Original Research Article

Assessment of factors influencing smallholder farmers willingness to pay for Climate change adaptation information access in South-Eastern Kenya

Abstract

Farmers' adaptation to climate change is crucial in ensuring agricultural production and improving food insecurity. Farmers needed access to climate change adaptation information to enable them to plan their agricultural investments. This study sought to assess farmers' willingness to pay to access climate change adaptation information as they seek to achieve resilience in the face of changing climatic conditions. Qualitative and quantitative research approach was adopted where data was collected first-hand by interviewing 443 smallholder farmers. Ordinary List Square method was applied to analyse the factors that influenced farmers' willingness to Pay. From the findings, 77.2% of the farmers were willing to pay for climate adaptation information. The mean willingness to pay in Cash was 12.78 USD per year whereas payment in Kind was dominantly through giving of maize yield from the production of 66.97 kgs per year which translated to 18.40 USD at current market price. The climate change adaptation information effectiveness, knowledge, and access to information were the leading factors that influenced farmers' WTP. Age and main source of income significantly influenced WTP negatively. Dissemination of this information through effective channels is encouraged to enable farmers to access and improve their WTP.

Keywords: Willingness to Pay, Climate change adaptation, Climate change adaptation information

1. Introduction

Climate change has been demonstrated over a long time as being one of the leading challenges to agricultural production in not only Sub-Saharan Africa (SSA) but the whole world (IPCC, 2019). These challenges are more ravaging in SSA especially in the Kenyan Arid and Semi-Arid Regions. This was because agriculture in the region predominantly relied on rainfall for production (D'Alessandro et al., 2015; World Bank, 2019). World over, several initiatives had been undertaken to curb climate change impacts, however, little gains could be quantified. Some of these measures included climate change mitigation through reduced greenhouse gas emissions and agroforestry, crop and livestock insurance, and climate change adaptation (Burton, 2006; Locatelli et al., 2020; Roggero & Thiel, 2018; Sarwary et al., 2020; Zolnikov, 2019).

The International Panel on Climate Change (IPCC), United Nations Framework Convention on Climate Change (UNFCCC), and World Meteorological Organization (WMO) prediction of the future climate in Eastern Africa, especially the ASALs appeared to benefit from enhanced rainfall (Donnelly et al., 2017; WMO, 2021). This implied that proper farmer investment decisions were key for farmers to take up and benefit from these opportunities which were presented by climate change. Although measures had been taken to try and combat climate change vagaries, climate change mitigation was a long-term initiative that could not be feasible in terms of solving the food crisis which was and still is eminent world over. Similarly, based on smallholder farmers' financial muscle, crop and livestock insurance was not financially feasible. This left the farmers with the option of adapting to the vagaries of climate change. As noted by IPCC (2014), to minimize the impacts of climate change that could not be reduced through mitigation actions, adaptation was key since it brought benefits both then and in the future.

As evident from numerous studies such as Gebru et al. (2015), (2018); Lumosi et al. (2016); McGahey & Lumosi (2018); Otitoju & Enete (2016), climate change adaptation was an information-intensive venture that required the farmer to be updated on what, when and how to invest in agricultural production for lucrative returns on their investments. The information needed to be communicated in a user-friendly format and within an acceptable lead time to enable the farmers to make informed decisions aimed at minimizing losses and maximizing the opportunities presented by climate variability and change. As presented by literature, access and implementation of these climate change adaptation advisories were key in promoting agricultural

production and in enhancing farmers' resilience to climate changes (DEE, 2017; Dutta et al., 2020; Lumosi et al., 2016; McGahey & Lumosi, 2018; Mugi-ngenga et al., 2016; Otitoju & Enete, 2016; Sarwary et al., 2020). As it had been demonstrated through research, the use of appropriate information when making agricultural investments decision yielded good results even under infringed climatic conditions (Cooper et al., 2008; Gebru et al., 2018; Kwena et al., 2018; Luseno et al., 2003; Rao et al., 2011). Therefore, farmers needed to access information on how to adapt to the changing climate and more specific information which was specific to their regions and/or location (Otitoju & Enete, 2016).

In most developing countries such as Kenya, dissemination of this information was mostly done by government agencies (21%) through funded projects, private organizations (27%), Non-Governmental Organizations (NGOs) (21%), Community-Based Organizations (CBOs), and Self-Help groups (17%) and International Organizations (14%) (World Bank, 2019, 2021a, 2021b). This insinuates that the project life expectancy was low since the projects phased out when funding was terminated.

Based on this background, For the period between 2018 and 2020, a regional project on "The last mile: Up-scaling Climate Information Services to Build Community Resilience in Uganda and Kenya" funded by the International Development Research Centre (IDRC) of Canada had endeavoured to provide downscaled climate change adaptation information to farmers in Machakos, Makueni and Kitui Counties using Information Communication Technologies (ICTs). The Climate Change Adaptation and ICT (CHAI) project was designed to seek a better understanding of how the ability of individuals and communities could be enhanced to improve farmers' response to climate-based challenges using ICT tools. To achieve this goal, the project deployed an information delivery mechanism that leverages the use of various dissemination channels such as Climate Field Schools, mobile phones, print media including farmer magazines, pamphlets, and traditional methods such as the use of agricultural extension service providers and Local FM radios within the three counties of Kitui, Machakos, and Makueni.

This study sort to determine smallholder farmers' willingness to pay (WTP) to access this information and factors that influenced their WTP. This was because a majority of the studies linked with climate change and WTP had focused on WTP for various technologies aimed at addressing challenges as a result of climate change (Lagoon et al., 2019; Moranga, 2016), or

specific value chain (Bhandari et al., 2016; Zongo et al., 2015). Little was known on the value associated by smallholder farmers to access climate change adaptation information especially in the Arid and Semi-Arid Lands (ASALs) of Kenya. This can be achieved through assessing their WTP.

In this study, the WTP for smallholders in South-Eastern Kenya counties of Kitui, Machakos, and Makueni was estimated. The contingent valuation (CV) method was used to provide necessary data. Demographics, socio-economic, and institutional factors that influenced smallholder farmers' WTP to access climate change adaptation information were identified and explored. This paper aimed at contributing to an understanding of how the communities could embrace an initiative on climate change adaptation and hunger reduction to achieve sustainable access to information and enhance their farm investment decisions.

2. Materials and methods

2.1.Description of the study area

The study was carried out in three counties as shown in table 1 below. Kitui county is located in the South-Eastern part of Kenya lying between latitude 0°10´ and 3°0´ south and longitudes 37°50´ and 39°0´ east. This county is predominantly arid and semi-arid receiving annual rainfall of between 500- 1050mm. Kitui County covers approximately 30, 570 km^2 with an estimated population of 1,130,134 from 262,942 households.

Machakos county is the smallest of the three counties with a total land area of 6,208 Km^2 and an approximate population of 1,414,022 persons (KNBS, 2019) based on the projections from the 2019 census. Machakos county is largely arid and semi-arid (ASAL), receiving annual rainfall of about 500mm-1300 mm (MoALF, 2017).

Makueni County, on the other hand, covers an approximate land mass of 8034.7km^2 with an estimated population of 977,015 from 244,669 households. Makueni receives between 300 mm to 1200 mm of rainfall annually (MoALF, 2016).

All three counties experience a bimodal rainfall pattern with long rains in March-May and short rains in October to December. The average temperatures range between 18- 29, 20.2 – 35.8, and 14 – 34^{o}c for Machakos, Makueni, and Kitui Counties respectively.

2.2.Research Design and Data analysis

The study adopted a multistage sampling technique to arrive at the desired sample size. In the first stage, Kitui, Machakos, and Makueni counties were purposively selected. The counties were selected based on their geographical situation in the Arid and Semi-Arid areas which are more vulnerable to vagaries of climate instability and transition, along with other areas (Birch, 2018; GoK, 2013, 2016).

In the second stage, two sub-counties from each county were randomly selected. In the third stage, two wards were randomly selected from each sub-county, and finally, 443 respondents were randomly selected from all the villages proportionately.

Primary data was collected using a semi-structured questionnaire developed through the Kobo toolbox application. The questionnaire was pretested and necessary adjustments were made before being administered to capture climate change adaptation information, channels for access, and factors that influenced farmers' access to the information. Descriptive statistics were used to analyse and present qualitative and categorical data using the statistical package for social science (SPSS) application version 26.

The contingent valuation method (CVM) was adopted to measure an individual's willingness to pay. According to Hynes & Howley (2011), CVM takes a more holistic approach by focusing on the value of moving from the status quo to an alternative status of the goods and services. This study's design was based on Lancaster consumer theory which states that consumers gain utility, not from the real contents of the basket (good or service), but the characteristics/attributes of the items in it (Hendler, 2007; Lancaster, 1966; Wierenga, 1984). The WTP philosophy originates from the economic theory which reflects the maximum amount of money or service an individual is willing to give up to obtain more of the goods or services (Garra & Mourato, 2016).

2.2.1. Justification of the use of Contingent Valuation Method

Contingent Valuation Method is used to give value to a commodity that is typically incapable of receiving a market price, such as environmental resources like environmental protection, climate change mitigation, and/or adaptation among other non-market goods and services (Carson, 2000; Carson et al., 2001). An individual's view, attitude, and preferences about information on climate change adaptation and its non-market worth are extracted using the CV survey. Without any actual transactions taking place, a fictitious market is established (Kafy et al., 2018; Lee & Heo, 2016). The CV survey asked farmers to report their willingness to pay as they endeavor to have continued access to agro-advisory information on climate change and adaptation.

Jin et al. (2019) conducted a comprehensive assessment of research that evaluated WTP for climate change adaptation measures in developing countries, in contrast to other ways of assessing WTP to get climate change adaptation information. The Contingent Valuation Method (CVM) and Choice Experiments were discovered to be the most widely employed techniques, however there was significant variance in how these techniques were used and the outcomes that were attained.

Jiao et al. (2020) compared the CVM, Choice Experiments, and Open-Ended Contingent Valuation methods for estimating WTP for climate change adaptation information in China. They found that the Open-Ended CVM method was the most reliable and valid, as it allowed respondents to provide their own value estimates rather than being limited by a pre-determined set of response option.

Dikgang et al. (2015) compared the CVM and Choice Experiments methods for estimating WTP for climate change adaptation measures in South Africa. They found that both methods produced reliable estimates, although CVM method was easier to administer and had a higher response rate.

In contrast to methods that focus on respondents' disclosed preferences, this method emphasizes the respondents' expressed preferences (Chatterjee et al., 2017). The CVM technique can yield useful data regarding the demand for knowledge on climate change adaptation, including how much people are ready to pay for it and what influences their

WTP (Zhang et al., 2020). CVM offers a broad range of applied and methodological case studies including a plethora of various public resources and natural resources (Loomis, 1990).

Different CVM designs are utilized to estimate WTP (Alvarez-Farizo, 1999); Loomis (1990) noted that the most popular designs are open-ended (OE) and dichotomous choice (DC). Loomis (1990) advocated OE designs nonetheless, adding that OE designs perform better than DC ones due to temporal stability.

2.2.2. Data Analysis

Farmers' perceptions were used to calculate the effectiveness of climate change dissemination channels. Effectiveness (*y)* was calculated as:

$$Effectiveness(y) = timeliness\ (x1) + accuracy(x2) + reliability\ (x3) + comprehensablity\ (x4) + user\ friendliness\ (x5) + credibility(x6) + informativeness(x7) + availability(x8).$$

The Ordinary List Squares (OLS) model was used to analyzed the factors that influenced the amount the farmers were willing to pay to access climate change adaptation information. The OLS model can be represented by the following formula:

$$WTP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_p X_p + \varepsilon$$

From this formula: WTP represents the dependent variable, i.e., the willingness to pay for climate change adaptation information. β_0 is the intercept term, representing the constant or baseline value of WTP when all explanatory variables are zero. X_1, X_2, ..., X_p represent the p explanatory variables (also known as independent variables or predictors). β_1, β_2, ..., β_p are the respective regression coefficients that quantify the impact of each explanatory variable on WTP. ε represents the error term, accounting for the unexplained variation in WTP not captured by the explanatory variables.

The following independent variables were hypothesized to impact the smallholder farmers WTP:

Farm characteristics: Variables such as farm size, farm type (e.g., crop farming, livestock farming), and years of farming experience.

Socio-economic variables: Variables related to farmers' socio-economic status, such as income, education level, and access to credit or financial resources.

Perceptions and attitudes: Factors influencing how farmers feel about climate change, including perceived dangers, awareness of its effects, and the efficacy of adaptation strategies.

Information sources: Availability of agricultural extension services, participation in farmer networks, or exposure to climate change training programs are examples of factors related to the source of information about climate change that farmers can access.

External factors: Variables related to external factors that may influence WTP, such as government policies or support programs, the availability of adaptation technologies or infrastructure, and the presence of market incentives.

3. Results

3.1.Socio-Economic Characteristics of Sampled households

Table 1: Household Socio-Economic Characteristics

Variable	Unit	Kitui ($n = 160$)	Machakos ($n = 147$)	Makueni ($n = 136$)	Whole sample ($n = 443$)
Male-headed households	Percentage	73.1	71.4	80.9	**74.9**
Farm size	Acres	4.99	2.04	3.99	**3.99**
Household Size	Number	5.61	4.96	5.68	**5.42**
Marital Status	Percentage				
Married		75.6	81.0	82.4	**79.5**
Single		4.4	4.1	3.7	**4.1**
Widowed		18.8	15.0	11.8	**15.3**
Divorced		1.3	0.0	2.2	**1.1**
Age of Household Head	Years	51.81	54.68	52.31	**52.92**
Farming experience	Years	21.58	24.29	20.70	**22.22**
Education Level	Percentage				
None		6.9	4.8	4.4	**5.40**
Primary		53.8	42.2	53.7	**49.90**
Adult education		0.0	0.0	0.7	**0.20**
Secondary		25.6	37.4	29.4	**30.7**
College/University		13.8	15.6	11.8	**13.8**
Main Income	Percentage				
Salaried Employment		9.4	21.8	12.5	**14.40**
Farming		48.8	47.6	60.3	**51.9**
Business		14.4	10.9	4.4	**10.2**
Casual Labor		25.6	19.7	22.8	**22.8**
Child Support		1.3	0.0	0.5	**0.50**
Remittances		0.6	0.0	0.2	**0.20**
Source of Labor	Percentage				
Family		56.9	53.1	57.4	**55.8**
Hired		3.8	12.9	4.4	**7.0**
Family & Hire		39.4	34.0	38.2	**37.2**
Land Ownership	Percentage				
With Title deed		34.4	34.0	28.7	**32.5**
Without Title Deed		35.6	27.9	39.7	**34.3**
Leased		0.6	0.0	3.7	**1.4**
Inherited		29.4	38.1	27.9	**31.8**
Group Members	Percentage				
Farmer Association		72	63	58	**65.0**
Credit Association		90	40	57	**66.0**
Climate Field School		18	36	27	**26.0**
Self Help Groups		89	41	56	**65.0**
Business Cooperatives		05	00	03	**3.0**

Source: Author (2021)

The results as indicated in table 1 represent the household socio-economic characteristics. The results showed that 74.9% of the households were predominantly male. The average age of the household head was 52.92 years with 22.22 years of farming experience. This shows that most of the small farmers in the study area are older and have been active in the agricultural industry for

a considerable period of time. As reported by Heide-Ottosen and Vorbohle (2014), the number of elderly farmers in rural areas in developing countries is increasing faster than in developed regions and reaching absolute levels. Compared to urban areas, rural areas are disproportionately home to older people. From the report, evidence of aging in agriculture shows that in sub-Saharan Africa, more than one-third of agricultural holders are over 55 years of age.

These findings support Muema et al. (2018), Murithi et al. (2021), Mutunga et al. (2018), and Onyango et al. (2021) who found out that the average age of farmers with more than 15 years of farming experience was 53 years.

The average household size was 5.42 persons and household heads were mainly married persons which was consistent with Murithi et al. (2021) and Kenya National 2019 Census findings. These findings showed that the household size in these regions was between three to six members and averaged 5 persons per household (KNBS, 2019). The extended family provides the labor force involved in agricultural production. Family farming plays a key role in agriculture and food production, particularly in SSA. As indicated by Moyo (2016), about 85 percent of investment in terms of financial savings and labour value applied to agriculture in SSA is accounted for by family farms.

The results showed that most of the families depended on agriculture as the main source of livelihood. The study reveals that 51.9 percent of households are dependent on agriculture as a source of livelihood both through labour and income. This large family provided convenient labor force which was deployed in climate change adaptation activities like water harvesting, land preparation. This is evident from a study by Mutunga, Ndungu and Muendo (2018); Murithi et al. (2021).

The average farm size of households was 3.99 acres owned by inheritance at 31.8%, with title deeds and at 32.5% and 34.3% without title deeds. This result is similar to Kenya's Ministry of Agriculture, Livestock and Fisheries (MoALF, 2016). Secure land tenure is critical when addressing challenges and implementing climate change adaptation strategies. The IPCC report confirms that land tenure is a key parameter in any discussion of land-climate interactions. Farmers who own their land are important in protecting existing forest and soil cover to help reduce land degradation through erosion (Kukkonen and Pott, 2019).

Majority of household heads have at least primary school education (49.90%) while 44.5% have post-primary education. This confirms the findings of the World Bank (2020) that the literacy level in Kenya was 82%, with a lower percentage that transitions to the post-primary level. Farmers with low levels of literacy may have limited access to information distributed through non-vernacular channels and print media such as farmer magazines, pamphlets, etc. United Nations Climate Action research has found that education can motivate people to change behaviour and attitudes and help them make informed decisions. In the case study, farmers with higher levels of education are better equipped to make decisions related to climate change adaptation.

Farmers in the three counties participated effectively in farmer associations (65%), credit and loan associations or table-banking (66%), and self-help groups (65%). From the findings by Ogunli et al. (2021), farmers' participation in initiatives to access social capital, such as farmer groups, among other organizations, increases their chances of accessing and adapting to climate change. Farmers share more insights on farming opportunities, adaptation information sources and implementation.

3.2. Smallholder farmers' willingness to pay (WTP) to access climate change adaptation information

Table 2: Smallholder farmers willingness to pay (WTP)

Variable	Unit	Kitui (n=160)	Machakos (n=147)	Makueni (n=136)	Total (n=443)
Willingness to Pay (WTP)	Percent	73.8	82.3	75.7	**77.2**
Mode of Payment	Percent				
Cash		51.9	41.5	50.0	**47.9**
Kind		21.9	40.8	25.7	**29.3**
Payment in Cash	Kenyan shillings (Ksh)	1,203.37	1,716.39	1,498.53	**1,445.66**
Payment in Kind	Percentage				
Maize					**51.6**
Beans					**7.1**
Green grams					**32.5**
Tomatoes					**1.6**
Pigeon Peas					**0.8**
Cowpeas					**5.6**
Sorghum					**0.8**

Crop Yield	**Percentage of WTP**	**Average (Kilograms)**
Maize	**51.6**	**66.97**
Beans	**7.1**	**58.89**
Green grams	**32.5**	**38.51**
Tomatoes	**1.6**	**70.00**
Pigeon Peas	**0.8**	**50.00**
Cowpeas	**5.6**	**39.14**
Sorghum	**0.8**	**50.00**

Source: Author (2021)

The majority of the smallholder farmers (77.2%) were willing to pay to access climate change adaptation information in South-Eastern Kenya. Out of these farmers, 62.05% were willing to pay in monetary form while 37.95% in kind, through the provision of farm produce (Livestock and farm crop produce). The average amount in cash farmers were willing to pay was Kenyan Shillings (Ksh.) 1445.56 per year. WTP in kind was distributed among different crop yields that the farmers were willing to offer as their mode of payment. Fifty-one-point six percent of the farmers were willing to pay through offering maize yield in facilitating the dissemination of climate change adaptation information. Farmers were willing to contribute an average of 66.97 kg of maize which translated to Ksh. 2013.56 per year based on the current market wholesale price of Ksh. 2,706 per 90 kg bag of maize according to (NCPB, 2021).

The farmers were asked about their reasons for willingness to pay to access climate change adaptation information. Fifty-eight percent of farmers who were willing to pay indicated that the information was beneficial in supporting their farm investment decisions. The farmers' unwillingness to pay primary reason was that they believed such information to be a public good that should be provided free by the government. This was constituted by 12.6% of the farmers. Similarly, Farmers claimed to be unable to pay for such information at 19.4%. This can be associated with the limited amount of income generated by farmers who depend mostly on farming as their only source of income.

Table 3: Justifications for smallholder farmers willingness to Pay

Reasons for willingness to pay	**Kitui**	**Machakos**	**Makueni**	**Average**
Beneficial information	59.4	47.6	67.6	58.2
It should be provided free	14.4	10.9	12.5	12.6
Unable to afford	15.0	34.7	8.1	19.2

Source: Author (2021)

3.3. Factors influencing smallholder farmers' willingness to pay to access climate change adaptation information in South – Eastern Kenya

Table 4: Factors that influence farmers WTP to access climate change adaptation information in South Eastern Kenya

Dependent Variables: Smallholder farmers' willingness to pay to access climate change adaptation information			
Independent Variable	Coefficient (β)	Std. Err (θ)	P
Household Head, Education Level	0.398	0.2073	0.051 **
Gender	0.105	0.1634	0.521
Age	-0.030	0.0075	0.000 ***
Household Size	-0.018	0.0129	0.531
Farm Size	-0.004	0.0137	0.746
Income source	-0.139	0.0723	0.052 **
Farming Experience	0.010	0.0069	0.135
Understanding Climate Change Adaptation	0.761	0.1608	0.000 ***
Access to Climate change Adaptation Information	1.027	0.4748	0.031 **
Information Access Period	0.024	0.0118	0.042 **
Climate Change Adaptation Information Usage	0.753	0.1708	0.000 ***
Group Membership	- 0.285	0.1891	0.132
Access to Market	0.480	0.1550	0.002 ***
Effective Dissemination of Information	0.164	0.0434	0.000 ***

*Note: Number of observations: 443 households, Omnibus test: Likelihood Ratio χ^2 = 69.283, significant at 1% level (p = 0.000). ***, ** and * represents 1%, 5% and 10% significance level respectively.*

The empirical results indicated in Table 4 above reveal that education level, age, the main source of income, understanding, and access to climate change adaptation information, the period of access, access to market, and the effectiveness of the climate change adaptation information had a statistical significance in determining farmers' WTP. Education level was significant at 10% level, had a positive correlation with the farmers WTP. Farmer's age at a significance level of 1%, influenced smallholder farmers' WTP, however, it had a negative correlation with WTP. The household's main source of income was significant at 10% with a negative correlation to WTP for climate change adaptation information. As evident from the findings of the study, 19.4% of the respondents stated that they were unable to afford in support to their non-willingness to pay for climate change adaptation information. Based on the annual per capita income of households in the region of 2,898 US Dollars (World Bank Group, 2019), households tend to use this income on consumption rather than production. Significant at 1%, understanding and use of climate change adaptation information which was positively correlated with WTP, demonstrated that increased awareness and utilization of climate change information by smallholder farmers increased their WTP. Effective dissemination of Climate change Adaptation Information was significant at a 1% significance level. This implied that increased effectiveness of climate change adaptation information increased farmers' willingness to pay. The period of access to climate change adaptation information was significant in explaining farmers' WTP. Together with information utilization, which was significant at a 1% significance level with a positive correlation to WTP, it illustrated that experience in access and utilization of the information had a great role in influencing farmers' WTP.

4. Discussion

From the descriptive results of the study, farmers stated their willingness to pay to access climate change adaptation information. This shows that the farmers are generally aware of climate change and the need to adapt to the changes as shown by Kitinya (2012); Lumosi et al., (2016); McGahey & Lumosi, (2018); Onyango et al. (2021) that found out that farmers are perceptive of the climate variability and pursue means to adapt to the new climatic conditions. The results also revealed the extend of value the farmers accorded the information received based on their willingness to pay amount.

From the empirical results, education level, age, the main source of income, understanding, and access to climate change adaptation information, the period of access, access to market, and the effectiveness of the climate change adaptation information had a statistical significance in determining farmers' WTP. These findings were similar to the findings by Ouédraogo et al., (2018) who found that several socioeconomic and motivational factors such as gender, age, education level, and awareness of climate change information affected the farmers' WTP for Climate information service in Burkina Faso.

Similar to the findings by Devkota et al. (2014); Ouédraogo et al. (2018); Zongo et al. (2015), an increase in farmers' education levels influenced farmers' WTP for climate change adaptation information. It may be understood that with the number of years of education increasing, it increases the ability of farmers to understand the importance of climate change adaptation information in agricultural decision-making.

As farmers increase in years, the study findings have shown that they tend to be risk-averse and desist from taking up new challenges to tackle climate change variability, hence would rather not invest in paying for climate change adaptation information. This finding corresponded to those of Ouédraogo et al. (2018) which implied that the older the farmer, the less willing they were to pay for climate change adaptation information but contradicted with Mabe et al. (2014); Zongo et al., (2015) in Ghana and Burkina Faso which stated that WTP tends to increase with an increase in farmer's years. The household's main source of income was significant at 10% with a negative correlation to WTP for climate change adaptation information. This finding contradicted findings by Aydoğdu et al., (2020); Doğan et al. (2020); Mabe et al. (2014), whose conclusion was that farmers with non-agricultural income tend to have a lower WTP probability. Instead, this study showed that farmers' over-reliance on farming as a source of income reduces their WTP. It may be that farmers with alternative sources of income would have more to spare for climate change adaptation information to strengthen farming and increase their food security situation. Whereas, farmers relying on farming as the only source of income had a low discretional income to invest in climate change adaptation information. As evident from the findings of the study, 19.4% of the respondents stated that they were unable to afford in support to their non-willingness to pay for climate change adaptation information. Based on the annual per capita income of households in the region of 2,898 US Dollars (World Bank Group, 2019), households tend to use this income

on consumption rather than production. Significant at 1%, understanding and use of climate change adaptation information which was positively correlated `with WTP, demonstrated that increased awareness and utilization of climate change information by smallholder farmers increased their WTP. Thus, to improve farmers' WTP, their awareness of what climate change adaptation was and its importance was crucial, and so was promoting the application of the information on-farm decision making. As illustrated by Kibue et al. (2016), awareness and recognition of variabilities in climate are crucial for adaptation and adoption of adaptation initiatives by farmers. Similarly, Devkota et al. (2014); Mabe et al. (2014); Zongo et al. (2015) all agreed that farmers who had access to climate change adaptation information and for a long time were more willing to pay. Effective dissemination of Climate change Adaptation Information was significant at a 1% significance level. This implied that increased effectiveness of climate change adaptation information increased farmers' willingness to pay. The period of access to climate change adaptation information was significant in explaining farmers' WTP. Together with information utilization, which was significant at a 1% significance level with a positive correlation to WTP, it illustrated that experience in access and utilization of the information had a great role in influencing farmers' WTP. Just as evident by findings from Devkota et al., (2014); Mabe et al. (2014), farmers need to experience and experiment with the information to gain the confidence to pay.

5. Conclusion

Smallholder farmers in the study area expressed a desire to pay to access climate change adaptation information. The amount of farmer WTP was directly associated with their understanding of impacts of climate change, the effectiveness of the information, the age of the farmers, the period or experience in farming as well as their level of literacy. It can also be noted that the farmers with multiple source of income were highly interested in investing in farming through use of adaptation information on climate change. Also, a number of farmers who were not willing to pay acknowledged the importance of this information, but majority were financially constrained.

6. Recommendation

Based on the findings of the study, the following recommendations were made: -

That the national government through the local government should provide incentives meant to create awareness and enhance access to climate change adaptation information among the smallholder farmers.

That programs such as Climate Field schools should be set up and facilitated to increase farmers' access and understanding of climate change adaptation information. Besides, farmers should be encouraged to organize themselves into groups to enable easy and cheap access to this information.

That the meteorological and advisory development programs should endeavour to increase information effectiveness. Farmers will be willingness to pay to access this information as it informs their agricultural investments

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