65.18714, βda = 53.75996) and grain yield (βd = 327.526, βs = 348.5798, βda = 677.9594) positively impacted farmers' willingness to pay for CIS; however, these results lacked statistical significance. The regression results confirm the validity of hypothesis 4. The coefficients for income from crop production (βd = 17948.62, βs = 16888.2, βda = 17259.44) and farm size (βd = 41.69273, βs = 40.98415, βda = 40.23853) were positive and significant across all three types of CIS, suggesting that both income and farm size positively affect farmers' willingness to pay for CIS. The regression results confirm the validity of hypothesis 3 and 7. The coefficients in Model 2, associated with the socio-demographic characteristics of the farmer, including household size (βd = 856.2557, βs = 757.8669, βda = 787.6929) and farmer's experience (βd = -299.5693, βs = -315.776, βda = -308.515), positively and negatively influenced farmers' willingness to pay for CIS; however, these effects were not statistically significant. The regression results confirm the validity of hypothesis 8. The coefficients for farmer's age (βd = -478.8106, βs = -506.4833, βda = -498.4046) were significantly negative, while farmer's awareness (βd = 28265.54, βs = 9937.768, βda = 9833.101) and level of education (βd = 3087.554, βs = 3188.776, βda = 2544.743) were significantly positive across all three types of CIS. This indicates that age negatively influenced farmers' willingness to pay for CIS, whereas awareness and education had a positive influence, accomplishing in this case hypothesis 1, 5 , 2. The income generated from crop production was identified as the primary factor affecting farmers' willingness to pay for Early warning system. The willingness to pay for Early warning system was primarily influenced by income derived from crops, rather than factors such as age, family size, farm size, or market orientation. Model 1, which pertains to farm characteristics, incorporates explanatory variables such as farm size, market orientation, yield level, and income share from the main activity. The average amount that farmers were willing to pay for decadal climate information was 23,632.19 Lek (23.6 Eur), for seasonal climate information was 21,608.06 Lek(21.6 Eur), and for daily weather information services was 22,596.27 Lek (22.6 Eur), annually. Model 2, incorporating explanatory variables associated with farmers' socio-demographic characteristics such as age, education, family size, and experience, reveals that the willingness to invest in decadal climate information amounts to 21,338.78 Lek(21.3 Eur), for seasonal climate information to 22,521.43 Lek(22.5 Eur), and for daily weather information services to 24,142.46 Lek (24.1 Eur), annually.

Figure 3 illustrates the results of the willingness to pay. In summary, YY cases (affirmative responses to both the initial and follow-up bids) constituted 28%, YN (affirmative-negative) or NY (negative-affirmative) cases accounted for 11.5% and 6%, respectively, while NN (negative-negative) cases represented 54.5%.

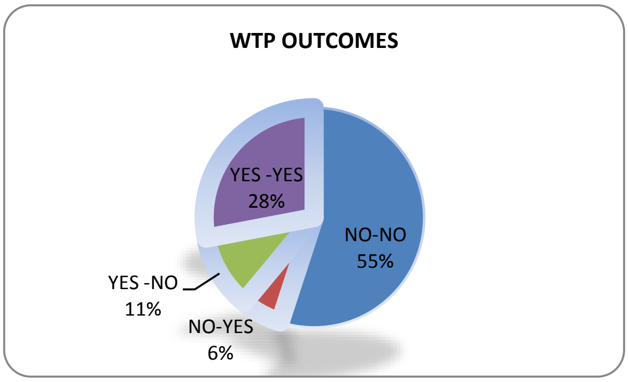

Fig. 3: Outcomes of the willingness to pay for CIS

4.5 Discussions

The study indicated a moderate willingness to pay for CIS, recorded at 45%, in the southern and eastern regions of Albania. The observed values are lower than those reported in studies conducted in other countries, [32], [50], [52], [79], [81]. The significant demand for CIS is associated with the considerable variability of climatic parameters managed by farmers in the region, [52]. The willingness to pay for climate information services is influenced by various factors, including farmers' risk attitudes, insurance, policy environment, and the scale of adoption, [85]. According to [86], the utilization of climate information by households is contingent upon the trust established in the forecasts. Furthermore, it is suggested that climate information must be reliable, trusted, and coherent for farmers to utilize it effectively in climate change adaptation. The demand for climate information remains low as farmers continue to rely on indigenous sources for their climate-related needs, [87]. Farmers are disoriented by inaccurate scientific forecasts and their inability to understand how certain activities contribute to climate change. However, it is emphasized that various seasonal forecasts possess limited value due to a lack of understanding by end-users, particularly because they are not adequately equipped at the time of demand. In the study conducted by [8], farmers' trust in seasonal forecasts has diminished due to losses incurred when relying on these forecasts for the planting process. Consequently, farmers transition to indigenous climate services, thereby decreasing the effective demand for scientific forecasts. The primary driver of CIS demand is the vulnerability to climate variability, [40] [88], [89]. Farmers facing climate shocks, such as droughts and floods, exhibit increased reliance on their vulnerability. Consequently, they are motivated to seek solutions, even if it requires financial investment. The research indicated that farmers' willingness to pay for climate information services is contingent upon the specific type of service provided. The seasonal climate forecast was the most requested Climate Information Service (CIS), with a demand of 98.5%; however, only 44% of users expressed a willingness to pay for it. In contrast, daily weather information was sought by 86% of farmers, yet only 46.7% indicated a readiness to pay. Decadal climate information follows, with 84.5% and 46.7% of farmers expressing willingness to purchase, respectively. The high demand for seasonal information arises from its impact on farmers' practices in plant production and decision-making processes. This Changes are associated with alterations in planting dates, land preparation timing, crop types, shifts in crop varieties, and the area designated for crops, all of which were influenced by seasonal climate information, [90], [91]. The significance of seasonal climate information is evident in its utilization by farmers for strategic and tactical decision-making. This includes the selection of crops and varieties, the choice of location (e.g., more humid areas, lowlands, or plains), and the determination of parcel size. Conversely, the daily forecasting requirements of the CIS encompass rainfall distribution and quantity to ascertain the appropriate fertilizer application on fields, as well as wind direction and speed for pesticide spraying, [92]. Daily climate information was utilized for various aspects of crop management, including the selection of dates for land preparation, plowing, sowing/planting, fertilizing, hoeing, weeding, pest management, harvesting, and threshing. A significant majority, 85.5%, of farmers indicated concerns regarding climate risks. Farmers' requests for climate information demonstrate their awareness of climate risks affecting agricultural production, [20], [72] Farmers require information regarding the onset and conclusion of the rainy season (95.5%), its duration (98%), and the periods of drought spells (99%). The significant concern regarding the planting of crops due to the risk of drought may support the decision to commence planting at the onset of the rainy season among farmers, [81]. Nearly a quarter of farmers' planting failures are attributed to the onset of insufficient rainfall, as noted in [26]. The perception of rainfall changes among farmers may elucidate the variations observed in their requirements for climate information, [81]. This study indicated that 82% of farmers preferred access to CIS via television, while 50% preferred mobile phones. Identifying preferred access channels would enable service providers to disseminate CIS effectively to farmers. Utilizing channels preferred by farmers can maximize the success and effects of CIS. The usability and communication channels, including radio, TV, farmers-based organizations, churches, and mosques, are significantly important for needs estimation in CIS, as noted in [93]. According to [94], mobile phone ownership has a positive impact on CIS demand. This indicates that CIS providers must consider which communications effectively reach end-users, specifically farmers. Nineteen percent of farmers willing to pay for all types of CIS are aged between 40 and 60 years. Young farmers exhibited a lack of interest in utilizing climate information, prioritizing non-agricultural activities that yield greater financial returns, [95]. The current study identified a negative and significant relationship between age and the likelihood of farmers being willing to pay for all types of CIS (seasonal, daily, and decadal), with a maximum threshold of $p=0.03<0.05$. The relationship between age and willingness to pay for climate information services (CIS) is unclear, as older farmers may leverage their farming experience to address climatic shocks, thereby countering the influence of new information. Conversely, these farmers may recognize the contrasting effects of climatic shocks, leading them to be receptive to new information, [39]. An increase of one unit in the farmer's age resulted in a decrease in the willingness to pay for climate information services of 478.8 Lek for decadal information, 506.5 Lek for seasonal information, and 498.4 Lek for daily forecasts. Education positively influences smallholder farmers' willingness to pay for climate information services. Farmers exhibiting higher educational attainment and greater concern regarding climate change demonstrated an increased willingness to invest in climate adaptation measures [12], [13], [53], [54], [81]. The present study indicates a positive and significant relationship between education and the likelihood of farmers' willingness to pay for CIS, with a maximum p-value of 0.09, which is less than 0.1. A unit increase in farmer education is associated with an increase in the likelihood of willingness to pay for climate information services of 3087.6 Lek for decadal information, 3188.6 Lek for seasonal information, and 2544.7 Lek for daily forecasts. Education can enhance farmers' awareness of weather and climate changes, [9]. Education enhances farmers' ability to comprehend climate information, thereby informing their agricultural production decisions in the context of climate change, [81]. An educated household head is likely to actively seek, comprehend, and apply information regarding, [39]. Increased awareness of climate information significantly enhanced farmers' willingness to pay. This indicates that farmers must conduct trials of CIS prior to committing to payment for the service, [96]. The lack of awareness regarding climate change was recognized as an obstacle to the effective implementation and utilization of Climate Information Services (CIS) in agricultural decision-making, [32]. According to [73], climate change awareness and perception may influence access to and needs for Climate Information Services (CIS) for two primary reasons: 1) Farmers experiencing adverse weather and climate conditions are likely to seek CIS to mitigate similar future occurrences. Farmers' incomplete understanding of the adverse effects of weather and climate conditions on production may lead to complacency regarding the impacts of climate change. As noted in [65], the lack of awareness regarding CIS serves as a significant barrier to its application in decision-making. There is a pressing need for improved advertising and dissemination of current CIS information packages. The current study indicates that awareness has a positive and significant relationship with the likelihood of farmers being willing to pay for all types of CIS, with a threshold of maximum $p=0.08<0.1$. An increase in farmer awareness correlates with a rise in the willingness to pay for climate information services, quantified as 28.265 Lek for decadal information, 9937 Lek for seasonal information, and 9833 Lek for daily forecasts. Farm size is significant ($p=0.09<0.1$) and positively correlated with farmers' bids regarding willingness to pay amounts. A unit increase in farm size resulted in an average increase of 41 Lek in the likelihood of willingness to pay for climate information services, contingent upon the type of CIS. Households with large farm sizes can increase crop diversity and mitigate risks associated with unpredictable climates, thereby addressing the high demand for CIS, [39]. This finding aligns with that of [97], which indicated that an increase in farm size correlates with improved access to agricultural information. Additionally, farmers operating large farms exhibit a heightened demand for climate information, attributable to the significant potential losses linked to climate change, [98]. Farmers with larger farm sizes are likely to achieve higher incomes from the market for their produce, which leads them to be willing to pay more for weather information, especially those with substantial on-farm income and significant farm sizes, [50]. Income from primary agricultural activities was found to significantly and positively influence smallholder farmers' willingness to pay for climate information services, with a threshold of p=0.00<0.001. [98] stated that there is a direct relationship between income and the demand for CIS. An increase of 1% in household monthly income significantly raised the likelihood of willingness to pay for climate information services by 17,948.6 Lek(17.9 Eur) for decadal information, 16,888.2 Lek for seasonal information, and 17,259.44 Lek (17.2 Eur)for daily forecasts. The lack of sufficient financial resources restricts farmers from utilizing essential tools for incorporating seasonal forecasts into their decision-making processes regarding climate risks, [99]. Consequently, increased household income enhances the adaptive capacity of households to climate change. In the same way, households that counted on farming as the main livelihood activity had a higher likelihood of using seasonal CIS. This is because these households may be forced to research for information and technologies that increment their yields contrasted to other farmers with alternative resources who call farming as a simple tradition, [100].

5 Conclusions

This research examined the preferences and option value of climate information services in Albania's southern and eastern regions. This study evaluated farmers' willingness to pay (WTP) for decadal, seasonal, and daily Climate Information Services (CIS) and examined the factors influencing this willingness. The overall demand for climate information increased; however, the extent of this demand varied based on the specific type of climate information required. The analysis indicated that a significant majority (98.5%) of farmers require seasonal climate information, while 86% seek daily weather information to inform their agricultural planning decisions. The demand for climate information is influenced by factors such as farmers' age, literacy level, farm size, and income derived from primary agricultural activities. The willingness to pay (WTP) is influenced by farmers' capacity to anticipate climate conditions, their utilization of television and mobile phones for information, their awareness of prior forecasts, and the early onset of the rainy season.

Approximately 46.7% of farmers willing to pay would contribute an estimated average of 21,338.78 Lek for decadal climate information. In contrast, 44.6% of farmers are prepared to pay an estimated average of 22,521.43 Lek for seasonal climate information, while 45% are willing to pay an estimated average of 24,142.46 Lek for daily weather forecasts, with sociodemographic factors as predictors. The estimated average willingness to pay (WTP) was 23,632.19 Lek for a 10-year decadal climate forecast, 21,608.06 Lek for a seasonal climate forecast, and 22,596.27 Lek for daily forecast information.

A pressing requirement exists for a climate report generated from advanced applications that is readily accessible and comprehensible to farmers. The distribution of climate information must be a central consideration in agricultural policy discussions to enhance farm risk management.

Governmental organizations can play a fundamental part in this concern, especially in building the capacity of farmers to transcribe and employ climate and weather information in their on-farm business. To quicken the commercial development of this type of services, private players could be subsidized for a period, to assist in creating a viable market for CIS and to stimulate private entities to invest in tailor-made climate and weather information services. Our findings suggest that CIS could be an important piece of the climate adaptation puzzle, as these services could take some of the risk out of farming activities, enhancing the climate elasticity of Albania's agricultural sector and rolling out its agriculture potential. Future research may encompass the types of information supplied by the EWS and the observed sectors. The model exhibited limitations regarding the sectors and crops analyzed. The type of crop or sector was excluded as a controlling factor. Furthermore, we focused exclusively on climate data to streamline the model. The most recent EWS designs incorporate supplementary information, including agronomy advisory, disease, and pest data.

Trust in EWS management and the quality of information are other significant factors. Given the absence of a functional Early Warning System (EWS) for at least the past decade, the limited experience of farmers with such a system precluded the inclusion of these factors in the model. Subsequent analyses regarding the willingness to pay for an established early warning system (EWS) should consider farmers' trust and quality perception. This includes assessing how farmers' perceived usefulness and trust in the EWS's functionality affect their willingness to pay for a fee-based system.

References:

[1] Trogrlić., R , M., van den Homberg, M., Budimir, C., McQuistan, A., Sneddon, B., Golding,. 2022. Early Warning Systems and Their Role in Disaster Risk Reduction. pp.11-46, https://doi.org/10.1007/978-3-030-98989-7_2.

[2] Dankelman I, Alam K, Ahmed W B, Gueye Y D, Fatema N, Mensah-Kutin R (2008), "Gender, Climate Change and Human Security Lessons from Bangladesh, Ghana and Senegal", Women's Environment and Development Organization (WEDO) with ABANTU for Development in Ghana, ActionAid Bangladesh and ENDA in Senegal, 73 pages, [Online]. https://repository.ubn.ru.nl/bitstream/handle/2066/72456/72456.pdf (Accesed Date: October 15, 2024).

[3] Antwi-Agyei, P., Stringer, L.C. and Dougill, A.J. 2014 Livelihood Adaptations to Climate Variability: Insights from Farming Households in Ghana. *Regional Environmental Change,* Vol.14, pages1615-1626. https://doi.org/10.1007/s10113-014-0597-9.

[4] Arshad, M., Amjath-Babu, T.S., K¨achele, H., Müller, K., 2016. What drives the willingness to pay for crop insurance against extreme weather events (flood and drought) in pakistan? A hypothetical market approach. Clim. Dev. Volume: 8 Issue 3, pp.234-244. - https://doi.org/10.1080/17565529.2015.1034232.

[5] Chatzopoulos, T., Lippert, C., 2015. Adaptation and climate change impacts: a structural ricardian analysis of farm types in *Germany. J. Agric. Econ*. Vol. 66 Issue 2, pp.537–554. https://doi.org/10.1111/1477-9552.12098.

[6] Hossain, M.S., Arshad, M., Qian, L., K¨achele, H., Khan, I., Islam, M.D.I., Mahboob, M.G., 2020. Climate change impacts on farmland value in bangladesh. *Ecol. Indic.,* Vol.112, pp.106-181. https://doi.org/10.1016/j.ecolind.2020.106181.

[7] Kurukulasuriya, P., Ajwad, M.I., 2007. Application of the ricardian technique to estimate the impact of climate change on smallholder farming in Sri Lanka. *Clim. Change*. Vol.81, Issue 1, pp.39-59. https://doi.org/10.1007/s10584-005-9021-2.

[8] Massetti, E., Mendelsohn, R., 2011. Estimating Ricardian models with panel data. *Clim. Change Econ.,* Vol.2, Issue 4, pp. 301-319. https://doi.org/10.1142/S2010007811000322.

[9] Moore, F.C., Lobell, D.B., 2014. Adaptation potential of European agriculture in response to climate change. *Nat. Clim. Change.*, Vol. 4, Issue 7, pp.610-614. https://doi.org/10.1038/nclimate2228.

[10] Amjath-Babu, T.S., Krupnik, T.J., Aravindakshan, S., Arshad, M., Kaechele, H., 2016. Climate change and indicators of probable shifts in the consumption portfolios of dryland farmers in sub-saharan africa: Implications for policy. *Ecol. Indic.*, Vol. 67, pp.830-838. https://doi.org/10.1016/j.ecolind.2016.03.030.

[11] Alam, M., Toriman, M., Siwar, C., Molla, R., Talib, B., 2011. The impacts of agricultural supports for climate change adaptation: farm level assessment study on paddy farmers. *Am. J. Environ. Sci.,* Vol.7, Issue 2, pp.178-182. https://doi.org/10.3844/ajessp.2011.178.182.

[12] Banna, H., Afroz, R., Masud, M.M., Rana, M.S., Koh, E.H.Y., Ahmad, R., 2016. Financing an efficient adaptation programme to climate change: a contingent valuation method tested in Malaysia. *Cah. Agric.,* Vol. 25, Issue 2, Article 25003. p.8. https://doi.org/10.1051/cagri/2016014.

[13] Masud, M.M., Azam, M.N., Mohiuddin, M., Banna, H., Akhtar, R., Alam, A.S.A.F.,Begum, H., 2017. Adaptation barriers and strategies towards climate change: challenges in the agricultural sector. *J. Cleaner Prod.,* Vol. 156, pp.698–706. https://doi.org/10.1016/j.jclepro.2017.04.060.

[14] Siwar, C., Alam, M., Murad, M.W., Al-Amin, A.Q., 2009. A review of the linkages between climate change, agricultural sustainability and poverty in malaysia. In: *International Review of Business Research Papers* (ISSN: 1832-9543), Vol. 5 Issue 6, pp. 309-321.

[15] Loboguerrero AM, Boshell F, León G, Martinez-Baron D, Giraldo D, Mejía LR,Díaz E, Cock J. 2018 Bridging the gap between climate science and farmers in Colombia. *Climate Risk Management.*, Vol. 22, pp.67-81. https://doi.org/10.1016/j.crm.2018.08.001.

[16] James W. Jones, John M. Antle, Bruno Basso, Kenneth J. Boote, Richard T. Conant, Ian Foster, H. Charles J. Godfray, Mario Herrero, Richard E. Howitt, Sander Janssen, Brian A. Keating, Rafael Munoz-Carpena, Cheryl H. Porter, Cynthia Rosenzweig, Tim R. Wheeler, 2016. Toward a new generation of agricultural system data, models, and

knowledge products: State of agricultural systems science, *Agricultural Systems,* Vol. 155, pp.269-288, ISSN: 0308-521X, https://doi.org/10.1016/j.agsy.2016.09.021.

[17] Boyd E, Cornforth R J, Lamb P J, Tarhule A, Lélé M I and Brouder A 2013 Building resilience to face recurring environmental crisis in *African Sahel Nat. Clim. Change,* Vol.3, pp.631-637. DOI: 10.1038/nclimate1969.

[18] Roudier P, Muller B, D'aquino P, Roncoli C, Soumaré M A, Batté L and Sultan B 2014 The role of climate forecasts in smallholder agriculture: lessons from participatory research in two communities in *Senegal Clim. Risk Manage.*, Vol. 2, pp.42-55. https://doi.org/10.1016/j.crm.2014.02.001.

[19] Phillips J, Deane D, Unganai L, Chimeli A 2002.Implications of farm level response to seasonal climate forecasts for aggregate grain production in Zimbabwe. *Agricultural Systems*. Vol. 74 Issue: 3, pp.351-369. https://doi.org/10.1016/S0308-521X(02)00045-8.

[20] Roncoli C, Jost C, Kirshen P, Sanon M,Ingram KT, Woodin M, Hoogenboom G. 2008 From accessing to assessing forecasts: An end to end study of participatory climate forecast dissemination in Burkina Faso (West Africa). *Climatic Change*, Vol.92, pp.433-460. https://doi.org/10.1007/s10584-008-9445-6.

[21] Traore B, Corbeels M, Van-Wijk MT, Rufino MC, Giller KE 2013. Effects of climate variability and climate change on crop production in southern Mali. *European Journal of Agronomy*, Vol.49, pp.115-125. https://doi.org/10.1016/j.eja.2013.04.004.

[22] Marteau R, Sultan B, Moron V, Alhassane A, Baron C, Traoré SB 2011. The onset of the rainy season and farmers' sowing strategy for pearl millet cultivation in Southwest Niger. *Agricultural and Forest Meteorology*, Vol.151 Issue 10, pp.1356-1369. https://doi.org/10.1016/j.agrformet.2011.05.018.

[23] Onyango E, Ochieng S, Awiti A. 2014 Weather and climate information needs of small-scale farming and fishing communities in western Kenya for enhanced adaptive potential to climate change. *Proceedings of Sustainable Research and Innovation Conference.* 2014, Vol.4, pp.187-193, Nairobi, Kenya.

[24] Vaughan C, Buja L, Kruczkiewicz A and Goddard L 2016 Identifying research priorities to advance climate services, *Clim. Services.* Vol.4, pp.65–74. https://doi.org/10.1016/j.cliser.2016.11.004.

[25] Adger W N, Dessai S, Goulden M, Hulme M, Lorenzoni I, Nelson D R, Naess L O, Wolf J and Wreford A 2009 Are there social limits to adaptation to climate change? *Clim. Change*, Vol.93, pp.335–54, https://doi.org/10.1007/s10584-008-9520-z.

[26] Hammer, G. L., Hansen, J. W., Phillips, J. G., Mjelde, J. W., Hill, H., Love, A., & Potgieter, A. 2001. Advances in application of climate prediction in agriculture. *Agricultural Systems.* Vol.70, pp.515-553. http://dx.doi.org/10.1016/S0308-521X(01)00058-0.

[27] Fonta, W.M., Sanfo, S., Kedir, A.M., Thiam, D.R., 2018. Estimating farmers' willingness to pay for weather index-based crop insurance uptake in West Africa: Insight from a pilot initiative in southwestern Burkina faso. *Agric. Food Econ.*, Vol.6 Issue 1, pp.1–20. https://doi.org/10.1186/s40100-018-0104-6.

[28] Allis.E , 2019 The future of climate services World Meteorol. Organ. Bull.18. Apr.2019, [Online]. https://wmo.int/media/magazine-article/future-of-climate-services (Accessed Date: October 15, 2024).

[29] Hewitt C, Mason S and Walland D 2012 The global framework for climate services Nat. *Clim. Change.*, Vol.2 Issue 12, pp.831-832. https://doi.org/10.1038/nclimate1745.

[30] Brasseur G P and Gallardo L 2016 Climate services: lessons learned and future prospects, *Earth's Future*. Vol. 4, pp.79–89. https://doi.org/10.1002/2015EF000338.

[31] Vaughan, M , Block, A., Christensen, Sh ., Allen, L ., Schmelz, E. 2018. The effects of climate change associated abiotic stresses on maize phytochemical defenses. *Phytochemistry Reviews.* Vol.17, pp.37-49. https://doi.org/10.1007/s11101-017-9508-2.

[32] Antwi-Agyei, P., Amanor, K., N. Hogarh, J., J. Dougill, A., 2021 aPredictors of access to and willingness to pay for climate information services in north-eastern Ghana: A gendered perspective, *Environmental Development,* Vol.37, article no: 100580, ISSN: 2211-4645, https://doi.org/10.1016/j.envdev.2020.100580.

[33] Antwi-Agyei, P., and L. C. Stringer, 2021: Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from

northeastern Ghana. *Climate Risk Manage.*, Vol. 32, Article no: 100304, https://doi.org/10.1016/j.crm.2021.100304.
[34] Singh, C., Daron, J., Bazaz, A., Ziervogel, G., Spear, D., Krishnaswamy, J., Zaroug, M., Kituyi, E., 2018. The utility of weather and climate information for adaptation decision-making: current uses and future prospects in Africa and India. *Clim. Dev.*, Vol.10 Issue5, pp.389–405. https://doi.org/10.1080/17565529.2017.1318744.
[35] Vaughan, M.F. Muth, D.P. 2019 Brown Evaluation of regional climate services: learning from seasonal-scale examples across the Americas, *Clim. Serv.*, Vol.15, Article no: 100104, https://doi.org/10.1016/j.cliser.2019.100104.
[36] Coulibaly, J.Y., Mango, J., Swamila, M., Tall, A., Kaur, H., Hansen, J., 2015. What climate services do farmers and pastoralists need in Tanzania? Baseline study for the GFCS adaptation program in Africa, [Online]. https://hdl.handle.net/10568/67192 (Accessed Date: July 1, 2024).
[37] Dayamba, D.S., Ky-Dembele, C., Bayala, J., Dorward, P., Clarkson, G., Sanogo, D., 2018. Assessment of the use of participatory integrated climate services for agriculture (picsa) approach by farmers to manage climate risk in mali and senegal. *Clim. Serv.*, Vol.12, pp.27–35. https://doi.org/10.1016/j.cliser.2018.07.003.
[38] Jagtap, S.S., Jones, J.W., Hildebrand, P., Letson, D., O'Brien, J.J., Podest´a, G.2002. Responding to stakeholder's demands for climate information: from research to applications in Florida. *Agric. Syst.*, Vol.74, Issue 3, pp.415–430. https://doi.org/10.1016/S0308-521X(02)00048-3.
[39] Muema, E., Mburu, J., Coulibaly, J., Mutune, J., 2018. Determinants of access and utilisation of seasonal climate information services among smallholder farmers in makueni county, kenya. *Heliyon.*, Vol.4, Issue 11, article no: e00889. https://doi.org/10.1016/j.heliyon.2018.e00889.
[40] Tall, A., Coulibaly, J.Y., Diop, M., 2018. Do climate services make a difference? A review of evaluation methodologies and practices to assess the value of climate information services for farmers: Implications for Africa. *Clim. Serv.*, Vol.11, pp.1–12. https://doi.org/10.1016/j.cliser.2018.06.001.
[41] Vaughan, C., Dessai, S., Hewitt, C., Baethgen, W., Terra, R., Berterretche, M., 2017. Creating an enabling environment for investment in climate services: the case of uruguay's national agricultural information system. *Clim. Serv.*, Vol. 8, pp.62–71. https://doi.org/10.1016/j.cliser.2017.11.001.
[42] Vermeulen, S.J., Aggarwal, P.K., Ainslie, A., Angelone, C., Campbell, B.M., Challinor, A. J 2012. Options for support to agriculture and food security under climate change. *Environ. Sci. Policy.*, Vol.15, Issue1, pp.136–144. https://doi.org/10.1016/j.envsci.2011.09.003.
[43] Vedeld, T., Mathur, M., Bharti, N., 2019. How can co-creation improve the engagement of farmers in weather and climate services (wcs) in india. *Clim. Serv.*, Vol.15, article no: 100103. DOI: 10.1016/j.cliser.2019.100103.
[44] Sivakumar, M.V.K., Wilhite, D., Pulwarty, R., Stefanski, R., 2014. The high-level meeting on national drought policy. *Bull. Am. Meteorol. Soc.*, Vol. 95, Issue 4, pp.ES85-ES88. https://doi.org/10.1175/BAMS-D-13-00159.1.
[45] Horita, F & De Albuquerque, J & Marchezini, V & Mendiondo, E. 2016. A qualitative analysis of the early warning process in disaster management. *Conference: 13th International Conference on Information Systems for Crisis Response and Management (ISCRAM)* At: Rio de Janeiro, Brazil.
[46] Matere, J & Simpkin, P & Angerer, J & Olesambu, E & Ramasamy, S & Fasina, F Oludayo. 2019. Predictive Livestock Early Warning System (PLEWS): Monitoring forage condition and implications for animal production in Kenya. *Weather and Climate Extremes.* Vol.27. Article no: 100209. https://doi.org/10.1016/j.wace.2019.100209.
[47] Kusunose, Y & Mahmood, R. (2016). Imperfect forecasts and decision making in agriculture. *Agricultural Systems.* Vol.146. pp.103-110. https://doi.org/10.1016/j.agsy.2016.04.006.
[48] Khanian, M & Marshall, N & Zakerhaghighi, K & Salimi, M & Naghdi, A (2018). Transforming agriculture to climate change in Famenin County, West Iran through a focus on environmental, economic and social factors. *Weather and Climate Extremes.* Vol.21, pp.52-64, https://doi.org/10.1016/j.wace.2018.05.006.
[49] Sharifzadeh, M. & Zamani, Gh & Khalili, Davar & Karami, Ezatollah. (2012). Agricultural Climate Information Use: An

Application of the Planned Behaviour Theory. *Journal of Agricultural Science and Technology*. Vol.14, pp.479-492.

[50] Mabe FN, Nketiah P, Darko D 2014. Farmers' willingness to pay for weather forecast information in Savelugu-Nanton Municipality of the Northern Region. *Russian Journal of Agricultural and Socio-Economic Sciences*. Vol.36, Issue 12, pp.34-44. https://doi.org/10.18551/rjoas.2014-12.05.

[51] Nakuja T, Sarpong DB, Kuwornu JKM, Ashante FA 2012. Water storage for dry season vegetable farming as an adaptation to climate change in the upper east region of Ghana. *African Journal of Agricultural Research*. Vol.4 Issues 2, pp.298-306. https://doi.org/10.5897/AJAR11.1601.

[52] Ouédraogo M, Barry S, Zougmoré RB,Partey ST, Somé L, Baki G 2018. Farmers' willingness to pay for climate information services: Evidence from cowpea and sesame producers in Northern Burkina Faso. *Sustainability*. Vol.10, Issue 611, pp.1-16. https://doi.org/10.3390/su10030611.

[53] Ahmed, A., Masud, M.M., Al-Amin, A.Q., Yahaya, S.R.B., Rahman, M., Akhtar, R., 2015. Exploring factors influencing farmers' willingness to pay (wtp) for a planned adaptation programme to address climatic issues in agricultural sectors. *Environ. Sci. Pollut. Res.*, Vol. 22 Issue 12, pp.9494–9504. https://doi.org/10.1007/s11356-015-4110-x.

[54] Al-Amin, A.Q., Masud, M.M., Kabir Sarkar, M.S., Filho, W.L., Doberstein, B., 2020. Analysing the socioeconomic and motivational factors affecting the willingness to pay for climate change adaptation in malaysia. *Int. J. Disaster Risk Reduction*. Vol.50, article no:101708. https://doi.org/10.1016/j.ijdrr.2020.101708.

[55] Vincent, K., Conway, D., Dougill, A.J., Pardoe, J., Archer, E., Bhave, A.G.,2020. Re-balancing climate services to inform climate-resilient planning–a conceptual framework and illustrations from sub-saharan africa. *Clim. Risk Manag.*, Vol. 29,article no: 100242. https://doi.org/10.1016/j.crm.2020.100242.

[56] Ouédraogo, M.; Zougmoré, R.; Moussa, S.A.; Partey, T.S.; Thornton, K.P.; Kristjanson, P.; Ndour, B.Y.N.; Somé, L.; Naab, J.; Boureima, M.; 2017 Markets and climate are driving rapid change in farming practices in Savannah West Africa. Reg. Environ. Chang., Vol. 17, pp.437–449. https://doi.org/10.1007/s10113-016-1029-9.

[57] Naab, F.Z., Abubakari, Z., Ahmed, A., 2019. The role of climate services in agricultural productivity in Ghana: the perspectives of farmers and institutions. *Clim. Serv.*, Vol. 13, pp.24–32. https://doi.org/10.1016/j.cliser.2019.01.007.

[58] Nkiaka, E., Taylor, A., Dougill, A.J., Antwi-Agyei, P., Fournier, N., Warnaars, T., 2019. Identifying user needs for weather and climate services to enhance resilience to climate shocks in sub-Saharan Africa. *Environ. Res. Lett.*, Vol. 14 Issue 12, article no: 123003, https://doi.org/10.1088/1748-9326/ab4dfe.

[59] Akter, S., Brouwer, R., Choudhury, S., Aziz, S., 2009. Is there a commercially viablemarket for crop insurance in rural bangladesh? Mitigation Adapt. *Strategies Global Change*. Vol. 14, Issue 3, pp.215–229. https://doi.org/10.1007/s11027-008-9161-6.

[60] Fuks, M., Chatterjee, L., 2008. Estimating the willingness to pay for a flood control project in brazil using the contingent valuation method. *J. Urban Plann. Dev.*, Vol.134, Issue 1, pp.42-52. https://doi.org/10.1061/(ASCE)0733-9488(2008)134:1(42).

[61] Sarkhel, P., Banerjee, S., 2010. Municipal solid waste management, source-separated waste and stakeholder's attitude: a contingent valuation study. *Environ., Dev. Sustainability*. Vol. 12, Issue 5, pp.611–630. https://doi.org/10.1007/s10668-009-9215-2.

[62] Gebremariam, G.G.; Edriss, K.A.; Maganga, M.A.; Terefe, T.A. 2013 Labor as a Payment Vehicle for Valuing Soil Conservation Practices in a Subsistence Economy: Case of Adwa Woreda in Ethiopia. *Am. J. Econ.*, Vol. 3, pp.283–290. https://doi.org/10.5923/j.economics.20130306.07.

[63] Cardell, L.; Michelson, H. 2022 Price Risk and Small Farmer Maize Storage in Sub-Saharan Africa: New Insights into a Long-Standing Puzzle. *Am. J. Agric. Econ.*, Vol.105, pp.737–759, https://doi.org/10.1111/ajae.12343.

[64] Ahsan, M. N., Khatun, A., Islam, M. S., Vink, K., Ohara, M., & Fakhruddin, B. S. (2020). Preferences for improved early warning services among coastal communities at risk in cyclone prone south-west region of Bangladesh. *Progress in Disaster Science*,

Vol.5, article no: 100065. https://doi.org/10.1016/j.pdisas.2020.100065.
[65] Soares, M., Alexander, M., Dessai, S., 2018. Sectoral use of climate information in Europe: a synoptic overview. *Clim. Serv.*, Vol.9, pp.5–20. https://doi.org/10.1016/j.cliser.2017.06.001.
[66] Hanemann, M., Loomis, J., Kanninen, B., 1991. Statistical efficiency of double-bounded dichotomous choice contingent valuation. *Am. J. Agric. Econ.*, Vol.73 Issue 4, pp.1255-1263. https://doi.org/10.2307/1242453.
[67] Winden, M., Jamelske, E., Tvinnereim, E., 2018. A contingent valuation study comparing citizen's willingness-to-pay for climate change mitigation in china and the united states. *Environ. Econ. Policy Stud.*, Vol. 20 Issue 2, pp.451–475. https://doi.org/10.1007/s10018-017-0202-9.
[68] Cameron, T., & Quiggin, J. 1994. Estimation using contingent valuation data from a dichotomous choice with follow-up questionnaire, *Journal of En-vironmental Economics and Management,* Vol.27, pp.. 218–234. https://doi.org/10.1006/jeem.1994.1035.
[69] Haab, T., & McConnell, K. 2003. Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation, Massachusetts: *Edward El-gar,*. https://doi.org/10.4337/9781840647044.00004.
[70] Mitchell, R.C., Carson, R.T., Carson, R.T., 1989. Using Surveys to Value Public Goods: The Contingent Valuation Method. Resources for the Future. ISBN: 9781315060569. https://doi.org/10.4324/9781315060569.
[71] Diederen, P & Van, H & Arjan, Meijl & Katarzyna, W & Meijl, H & Wolters, Arjan & Bijak, Katarzyna. (2003). Innovation Adoption in Agriculture: Innovators, Early Adopters and Laggards. *Cahiers d'economie et sociologie Rurales.* Vol.67, pp.29-50, https://doi.org/10.3406/reae.2003.1714.
[72] Tarhule, A., and Lamb, J. (2003). Climate research and seasonal forecasting for WestAfricans: Perceptions, dissemination, and use? Perceptions, dissemination, and use? Bullet. *Am. Meteorol. Soc.,* Vol.84, pp.1741-1760. https://doi.org/10.1175/BAMS-84-12-1741.
[73] Warner, S. Moonsammy, J. Joseph 2022 Factors that influence the use of climate information services for agriculture: A systematic review, *Clim. Serv.,* Vol.28, Article no 100336. https://doi.org/10.1016/j.cliser.2022.100336.
[74] Kumar, U.; Werners, S.; Paparrizos, S.; Datta, D.K.; Ludwig, F. Hydroclimatic Information Needs of Smallholder Farmers in the Lower Bengal Delta, Bangladesh. *Atmosphere.* Vol.11 Issue 9, article no: 1009. https://doi.org/10.3390/atmos11091009.
[75] Diallo,A, Dossou-Yovo, E A gendered analysis of farmers' access to and willingness to pay for climate information services: Evidence from rice farmers in Mali, *Climate Services,* Vol.35, article no:100507, ISSN: 2405-8807, https://doi.org/10.1016/j.cliser.2024.100507.
[76] Sharp, C. A. (2003). Qualitative Research and Evaluation Methods (3rd ed.). *Evaluation Journal of Australasia,* Vol.3, Issue 2, pp.60-61. https://doi.org/10.1177/1035719X0300300213
[77] Ibrahim, N, Alhassan, K., Adzawla, H., Adjei-Mensah, W., 2019. Analysis of Smallholder Farmers' Perceptions on Climate Change, Preference and Willingness-to-pay for Seasonal Climate Forecasts Information in Savelugu Municipality, Ghana. *Asian Journal of Environment & Ecology.* Vol.9 Issue 1, pp.1-11. https://doi.org/10.9734/AJEE/2019/v9i130084
[78] Paparrizos, U. Kumar, T.S. Amjath-Babu, F. Ludwig 2021 Are farmers willing to pay for participatory climate information services? Insights from a case study in peri-urban Khulna, Bangladesh, *Clim. Serv.,* Vol.23, article no: 100241, https://doi.org/10.1016/j.cliser.2021.100241.
[79] Awolala, D, Adefisan, J., Antwi-Agyei, Taylor, P., 2023. Economic Value and Latent Demand for Agricultural Drought Forecast: Emerging Market for Weather and Climate Information in Central-Southern Nigeria. *Climate Risk Management.* Vol.39. Article no: 100478. https://doi.org/10.1016/j.crm.2023.100478.
[80] Vincent k, Daly, M Scannell,C Leathes, B 2018 What can climate services learn from theory and practice of co-production?, *Climate Services,* Vol.12, pp.48-58, ISSN: 2405-8807, https://doi.org/10.1016/j.cliser.2018.11.001.
[81] Zongo, B., Diarra, A. Barbier, B., Zorom, M, Yacouba, H., Dogot, Th. 2015. Farmers' Perception and Willingness to Pay for Climate Information in Burkina Faso. *Journal of*

Agricultural Science. Vol.8 Issue 1, pp.175-175. https://doi.org/10.5539/jas.v8n1p175.

[82] Acquah, H. de-Graft & Onumah, Edward E., 2011. "Farmers Perception and Adaptation to Climate Change: An Estimation of Willingness to Pay," *AGRIS on-line Papers in Economics and Informatics,* Czech University of Life Sciences Prague, Faculty of Economics and Management, Vol. 3 Issue 4, pp.1-9,. https://doi.org/10.22004/ag.econ.120241.

[83] Ngigi, M.W., Muange, E.N. 2022 Access to climate information services and climate-smart agriculture in Kenya: a gender-based analysis. *Climatic Change,* Vol.174, article no: 21. https://doi.org/10.1007/s10584-022-03445-5.

[84] Donkoh, S, Azumah, Sh, Awuni, J. 2019. Adoption of Improved Agricultural Technologies among Rice Farmers in Ghana: A Multivariate Probit Approach. *Ghana Journal of Development Studies.* Vol.16. pp.46-67. https://doi.org/10.4314/gjds.v16i1.3.

[85] Meza, F.; Hansen, J.; Osgood, D. 2008 Economic Value of Seasonal Climate Forecasts for Agriculture: Review of Ex-Ante Assessments and Recommendations for Future Research. *J. Appl. Meteorol. Climatol.,* Vol.47, pp.1269–1286. https://doi.org/10.1175/2007JAMC1540.1.

[86] Ziervogel, G.; Opere, A. 2010 Integrating meteorological and indigenous knowledge-based seasonal climate forecasts in the agricultural sector: Lessons from participatory action research in sub-Saharan Africa. *Clim. Chang. Adapt. Afr. Learn. Pap. Ser.,* Vol.1, pp.1–24. http://hdl.handle.net/10625/46185.

[87] Nyadzi, E.; Werners, S.E.; Biesbroek, R.; Ludwig, F. 2020 Techniques and skills of indigenous weather and seasonal climate forecast in Northern Ghana. *Clim. Dev.,* Vol.13, pp.551–562. https://doi.org/10.1080/17565529.2020.1831429.

[88] Carr, E.R.; Owusu-Daaku, K.N. 2015 The shifting epistemologies of vulnerability in climate services for development: The case of Mali's agrometeorological advisory programme. Area 2015, Vol.48, pp.7–17. https://doi.org/10.1111/area.12179.

[89] Loboguerrero, A.M.; Baethgen, W.E.; Baron, D.M. 2017 Climate Services and Insurance: Scaling Climate Smart Agriculture. *Agriculture for Development.* Vol.30, pp. 31-34, [Online]. https://hdl.handle.net/10568/81377 (Accessed Date: October 7, 2024).

[90] McKune, S., Poulsen, L., Russo, S., Devereux, T., Faas, S., McOmber, C., 2018 Therese Ryley,Reaching the end goal: Do interventions to improve climate information services lead to greater food security?, *Climate Risk Management,* Vol.22, pp.22-41, ISSN: 2212-0963, https://doi.org/10.1016/j.crm.2018.08.002.

[91] Mudombi, S., Nhamo, G., 2014. Access to weather forecasting and early warning information by communal farmers in seke and murewa districts, Zimbabwe. *J. Hum. Ecol.*, Vol.48, Issue 3, article no: 357e366. https://doi.org/10.1080/09709274.2014.11906805.

[92] Nyadzi, E.; Werners, S.E.; Biesbroek, R.; Ludwig, F. 2022 Towards weather and climate services that integrate indigenous and scientific forecasts to improve forecast reliability and acceptability in Ghana. *Environ. Dev.,* 2022, Vol.42, article no: 100698. https://doi.org/10.1016/j.envdev.2021.100698.

[93] Lugen, M. 2019 The role of climate services on the adaptation of agriculture: Insights from the case of Burkina Faso (Le rôle des services climatiques dans l'adaptation de l'agriculture: Perspectives avec le cas du Burkina Faso). *Mondes Dev.,* 2019, Vol.185, pp.149-164. https://doi.org/10.3917/med.185.0149.

[94] Djido, A.; Zougmoré, R.B.; Houessionon, P.; Ouédraogo, M.; Ouédraogo, I.; Diouf, N.S. 2021 To what extent do weather and climate information services drive the adoption of climate-smart agriculture practices in Ghana? *Clim. Risk Manag.,* 2021, Vol.32, article no: 100309. https://doi.org/10.1016/j.crm.2021.100309.

[95] Thune, M. (2011). Industrialization of gold mining in Kalsaka, Burkina Faso: An opportunity for a poor rural population? EchoGéo, (L'industrialisation de l'exploitation de l'or à Kalsaka, Burkina Faso: Une chance pour une population rurale pauvre? EchoGéo), Vol.17, Issue 17 DOI: 10.4000/echogeo.12535.

[96] Ouedraogo, A.; Egyir, I.S.; Ouedraogo, M.; Jatoe, J.B.D. 2022 Farmers' Demand for Climate Information Services: A Systematic Review. *Sustainability,* Vol.14, Issue15, article no: 9025. https://doi.org/10.3390/su14159025.

[97] Rehman, F., Ruby, T., Ismat, Dr. 2013. Effect of farmers' socioeconomic characteristics on access to agricultural information: Empirical evidence from Pakistan. *Journal of Animal and Plant Sciences*. Vol.23. pp.324-329.

[98] Oyekale AS 2015. Access to Risk Mitigating Weather Forecasts and Changes in Farming Operations in East and West Africa: Evidence from a Baseline Survey. *Sustainability*. 2015, Vol. 7 Issue, 11, pp.14599-14617. https://doi.org/10.3390/su71114599.

[99] Ingram, K.T., Roncoli, M.C., Kirshen, P.H., 2002. Opportunities and constraints for farmers of West Africa to use seasonal precipitation forecasts with Burkina Faso as a case study. *Agric. Syst.*, Vol.74, article no: 331e349. https://doi.org/10.1016/S0308-521X(02)00044-6.

[100] Mulinya., C. 2017. Factors Affecting Small Scale Farmers Coping Strategies To Climate Change In Kakamega County In Kenya. *IOSR Journal of Humanities and Social Science*. Vol.22, Issue 2, pp.100-109, https://doi.org/10.9790/0837-220202100109.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Leka : Edited the draft, reviewed the paper.
- Gjermeni: Conceived the research and provided the original idea of the study. Designed the methods, selected research data, analyzed and interpreted the data. Finalized research and paper before submission, verification and validation data

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

The authors have no conflicts of interest to declare.

APPENDIX

Table 1. Bid Structure used in the study (1,000Lek =1Euro)

Initial Bid	Follow-up Inferior Bid	Follow-up Superior Bid
10,000	5,000	15,000
15,000	10,000	20,000
20,000	15,000	25,000
25,000	20,000	30,000
30,000	25,000	35,000
35,000	30,000	40,000

Table 2. Comparative analysis

Author	Econometric Model	Dependent variable	Independent variable	Effects
[77]	Two-step Heckman selection model	Y- farmer's WTP for seasonal climate forecast	- Gender - Source of Information - Off-farm incomes - Membership in farmers associations - Farmer's Climate perception	+ +/- + + +
[78]	Double-bounded logit model	Y- farmer's WTP for climate information services	- Age of respondent - Cost to access CIS - Education level - Training toward technology gaps	- - + +
[79]	Tobit	Y- farmer's WTP for seasonal climate information	- Education - Farm size - Farm Income - Access to Market linkage - Ownership of a Radio	- + + - +
[80]	Logit	Y- Farmers willingness to pay for improved climate services	- Type of CIS/ Seasonal forecasts - Accuracy of CIS - Dissemination channel - Market information/ selling price	- + + +
[81]	Probit	Y-farmers willingness of to pay for climatic information	- The need for climatic information - Source of information - The role of the farmer's age and his access to technology - The use of climatic information in decision making plan production - Type of agricultural information	+ + +/- + +
[82]	Logit	Y-WTP for Climate Change Mitigating Policies	- Age of respondent - Farming experience in years - Own farmland - Farm Size - Other Income generating activity	- + + - +
[83]	Probit	Y –needs for early warning climate system	- Gender - Access to smart technologies - Crop variety rotation/influence - Diversity of information sources - Reliability in information sources	+/- + + + +
[32]	Logit	Y - farmers willingness to pay for service on climatic information	- Experience with the dryer - Access to the irrigation system - Farming experience/years of experience - Income/farm size	+ - + +
[52]	Tobit	Y - farmers willingness to pay for service on climatic information	-Market orientation -Type of climatic information -Awareness of climate information -Climate-smart agriculture	+ + + +
[84]	Double-hurdle	Y - farmers willingness to pay for service on climatic information	- Production purpose - Access to loans/other services - Adaptive capacity - Perception of climatic conditions - Climatic information - The level of education - Farmer's Age	+ + +/- - + + -

Source: Author's own elaboration

Table 3. Access to climate information through dissemination channels

Information Type	Percent	Channel of Climate Information Services: TV	Extension Service Agent	Mobile Phone	NPO	From Other Farmers
daily high-temperature periods	*91*	*73.0*	*2.5*	*43.5*	*16.5*	*0.5*
nightly high-temperature periods	*87.5*	*70.5*	*2.0*	*45.0*	*16.5*	*0.5*
Start and end of the rainy season	*95.5*	*77.5*	*3.0*	*48.0*	*16.5*	*1.0*
length of rainy season	*98*	*80.0*	*2.5*	*49.5*	*16.5*	*1.0*
drought spells period	*99.5*	*81.5*	*3.0*	*49.5*	*16.5*	*1.0*
flood	*73*	*56.5*	*2.0*	*37.5*	*16.5*	-

Table 7. WTP (Lek)(1 Eur=1,000 Lek) for climate information services according to farmers' characteristics.

Variables	Decadal Climate Information		Seasonal Climate Information		Daily Climate Information	
Age	**Percent**	**WTP**	**Percent**	**WTP**	**Percent**	**WTP**
Less than 40	16.9	22,413.79	14.9	22,413.79	14.5	22,413.79
40 to 60 years	19.3	22,878.79	19	22,972.97	19	22,763.16
More than 60 years	10.5	20,000.00	10.76	20,000.00	11.5	19,130.43
Gender						
Male	45	22,012.99	42.1	21,768.00	42.5	21,411.76
Female	1.7	23,333.33	2.6	27,000.00	2.5	27,000.00
Education						
Not educated	24.6	21,547.62	25.1	21,632.65	26	21,057.69
Educated	22.1	22,631.58	19.5	22,631.58	19	22,631.58
Farming experience						
0-15	14	22,916.67	13.9	22,592.59	13.5	22,592.59
15-40	32.7	21,696.43	30.8	21,833.33	31.5	21,349.21
Wheat Cropping area						
Less than 1 ha	4.8	20,625.00	4.4	20,625.00	4	20,625.00
1 to 4 ha	19.9	21,323.53	21.2	21,463.41	22	20,795.45
more than 4 ha	22	23,026.32	19	23,026.32	19	23,026.32
Household Size						
Less than 4 person	44.4	22,302.63	42.1	22,378.05	42.5	22,000.00
more than 4 persons	2.3	17,500.00	2.5	17,000.00	2.5	17,000.00
Awareness to Climate information						
Not exposed	9.9	21,176.47	9.2	20,833.33	9	20,833.33
Exposed	36.8	22,301.59	35.4	22,391.30	36	21,944.44
Livestock						
No livestock	18	21,451.61	16.4	21,562.50	16	21,562.50
Practice livestock	28.7	22,448.98	28.2	22,363.64	29	21,810.34
Farmes main activity						
Agriculture as primary	40.9	22,000.00	39.5	22,012.99	39.5	21,708.86
Agriculture as secondary	5.8	22,500.00	5.1	22,500.00	5.5	21,818.18
Income derived from agriculture activity						
less than 50%	32.1	21,454.55	31.3	21,475.41	31.5	21,111.11
more than 50%	14.6	23,400.00	13.3	23,461.54	13.5	23,148.15
Market orientation						
Non market oriented	10.5	21,111.11	11.3	21,363.64	12.5	20,200.00
Market oriented	36.2	22,338.71	33.3	22,307.69	32.5	22,307.69
wheat cropp yields						
Less than 4 kv/dyn	12.9	19,545.45	11.3	19,545.45	11	19,545.45
4 to 6 4 kv/dyn	23.4	22,375.00	23.6	22,282.61	24.5	21,632.65
more than 6 kv/dyn	10.4	24,444.44	9.7	24,473.68	9.5	24,473.68

Table 8. Model 2 Coefficients of explanatory variables on WTP based on type of CIS and Socio-demographic factors

Variables	Decadal Climate Information		Seasonal Climate Information		Daily Climate Information	
	Coefficients	P>|z|	Coefficients	P>|z|	Coefficients	P>|z|
Household size	*856.2557 (1714.04)*	*0.62*	*757.8669 (1631.575)*	*0.64*	*787.6929 (1588.103)*	*0.62*
Age	*-478.8106** (219.0439)*	*0.03*	*-506.4833*** (205.2341)*	*0.01*	*-498.4046*** (197.7586)*	*0.01*
Education	*3087.554* (1633.796)*	*0.06*	*3188.608** (1579.927)*	*0.04*	*2544.743* (1504.052)*	*0.09*
Farmer's Experience	*-299.5693 (241.2136)*	*0.21*	*-315.776 (229.6783)*	*0.17*	*-308.515 (223.5913)*	*0.17*
Awareness	*8265.54** (4340.65)*	*0.05*	*9937.768* (5635.4)*	*0.08*	*9833.101* (5465.823)*	*0.07*
Constant	*28265.54 (14340.65)*		*28703.43 (13746.7)*		*30833.01 (13369.04)*	
Sigma	*20720.77 (3063.17)*		*20370.78 (2808.602)*		*19962.3 (2650.25)*	
Number of obs	*170*		*194*		*199*	
Wald chi2	14.83		17.78		17.45	
Prob > chi2	*0.01*		*0.00*		*0.00*	
Log likelihood	*-167.79892*		*-188.64594*		*-196.40493*	
Restricted WTP point estimate with confidence intervals(95% CI)	*21338.78*		*22521.43*		*24142.46*	

*Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1.*

Table 9. Model1 Coefficients of explanatory variables on WTP based on type of CIS and farm typology

Variables	Decadal Climate Information		Seasonal Climate Information		Daily Climate Information	
	Coefficients	P>|z|	Coefficients	P>|z|	Coefficients	P>|z|
Farm size(Dynym)	*41.69273* (24.75214)*	*0.09*	*40.98415* (24.38829)*	*0.09*	*40.23853* (23.75393)*	*0.09*
Market Orientation	*39.59217 (56.1264)*	*0.48*	*65.18714 (53.52174)*	*0.22*	*53.75996 (50.90618)*	*0.29*
Shared income from main activity	*17948.62*** (6275.215)*	*0.00*	*16888.2*** (6099.961)*	*0.01*	*17259.44*** (5851.39)*	*0.00*
Grain Productivity	*327.526 (395.0817)*	*0.41*	*348.5798 (395.0945)*	*0.38*	*677.9594 (378.8039)*	*0.39*
Constant	*5274.75 (4285.167)*		*4265.116 (4050.152)*		*4920.678 (3813.345)*	
Sigma	*19036.98 (2719.021)*		*18944.53 (2526.901)*		*18488.9 (2377.472)*	
Number of obs	*171*		*195*		*200*	
Wald chi2	18.04		20.89		21.67	
Prob > chi2	*0.00*		*0.00*		*0.00*	
Log likelihood	*-169.23746*		*-190.18631*		*-197.03985*	
Restricted WTP point estimate with confidence intervals(95% CI)	*23,632.19*		*21,608.06*		*22,596.27*	

*Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1.*