climate

MDPI

Article

Factors Influencing Rural Women's Adoption of Climate Change Adaptation Strategies: Evidence from the Chivi District of Zimbabwe

Johanes Belle, Tendai Mapingure and Solomon Temidayo Owolabi *

Faculty of Natural and Agricultural Sciences, Disaster Management Training and Education Center for Africa, University of the Free State, P.O. Box 339, Bloemfontein 9300, South Africa; belleja@ufs.ac.za (J.B.); tendaimapingure@gmail.com (T.M.)

* Correspondence: solomonowolabi11@gmail.com; Tel.: +27-788-357-662

Abstract: The socio-cultural leadership system in rural communities of developing countries is generally gender-biased, thus rendering female-headed households (FHHs) vulnerable to climate change risk. This study explored the factors influencing FHHs' adoption of a climate change adaptation strategy (CCAS) in Chivi District, Zimbabwe. We used a multistage sampling technique and logistic regression to evaluate 107 women household heads' livelihood and their decision to adopt the CCAS in Ward 25 of the Chivi District. The results show that the age of the female head significantly influenced the CCAS decision (R^2 = −0.073), along with marital status (R^2 = 0.110), agricultural training (R^2 = 0.133), club membership (R^2 = 0.084), and farm size (R^2 = 0.014). Access to formal agricultural training plays a prominent role. At the same time, the institutional framework showed variations and laxity on the part of the local government, as access to extension services varies significantly. In addition, education level was reported to have an insignificant (p = 0.098) influence on CCAS adoption. Overall, multiple institutional and socio-economic factors are essential in influencing CCAS decisions. Hence, central and local governments are encouraged to improve outreach strategies on deploying supporting tools, extension agents, and vital stakeholders for strategic information dissemination to sensitize rural dwellers and community leaders on women's and FHHs' crucial role in food security and their resilience to climate change risk. Moreover, the educational syllabus can be enhanced at all rural education levels to reshape the norms of future generations against the customary impact of old age on farming approaches and to encourage women's participation in decision making and interventions, particularly those sensitive to their societal contributions.

Keywords: climate change; adaptation strategies; female-headed household; logit model; Sub-Saharan Africa

check for updates

Citation: Belle, J.; Mapingure, T.; Owolabi, S.T. Factors Influencing Rural Women's Adoption of Climate Change Adaptation Strategies: Evidence from the Chivi District of Zimbabwe. *Climate* **2024**, *12*, 191. https://doi.org/10.3390/cli12110191

Academic Editor: Nir Y. Krakauer

Received: 22 October 2024
Revised: 10 November 2024
Accepted: 18 November 2024
Published: 20 November 2024

1. Introduction

A significant dimension of future food insecurity is much more likely to come from the farming proportion of the female-headed households [FHHs] severely affected by patriarchal system parity should their climate change adaptation decision be left unattended to [1]. The stronghold of gender marginalization in rural communities and its adverse role against the effectiveness of climate change adaptation is already a global discourse [2]. More than two-thirds of the world's population in rural areas is female farmers and laborers, and 90% of them are from SSA [3,4]. Meanwhile, FHHs are estimated at 25% globally with significant regional variations, especially in the Sub-Saharan Africa (SSA) countries, where they account for approximately 45% [4]. These fractions represent a substantial percentage of the global agricultural goods and service providers affected by social, political, cultural, legal, and institutional inequality. Unsustainable farming practices, inadequate climate change information, and the lack of suitable technologies to alleviate climate change impacts are notable issues in rural communities [5,6]. As a result, several initiatives such as

drought-driven agricultural policy and irrigation schemes, climate-smart agriculture [7], national adaptation plans [8], capacity-building initiatives [9], the improvement of early warning systems, livelihood diversification [10], and community-based natural resource management [11,12] were devised to lessen the impacts. Financial constraints, inequitable distributions of climate change amelioration resources, inadequate skills, environmental challenges, and infrastructure deficiencies are the general barriers to communities in SSA, with socio-cultural barriers ranking higher above others in rural communities [13]. In recent times, several pieces of literature have attested to the severity of socio-cultural obstacles to climate change adaptation strategies in rural communities, with FHHs at the receiving end among other vulnerable groups.

A climate change adaptation strategy (CCAS) entails plans and human development to cope, mitigate, and recover from the numerous pressures and harms caused by climate change and take advantage of the opportunities associated with its effects [14,15]. CCAS measures vary spatially across human society depending on political, socio-economic, and biophysical factors and their interdependencies [16]. A vital consideration is the extent of adoption of the CCAS, and this is a topical issue among researchers across different academic fields due to its influence on the adaptive capacity to climate change. Adaptive capacity refers to the behavioral changes, resources, and technological advancement engaged to accommodate the unavoidable impact of climate change in a positive way to strengthen resilience to its harmful outcome [14]. Adaptive capacity varies across social groups due to numerous factors, including the generic adaptive capacity, the nature of the hazard, vulnerability extents, economic well-being, health, education status, access to critical information, and social (in)equities [17,18]. Female-headed households (FHHs) refer to household units sustained and controlled by women, possibly due to single motherhood, widowhood, husband separation, or a husband's financial incapability [1]. Saad et al. [1] outlined the following categories as the basic demographics of female-headed households: FHHs with children only, FHHs with women living alone, FHHs with no husband but with other adults (men and women) and children, FHHs with a husband and children, FHHs with extended family such as grandparents and siblings, and FHHs with non-family members but friends and children. In some SSA countries, female-headed households are faced with severe challenges due to the societal norms and culture that are inattentive to female leadership and gender equality [19,20]. As a result, households headed by females are often at a disadvantage due to discrimination, gender stereotyping, and unequal gender access [1,6].

The situation is more pertinent in rural communities, where patriarchal masculinity is the central structure of the homestead, with power-sharing, access, controls, resource/property rights, and benefits of opportunities incontestable along the gender line [21,22]. In such an environment, the confinement of women to subordinate roles accounts for their underrepresentation in political power and as stakeholders, especially their role in climate change initiatives [23]. The dissonant legal parity on the side of the women is a substantial basis for female-headed households' insecurity, oppression, and injustice, among other multiple stressors, including political, social, economic, and environmental stressors [24]. As a result, the resilience and adaptation strategies of FHHs have been inhibited by a lack of access to assets [25], economic disparities and dependencies [24], increased workload [26], apprenticeship and educational barriers [26,27], and health risks and gender-based violence [28,29]. With the substantial contribution of women to agriculture, gender inequality against FHHs may begin to impact SSA severely. The results are already hitting deep regarding several socio-economic problems, such as high food insecurity, the long-term trend of declivity of income per capita, the drastic reduction in the human development index, and rising poverty at the household and national levels [30].

While keeping the interest on FHHs, the recent surge in gendered CCAS research is an essential highlight of the sensitivity of gender issues in climate change coping capacity. So far, perspectives of gendered CCAS research include livelihood diversification [31–33], gendered CCAS advocacy and sensitization [21,34,35], community-based adaptation [36,37],

health impacts [38], and migration cases [39,40], among others. Despite several research attempts to advocate for gender mainstreaming, other community-based research tends to be indifferent about the impact of gender inequality on CCASs. For example, Jiri et al. [41], in a study undertaken in Masvingo Province, Zimbabwe, noted no significant difference in gender concentration for adopters and non-adopters of CCASs. Contrarily, Nyathi et al. [42] identified the anecdotal evidence of disproportionate access to power and opportunities that compounds their adoption of CCAS despite their innovative ability to manage the available resources in Matabeleland in Zimbabwe. Mwadzingeni et al. [43] also reaffirmed that agricultural communities are peculiar when it comes to gendered inequalities with patriarchal influence, ensuring biases in access to land, credit support, and development programs of vital significance in the South Midlands Province of Zimbabwe. Other studies, which include forty-two years (1980–2021) of investigations into the general understanding and dominant narrative around climate change management in Zimbabwe [44], CCAS perceptions among smallholder schemes, and knowledge on climate trends [45], showed that gender biases are a central issue in the country. Overall, while education level, farmland soil fertility, and critical asset ownership are vital considerations for the two genders, FHHs lag significantly in credit access [46] and cropping land availability [25]. Using boosted regression trees, Pike et al. [16] reported that the level of adaptive capacity is significantly lower for women-headed households compared to their male counterparts for factors such as agency, low ecosystem dependence, occupational diversity, education, material condition, and needs satisfaction. Based on the participatory research approach, Nnadi et al. [47] posited that migration, participation in human capital development, and livelihood diversification are significant challenges for women's responses to climate change and its adaptation. Notwithstanding, numerous publications showed that women are more resilient to climate change than men [38–40]. However, with the increasing feminization of agriculture in SSA, climate change impacts might constitute a significant threat to food security and socio-economic activities due to the patriarchal system's stronghold in agrarian rural communities [48].

To this end, this study builds on the research of Jiri et al. [41], who explored CCASs among smallholder farmers using the resilience to vulnerability model in the Chiredzi District, a highly urbanized center in the south of Masvingo Province, Zimbabwe. However, the novelty of this study lays in hybridizing three disaster management frameworks with a specific focus on FHHs in Chivi District, a rural community in the north of Masvingo Province, Zimbabwe. The disaster management framework includes the pressure and release (PAR) model, the sustainable livelihood framework (SLF), and the social capital theory (SCT). This is due to the rationale that drought impact, which is a slow-onset disaster, could constitute a substantial reduction in the agricultural productivity of FFHs should CCAS non-adoptions persist and continue. The PAR model transforms root causes of dynamic pressure into unsafe conditions. The "dynamic pressure" encompasses institutional inadequacies and environmental risk; the "root cause" refers to the socio-political restraints and ideologies, while the "unsafe conditions" are the fragile economy, social vulnerability, and the public (Figures 1–3) [49]. The SLF model enables the quantification of livelihood assets of vulnerable groups, their potential constraints impacting the assets, and the roles of social structures and processes in abating or amplifying the impact [50]. The livelihood assets include human, natural, social, financial, and physical capital. The SLF also enables the investigation of potential constraints that entail shocks, trends, and the seasonality of climate change-related hazards. The social structures include the tiers of government and the private sectors, while the social processes are the laws, policies, culture, and institutions [50]. The SCT model is included to bolster the significance of social ties, cooperative trust, reciprocity, and shared rules in enhancing the common goals, strengthening human capital and development, and acquiring tangible welfare support despite existing among the SLF livelihood assets [51]. In doing so, the priority of the Sendai Framework entails the understanding of disaster risk and guides the selection of the most vulnerable group, the rural FHHs, and the high-risk area in terms of exposure to

agricultural drought, which is Chivi District, Zimbabwe. This is pertinent in Chivi District, where most rural dwellers depend on rain-fed agriculture despite the "deficient" annual rainfall and the severity of drought [52]. With this, the research is guided by the following research questions:

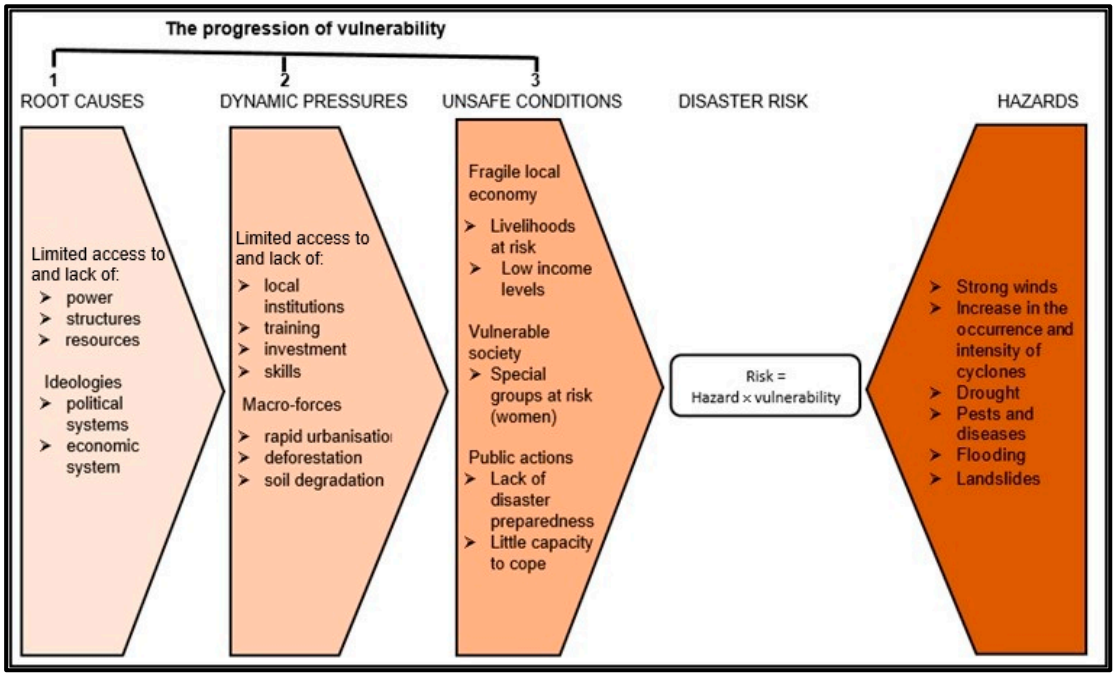

Figure 1. The pressure and release (PAR) model; involving the integration of hazard drivers and the progression of vulnerability, comprising of the (1) root cause, (2) dynamic pressure, and (3) unsafe condition [49].

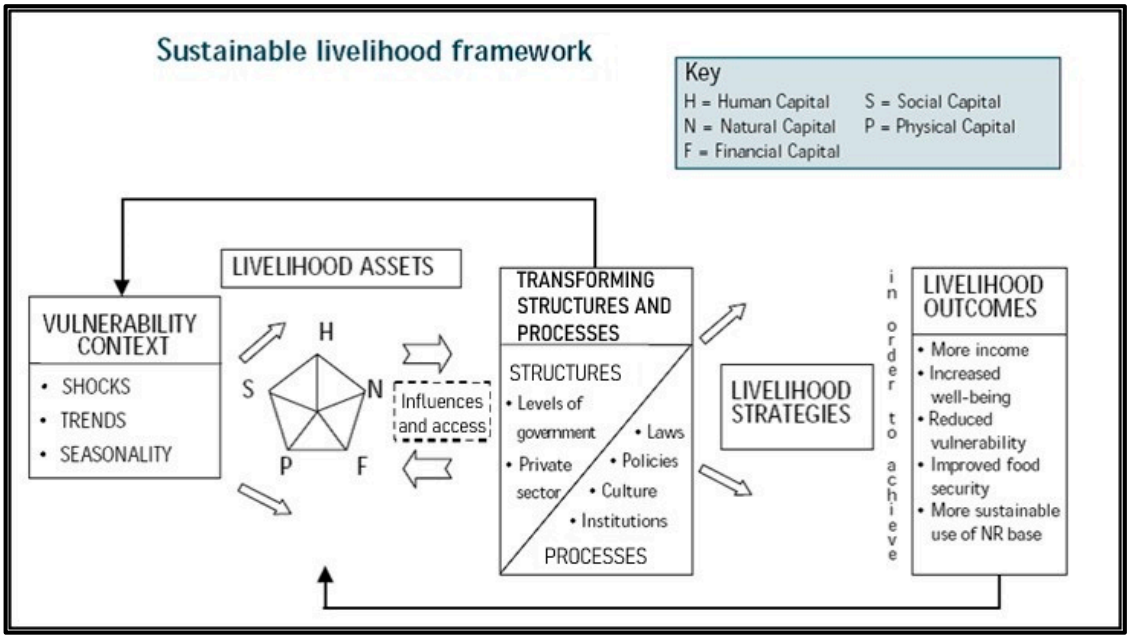

Figure 2. The sustainable livelihood framework [50].

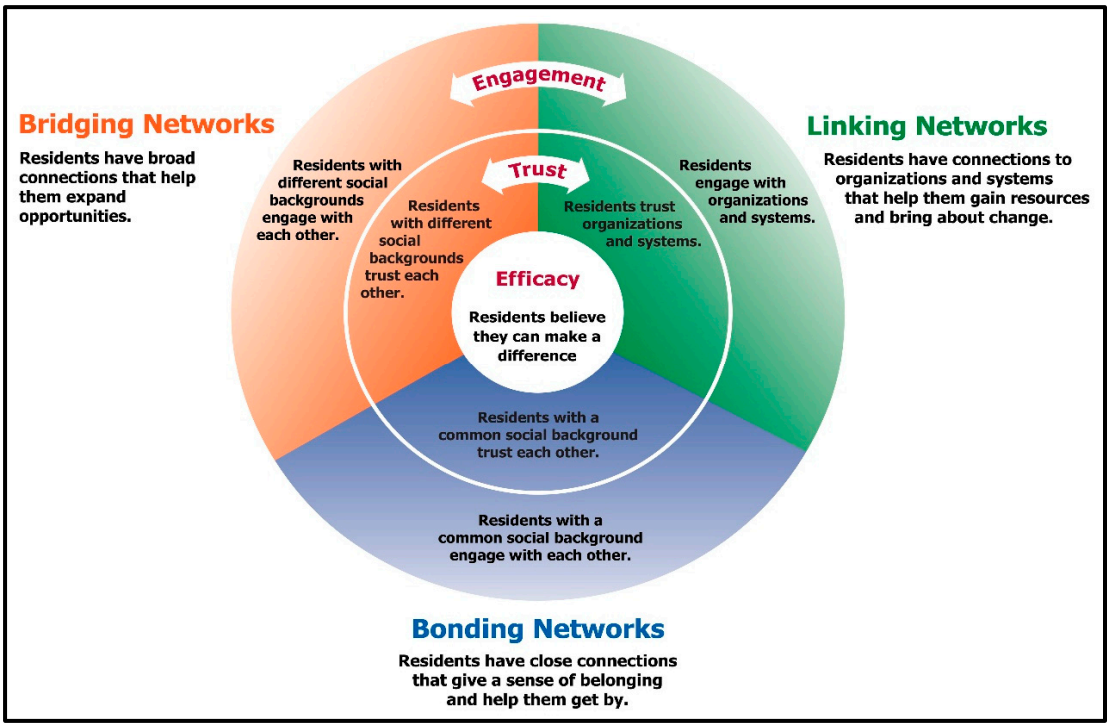

Figure 3. Components of social capital theory [51].

What is the core factor determining women's awareness of climate change risk?

What are the influential factors driving the popularity of FHHs' adoption of CCASs?

By addressing these questions, this study examines the disaster risks associated with FFH farmers based on their choice of adaption options in Chivi District, Zimbabwe. In doing so, this study provides a better understanding of the tactical approach to sensitizing vulnerable women to the risk of climate change and the combination of factors that enhance the anticipated response to adopting adaptation strategies for climate change. Empirical modeling enabled the visualization of rural women's viewpoints on climate change risk and the substantial considerations that empower their understanding of the essence of the adoption strategies.

2. Materials and Methods

2.1. Description of the Study Area

Chivi District (CD) falls under agroecological regions IV and V, characterized by semi-arid conditions [53,54], limited rainfall, with an average annual rainfall of approximately 530 to 545 mm, low crop output, and food insecurity [53,55]. CD is located in south-central Zimbabwe, in the north of Masvingo Province. The district spans across latitude 19°57′58″ S to 21°07′52″ S and longitude 30°03′08″ E to 31°02′27″ E, about 3510 km^2, at an elevation of 811 m above sea level [53] (Figure 4). Major soils in CD are primarily made from coarse-grained granite and include chromic luvisols, ferric luvisols, and eutric regosols, described as infertile [54]. Baobab trees are known to be drought-resistant, and thorn bushes are typical vegetation in CD. CD is found in the drought-prone region of the country, occupied by subsistence farmers working for their sustainable livelihood. The farming system in the area is mainly mixed farming, consisting of maize, small grains, and livestock [55].

CD is inhabited by approximately 172,979 people, comprising 32,757 households as of April 2022 [56]. The demography of CD indicates an aging population, as many young individuals migrate for work opportunities in urban areas or neighboring countries. Several households are large, often including extended family members, which influences resource distribution and constitutes the essential labor for agricultural activities [56]. Other vital

socio-economic engagements include the collection of firewood and the creation and selling of traditional artifacts [55]. The most common source of information in CD is through the local government, community meetings, educational institutions, training programs, non-governmental organizations, publications, research studies, media outlets, and social networks [55].

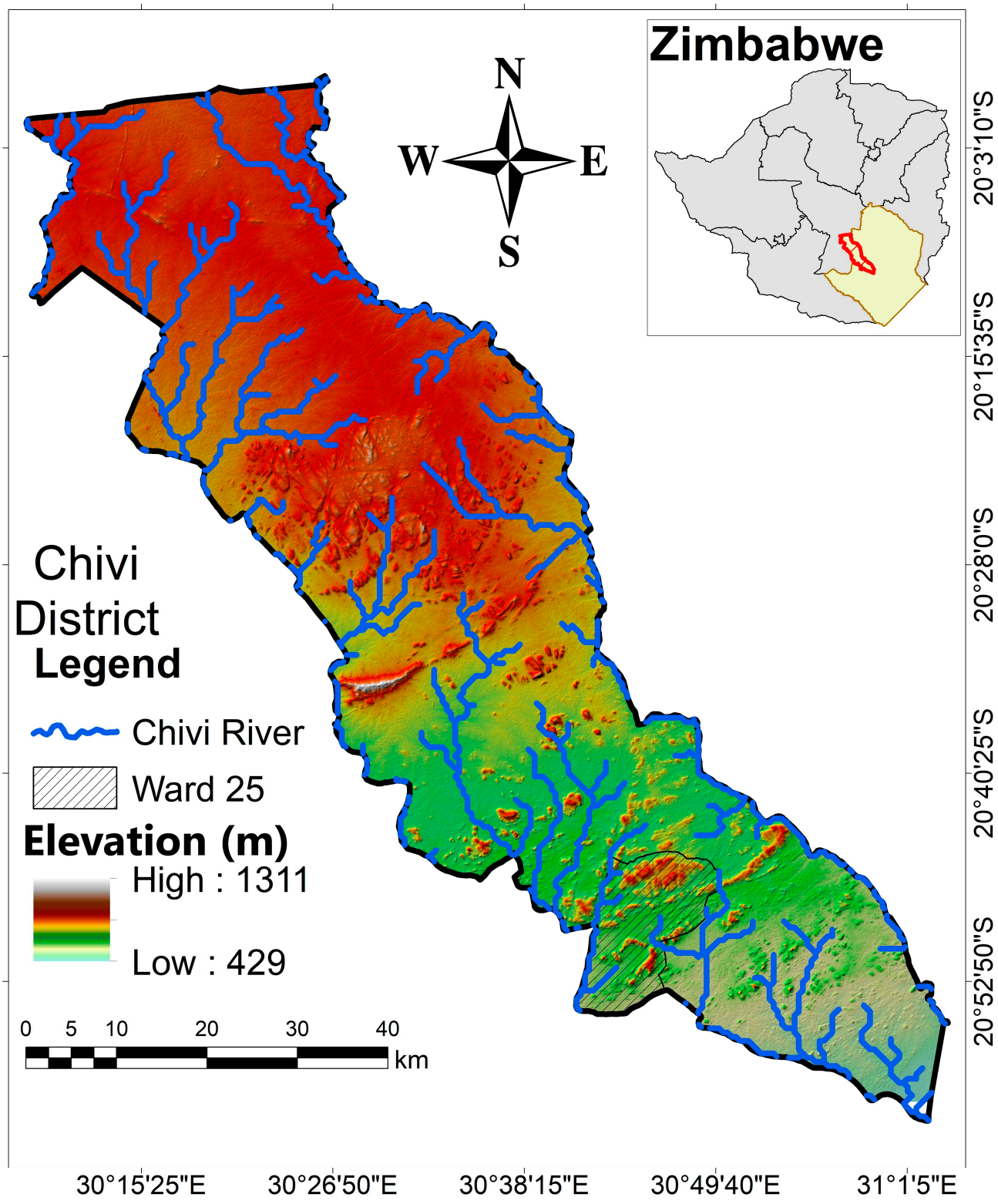

Figure 4. The study area map showing the elevation, drainage, and location of Ward 25 in Chivi District.

2.2. Research Design Empirical Modeling

This research used mixed method research (MMR), a combination of qualitative and quantitative methods, to provide an exploratory and explanatory ground for the study. The research developed a structured questionnaire guided by Creswell and Miller [57] and obtained responses from 107 out of 120 female household heads administered to Ward 25, Chivi District. As of 2018, when the survey was carried out, Ward 25 comprised 1070 households of the 10,893 population, with women making up 55% and men 45%. The female-headed household to male-headed household proportion is 58% (621) to 42%. Hence, the sampling intensity is 17% of the entire population of FHHs of the ward [56]. The respondents were selected using a stratified random sampling procedure. Before embarking on the qualitative sampling, this study considered the principle of ethical research, which includes justice, benevolence, and respect for human dignity. Hence, the researchers applied and obtained relevant ethical clearance approval from the University of Free State's General/Human Research Ethics Committee (UFS-HSD2020/1710/0512). Imperatively, the researchers communicated the ethical principles, study protocol, and research purpose in detail to the research participants in Shona and Ndebele (their local languages). This research engaged crucial informant interviews comprising 10 participants who are leaders and active members of various social groups (clubs, religious centers, insurance, and widows), focus group discussions, and observations to triangulate the sampled data and to ensure adequate interpretation, corroboration, refuting, and model validation. As a result, unstructured questions were presented for the focus group discussion to consider their views.

2.3. Empirical Modeling

This study used the logit model to analyze the dominant options of CCASs in rural communities. Guided by a literature review [58,59], three categories of explanatory variables were used for the study. These were household characteristics, institutional structures available to the households, and broader socio-economic attributes. Adoption refers to the acceptance of progressions and introduction to innovation phases and their usage considerations [60]. In this context, this study interprets adoption as any form of a CCAS embraced by the respondents. Hence, from the perceptions of a binary Likert scale, a respondent is construed as an adopter (user of a CCAS) or non-adopter (non-user of a CCAS). Guided by Schneider and Kubis [61], the logit model specification allowed the examination of the CCAS adoption determinants within the context of the sampled decision-making units. The expected effects of selected determinants on the adoption decision of climate change adaptation strategies are presented and defined in Table 1. The study tested the likelihood of observing the dependent variable (P_i) as a function of independent variables. The independent variables include the age of the respondent, awareness of climate change adaptation strategy options, the gender of the respondent, and experience using the CCAS platforms [62]:

$$P_i = \Pr(Y_i = 1) = \frac{\exp(Z)}{1 + \exp(Z)} \quad (1)$$

Burke et al. [63] also showed that a natural log transformation of (1) will result in (2) and can then further be modified to (3) as follows:

$$In\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \sum_i^n \beta_i X_i + {}_i \quad (2)$$

$$Z_i = \beta_0 + \sum_i^n \beta_i X_{i\prime} + {}_i \quad (3)$$

where the components are as follows:

- P_i is the probability that the ith respondent is an adopter of climate change mitigation strategies (Y_i = 1).
- β_0 is the intercept, β_i is the slope parameters, and X_i's are the independent variables.

Table 1. Description of climate change adaptation strategies.

Variable	Description	Units	Expected Effect
	Dependent Variable		
Choice	The choice made by the respondent (= 1 if adopter)	dummy	
	Independent Variables		
Age of head	Age of the respondent in years. Older generations are more likely to cleave to their experience than younger generations, who are more likely to be influenced by education and evolution. Hence, increasing age of FHHs is expected to demotivate CCAS adoption.	Year	−ve
Marriage	Marital status of female head (= 1 if married). The marriage includes a female head with a migrated husband and an available husband. Marital aspects of an FHH, such as access to power, rights, inheritance, and broader social networks, can potentially motivate CCAS adoption. The single (woman or mother heading a house), the divorced, and the widowed under a patriarchal system are less likely to adopt a CCAS compared to the married. Hence, married FHHs can positively influence CCAS adoption.	dummy	+ve
Distance	Distance to the nearest markets. An increase in distance to the nearest market substantially influences logistics. It strains the gross production cost and reduces participation in community decision-making processes and information exchange that influence CCAS adoption.	km	−ve
Labor availability	Labor availability index for the household. Labor size can influence productivity, efficiency, improved crop management, economic benefits, and increased resilience. Larger households have more members likely to induce diverse adaptation strategies, thus enhancing the FHH and her adaptive capacity.	number	+ve
Membership	Number of social groups of the respondent. Social groups and networks play a substantial role in motivating the adoption of a CCAS through networking, community building, access to resources, social support, and policy advocacy through collective voice. The presence of and increase in such a number fosters access to relevant information about CCAS adoption.	number	+ve
Training	Formal agricultural training (= 1 if yes). Apprenticeship, mentorship, and education level are combined to describe formal training obtainable in rural communities. Training enhances farmers' productivity by improving their knowledge and skill development for varying agricultural practices such as crop rotation, pest management, and sustainable farming methods. It also improves the economic benefits of farming, providing an eye-opening opportunity to sustainable practices and resource management, thus positively influencing CCAS adoption.	dummy	+ve
Extension service	Frequency of access to extension services. Through the provision of scientific guidance, climate information, and adaptation strategies, extension service is expected to influence FHHs positively.	dummy	+ve
Land tenure	Fixed land tenure (= 1 if yes). Length of tenure can motivate the adoption of CCASs by FHHs as short-term access dwindles investment and discourages the motivation for CCAS adoption.	number	+ve
Farm size	Farm size of the household in acres. The farm size indicates the investment size. Bigger farm sizes are expected to influence risk management in the adoption of CCASs by FHHs.	Years	+ve
Information	Number of times exposed to awareness per week. Access and exposition to information could facilitate access to climate-related information and adaptation strategies, thus motivating the adoption of CCASs.	Number	+ve

Note: +ve means positive effect and −ve means negative effect.

As suggested by Hoffman and Duncan [64], in this logit model, the dependent variable, Z_i in (3), is to be interpreted as the natural logarithm of the probability that the choice to adopt climate change mitigation strategies would be made. The model's coefficients

will show the partial effects of each independent variable on the likelihood of a woman respondent using climate change adaptation strategies [65].

3. Results

The analysis across the vital CCAS options adopted by FHHs, including the demographic, socio-economic, and institutional factors and farm characteristics, is presented in Table 2. Several variables in Table 2 show some significant ($p < 0.05$) differences between adopters and non-adopters on climate change adaptation strategies (CCASs). These include the age of the household head, livestock ownership, and crop production, among others.

Table 2. General characteristics of households in the study.

	Adopters	Non-Adopters	Significance—*p* Level
Age of head (average)	41	53	0.013 **
Marital status (married)	68.3	66.1	0.047 **
Education (years)	11.6	10.1	0.098 *
Agriculture training (Yes)	2.1%	1.6%	0.000 ***
Household Characteristics			
Size	7.3	6.1	0.011 **
Income (Rand)	2640.2	2864	0.094 *
Distance to market (m)	2017	2019	0.245
Children < 5 years	3.2	2.7	0.013 **
Farm size (Ha)	3.7	3.2	0.022 **
Grow maize	92.3	74.1	0.000 ***
Grow legumes	54.9	45.7	0.000 ***
Grow cotton	7.9	6.8	0.000 ***
Grow sunflower	1.7	2.2	0.016 **
Cattle owned	61.3	53.9	0.004 ***
Donkeys owned	56.7	46.1	0.007 ***
Chicken owned	65.9	62.8	0.093 *
Sheep owned	76.7	78.1	0.168

Note: * means significant at 10% level, ** means significant at 5% level, *** means significant at 1% level.

The logit regression model estimates the parameters for the decision to participate in the various climate change adaptation strategies available in the community. Table 3 presents the maximum likelihood estimations of the logit model for the factors affecting the adoption of climate change adaptation strategies.

Table 3. Results of the logit model.

Variable	Logit Model		Marginal Effects	
	Coefficient	S.E	Coefficient (R^2)	S.E
Age of head (years)	−1.66 *	0.015	−0.073 *	0.091
Marriage presence	0.98 *	0.127	0.110 *	0.081
Income level	1.04 *	0.03	0.041 *	0.012
Distance from market	−1.11	0.035	−0.031	0.083
Labor availability	2.34 **	0.124	0.055 **	0.167
Social club membership	1.23 **	0.087	0.084 **	0.064
Formal agricultural training	1.56 ***	0.113	0.133 ***	0.018
Access to extension	1.63 **	0.105	0.099 **	0.059
Land tenure (fixed)	1.34 *	0.072	0.088 *	0.031
Farm size (acres)	2.17 *	0.067	0.014 *	0.024
Information access	0.98 *	0.052	0.063 *	0.033
Intercept	3.44	0.271	0.021	0.065

Note: The assessment was conducted at the fiducial confidence interval (95%). * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Expectedly, reception of formal agricultural training has the most substantial influence ($\alpha < 0.01$), while access to the services/guidance of extension workers, membership in a relevant social club, and labor availability are also enormously correlated ($\alpha < 0.05$). The relative degree of association ($\alpha < 0.1$) characterizes the influence of marriage presence, land tenure, access to information, income level, and farm sizes. Only the distance to the market showed no significant correlation, whereas the household's age showed an inverse solid influence on CCAS adoption = 1. The marginal effect showed precisely how a unit increase in the independent variable influences the chance of adopting a CCAS and how each characteristic influences the adoption rate.

According to the results, a household head's old age is more likely to retard, impede, and discourage the adoption of a CCAS and its innovative technologies because aging household heads tend to be guided by their customary or traditional perception. Contrarily, the younger generations of farmers are more likely to influence data distribution on solid adherence to climate change innovative technologies. The younger farmers are relatively more educated and likely to be more informed and refined in their farming approach; hence, they are more flexible to the innovation and experimentation motivated by a CCAS. Focus group discussions asserted the impact of traditional perspectives of older farmers' farming approaches, which is also likely to vary in education and exposure level. With an increase in age, there is a decrease in the chances of adopting climate change technologies by 7.3%. The marginal effect of transportation costs on business profits can explain the negative correlation between distance to markets and the adoption of a CCAS. However, this study proved that market distance is insignificant, possibly because marketing strategies vary for all farmers, as product size and demand level could lessen the inverse correlation of transportation costs.

Expectedly, the substantial positive correlation of farm size and income in adopting climate change strategies is chiefly because of the apparent contribution in insulating the effect of climate change. Higher incomes imply a quicker recovery, a more potent reduction, a more intense leveraging edge, and budgetary control for innovation. Moreover, a larger farm size suggests a more substantial risk-factored agricultural investment, as a high income stream has higher purchasing power. Large farm owners may readily consider and invest in innovations that protect their business compared to small farm owners. Access to general and quality information would likely motivate women household-head farmers to adopt a CCAS.

Similarly, the longer the tenure system and property rights of a farmer, the more farmers are likely to be motivated to invest in innovative technologies of CCASs, considering that long-term investments yield higher dividends. Farmers with a fixed land tenure arrangement have an 8.8% higher likelihood of adopting climate change adaptation strategies than those without a designated land tenure arrangement. As projected by the results, the influence of the marriage of household heads on adopting CCASs in farming activities may be due to the gainful property rights, resources, flexibility, and power compelled by the male party, compared to a single or widow-headed household.

Climate change adaptation and coping strategies are labor-intensive, especially in an agricultural enterprise. Dealing with drought requires greenhouse intervention and an irrigation system; pest and disease outbreaks require constant farm treatment, veterinary interventions, and farm remediation. Flood influx requires drainage control and diversion and soil nutrient protection. Labor availability is, therefore, tremendously vital to the adoption of CCASs, especially in CD, considering the marginal effect of an increase in the likelihood of the availability of labor resulting in a 5.5% chance of adopting climate technologies. Labor scarcity in CD can be linked with the propensity of younger age groups to consider the emigration option rather than being energetic enough for farming activities and settling for making a living in their rural community.

The local economic development initiative has strongly impacted the local governments of CD and some non-governmental organizations (NGOs) in facilitating the formation of social groups. Social groups are the essential informal financial system that

serve as pivotal support systems and sources of financial capital. Social groups range from savings clubs to agricultural cooperatives and funeral societies, where related agriculture and nature conservation members were positively influenced to adopt CCASs. Social groups tend to increase women's flexibility, exposure, and knowledge of climate change information compared to non-social households. Positive peer pressure is another reason farmers learn, imitate, or even compete with each other to reinforce positive behavior. As depicted in Table 2, club membership increases the chances of a farmer adopting climate change adaptation strategies by 8.4%, which is significant at the 5% significance level.

The Knowledge, Attitude, and Practice (KAP) framework postulates that knowledge changes attitude, which changes practice or behavior. The results from this study support this notion for the farmers in the study area. Training in agriculture and access to agricultural extension advice had a far more significant influence on adopting CCASs. Training in agriculture had a 13.3% increase in the chances of adopting climate change technologies, while access to extension services had a 9.9% influence. This finding is not surprising because issues related to climate change and nature conservation form a significant part of agricultural training and agricultural extension advice. The number of times communities are exposed to this information is also substantial and positively related to adopting climate change technologies.

NGOs also had a role in this because they work with government extension officers in the study area to promote smart agriculture and nature conservation. These NGOs include the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and CARE International.

Based on the level of significance (Table 2), this study classified and ranked the relatively impactful factors of CCAS adoption categorically: farm size < income < information < land tenure < marriage. Accordingly, marriage is more likely to influence an increase in property rights, financial resources, and power gain to influence land tenure, access to information, and farm size. Land tenure length strongly influences the application of acquired knowledge, whereas income without information would increase investment loss. Meanwhile, income is a crucial determinant of farm size expansion. The ranking factor of labor availability is at a higher level of significance, which has less influence on membership < access to extension works < access to formal agricultural training.

4. Discussion

The factors influencing climate change risk among women-headed households, mainly farming households, were explored using the logit model. This study shared a similar view with Mahaarcha [66], focusing on farmers in a district in Thailand regarding the strong inverse relation of age and solid correlations of access to extension, land tenure size, agricultural training, and labor size with the adoption of CCASs. Similarly, our findings are consistent with Datta and Behera [67], whose studies focused on CCAS feasibility, effectiveness, and sustainability in India regarding farm size and credit accessibility, though their results varied regarding contact with extension agents. Also, Kibue et al. [68] highlighted the education of the household head, income, contact with extension agents, and information access as CCAS motivators in their study performed in China in correspondence to this study, while it differs on age being a demotivator. Their findings suggest that knowledge is the most tangible and core factor in improving women-headed households' awareness of climate change risk. With the high significance of knowledge-related factors, the institutional framework is the influential factor driving the popularity of women's adoption of adaptation strategies. This comprises formal agricultural training, agricultural extension services, social group initiatives, general CCAS information circulation, and female education.

Earlier studies highlighted that relevant knowledge acquired from institutional channels is a vital determinant of CCAS. It is an early warning system for the household on climatic information, risks, tips against extreme weather, and socio-economic impacts [69,70]. The current study showed tremendous improvement in women's access to relevant knowl-

edge, contrary to the previous findings in CD [52], rural communities of Zimbabwe [71,72], and Africa [17,70,73], where correlation to adaptation decisions was insignificant. This study agrees with other studies in Zimbabwe on the significant positive influence of institutional frameworks on CCASs [71,74].

The resource–network–power nexus of social group membership and marriage is vital for raising the social capital to adopt CCASs [75]. Sammie et al. [45] noted that the organizational structure of social life could serve as a platform for continuous education and dissemination of climate change risk information. This makes the socio-economic tool usable for raising the climate risk mitigation rate among women-headed households, considering its strong positive correlation with the subject matter. The positive outcome derived from this study is consistent with the previous studies [70,76].

Progression in farming characteristics such as labor availability, farm income, and farm size is expected to positively influence climate risk adaptation decisions. At the same time, an increase in market distance is a deterrent. Most of the roads across rural communities are untarred, undulated, and covered with gravel. Thus, the high cost of transporting farm produce to the market is influenced by the state of the road, further complicating the adoption of CCASs [77]. Muzamhindo et al. [71] noted that farm size is a yardstick for quantifying wealth in the rural communities of Zimbabwe. The outcome here agrees with theirs on the positive significance of farm size and aligns with previous studies on the substantial motivation of farm income proportion on adopting CCASs [77,78]. With a contradicting result, Muzamhindo et al. [71] emphasized that lower farm income compels farmers to adapt. This study maintains that farm income indicates investment size, a measure of farmers' commitment, and the stake to mitigate climate risk for investment protection [72]. The negative relationship between women-headed household age and CCAS adoption corresponds with many previous studies [71,79]. Nciizah [80] pointed out that aged local farmers employ traditional perceptions in addressing climate variability challenges rather than considering technological innovations.

5. Conclusions

The significant contributions of female-headed households to agricultural production and food security have motivated several research interests on the factors detracting from their adoption of climate change adaptation strategies (CCASs), particularly in rural communities. Due to the stronghold of socio-cultural barriers that compound climate change resilience in rural communities, this study approached the investigation of the detracting factors using a hybrid approach of disaster management frameworks and a logit model to characterize the perspectives in Chivi District, Zimbabwe. The following essential deductions were made:

- Addressing socio-cultural barriers in rural communities is essential for effective climate change strategies.
- The importance of the socio-economic and institutional interpretation of adaptation strategies contributes significantly to CCAS adoption decisions.
- While women are generally more resilient, their adaptive capacity is compromised by systemic inequality.
- Central and local governments must strengthen the discussion of women's rights and access to education and formal training and enhance outreach and information dissemination regarding climate risks, women's roles in agriculture, and gender biases.
- There is a clear call for inclusive policies that recognize the unique challenge facing FHHs and ensure the improved participation of women in policy formulation.
- The local government must devise approaches that accelerate the impactful social capital services of clubs, cooperatives, and other associations with policies and infrastructures.
- FHHs are advised to leverage social capital, while community-based intervention on women empowerment through education and resource access is encouraged.

- Due to labor scarcity, subsidized user-friendly technologies and machinery could be manufactured as plausible recommendations and distributed through non-governmental organizations advocating women's rights.
- Environmental stakeholders need to reform policies on land tenure systems in favor of agricultural utilities and considering gender biases.

The approach engaged in here provides excellent insight into the multifaceted challenges and opportunities surrounding climate change adaptation among female-headed households, emphasizing cultural and socio-economical dimensions. A significant limitation of this study is the lack of adequate funds to expand the sampling coverage into other wards and classify the FHHs to explore the variation among the FHH classes. Future studies may assess the political framework deterring women's engagement in contributing to policy-driven climate change and food security forums and explore the varying FHH classes using broader participants interviewed across distressed and selected rural communities. This study also encourages extending women-focused data sampling across districts for a significant group representation.

Author Contributions: Conceptualization, T.M. and J.B.; methodology, T.M. and J.B.; software, J.B.; validation, J.B. and S.T.O.; formal analysis, T.M.; investigation, J.B.; resources, T.M. and J.B.; data curation, T.M.; writing—original draft preparation, T.M. and S.T.O.; writing—review and editing, S.T.O.; visualization, J.B.; supervision, J.B.; project administration, J.B.; funding acquisition, J.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This research obtained ethical clearance from the General/Human Research Ethics Committee of the University of the Free State, and it was granted on December 07, 2020 using the number UFS-HSD2020/1710/0512 before embarking on the study area visit.

Data Availability Statement: Data are contained within the article.

Acknowledgments: The authors would like to thank the DiMTEC and Research Development office of the University of the Free State for facilitating the platform for the publication of this research article.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the study's design, collection, analysis, or interpretation of data; writing the manuscript; or deciding to publish the results.

References

1. Saad, G.E.; Ghattas, H.; Wendt, A.; Hellwig, F.; DeJong, J.; Boerma, T.; Victora, C.; Barros, A.J. Paving the way to understanding female-headed households: Variation in household composition across 103 low-and middle-income countries. *J. Glob. Health* **2022**, *12*, 04038. [CrossRef] [PubMed]
2. Liverman, D.; Vonhedemann, N.; Nying'uro, P.; Rummukainen, M.; Stendahl, K.; Gay-Antaki, M.; Craig, M.; Aguilar, L.; Bynoe, P.; Call, F.; et al. Survey of gender bias in the IPCC. *Nature* **2022**, *602*, 30–32. [CrossRef] [PubMed]
3. World Bank. *Women, Business and the Law 2020*; The World Bank: Washington, DC, USA, 2022.
4. Yoosefi Lebni, J.; Mohammadi Gharehghani, M.A.; Soofizad, G.; Khosravi, B.; Ziapour, A.; Irandoost, S.F. Challenges and opportunities confronting female-headed households in Iran: A qualitative study. *BMC Women's Health* **2020**, *20*, 183. [CrossRef] [PubMed]
5. Rodgers, Y.; Akram-Lodhi, H. The gender gap in agricultural productivity in sub-Saharan Africa: Causes, costs and solutions. *UN Women* **2019**, *11*, 1–5. [CrossRef]
6. Fahad, S.; Hossain, M.S.; Huong, N.T.L.; Nassani, A.A.; Haffar, M.; Naeem, M.R. An assessment of rural household vulnerability and resilience in natural hazards: Evidence from flood prone areas. *Environ. Dev. Sustain.* **2023**, *25*, 5561–5577. [CrossRef]
7. Abegunde, V.O.; Sibanda, M.; Obi, A. The dynamics of climate change adaptation in Sub-Saharan Africa: A review of climate-smart agriculture among small-scale farmers. *Climate* **2019**, *7*, 132. [CrossRef]
8. Adetuyi, A.M.; David, A.B.; Adebowale, A. Climate change: Policy support for national adaptation plans in Sub-Saharan Africa. *WSEAS Trans. Environ. Dev.* **2022**, *18*, 737–745. [CrossRef]
9. Shiferaw, B.; Tesfaye, K.; Kassie, M.; Abate, T.; Prasanna, B.M.; Menkir, A. Managing vulnerability to drought and enhancing livelihood resilience in sub-Saharan Africa: Technological, institutional and policy options. *Weather. Clim. Extrem.* **2014**, *3*, 67–79. [CrossRef]

10. Musumba, M.; Palm, C.A.; Komarek, A.M.; Mutuo, P.K.; Kaya, B. Household livelihood diversification in rural Africa. *Agric. Econ.* **2022**, *53*, 246–256. [CrossRef]
11. Afuye, G.A.; Kalumba, A.M.; Owolabi, S.T.; Thamaga, K.H.; Ndou, N.; Sibandze, P.; Orimoloye, I.R. Analyzing spatiotemporal variations and dynamics of vegetation over Amathole district municipality in South Africa. *Environ. Dev. Sustain.* **2024**, 1–26. [CrossRef]
12. Tantoh, H.B. Community-Based Natural Resources Management in Sub-Saharan Africa: Barriers to Sustainable Community Water Supply Management in Northwest Cameroon. In *Signs of Water: Community Perspectives on Water, Responsibility, and Hope*; University of Calgary Press: Calgary, AB, Canada, 2022; pp. 185–216.
13. Magwegwe, E.; Zivengwa, T.; Zenda, M. Adaptation and Coping Strategies of Women to Reduce Food Insecurity in an Era of Climate Change: A Case of Chireya District, Zimbabwe. *Climate* **2024**, *12*, 126. [CrossRef]
14. Brooks, N.; Adger, W.N. Assessing and Enhancing Adaptive Capacity. In *Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures*; Cambridge University Press: Cambridge, UK, 2005; pp. 165–181.
15. Intergovernmental Panel on Climate Change (IPCC). *Special Reports on Climate Change and un Framework Convention on Climate Change*; Lampert Academic Publishing: Saarbrucken, Germany, 2018.
16. Pike, F.; Jiddawi, N.S.; de la Torre-Castro, M. Adaptive capacity within tropical marine protected areas–Differences between men-and women-headed households. *Glob. Environ. Chang.* **2022**, *76*, 102584. [CrossRef]
17. Nabikolo, D.; Bashaasha, B.; Mangheni, M.N.; Majaliwa, J.G.M. Determinants of climate change adaptation among male and female-headed farm households in eastern Uganda. *Afr. Crop Sci. J.* **2012**, *20*, 203–212.
18. Handayani, W.; Ananda, M.R.; Esariti, L.; Anggraeni, M. Climate change adaptation in Tanjung Mas–Semarang: A comparison between male-and female-headed households. In *IOP Conference Series: Environmental Earth Sciences, Proceedings of the International Conference on Climate Change: Challenges and Opportunity on Environment Degradation Researches, Surakarta, Indonesia, 24–26 October 2017*; IOP Publishing Ltd.: Bristol, UK, 2018; Volume 129, p. 012025.
19. Flatø, M.; Muttarak, R.; Pelser, A. Women, weather, and woes: The triangular dynamics of female-headed households, economic vulnerability, and climate variability in South Africa. *World Dev.* **2017**, *90*, 41–62. [CrossRef]
20. Msuya, N.H. Concept of culture relativism and women's rights in sub-Saharan Africa. *J. Asian Afr. Stud.* **2019**, *54*, 1145–1158. [CrossRef]
21. Sultana, F. Gendering climate change: Geographical insights. *Prof. Geogr.* **2013**, *66*, 372–381. [CrossRef]
22. Jaiyeola, E.O. Patriarchy and colonization: The "brooder house" for gender inequality in Nigeria. *J. Res. Women Gend.* **2020**, *10*, 3–22.
23. Batliwala, S. Taking the Power out of Empowerment—An Experiential Account. *Dev. Pract.* **2007**, *17*, 557–565. [CrossRef]
24. Adeola, O.; Evans, O.; Ngare, I. Explaining Gendered Vulnerability to Climate Change: The Contextual Conditions. In *Gender Equality, Climate Action, and Technological Innovation for Sustainable Development in Africa*; Springer International Publishing: Cham, Switzerland, 2023; pp. 59–79.
25. Nnadi, O.I.; Lyimo, J.G.; Liwenga, E.T. Socio-economic determinants of vulnerability to climate variability and change across gender in southeast Nigeria. *J. Agric. Ext.* **2019**, *23*, 122–137. [CrossRef]
26. Osman-Elasha, B. In the shadow of climate change. *UN Chron.* **2012**, *46*, 54–55. [CrossRef]
27. Global Gender and Climate Alliance. *Gender and Climate Change: A Closer Look at Existing Evidence*; Global Gender and Climate Alliance: Frankfurt, Germany, 2016.
28. Andrijevic, M.; Crespo Cuaresma, J.; Lissner, T.; Thomas, A.; Schleussner, C.F. Overcoming gender inequality for climate resilient development. *Nat. Commun.* **2020**, *11*, 6261. [CrossRef] [PubMed]
29. Pinho-Gomes, A.C.; Woodward, M. The association between gender equality and climate adaptation across the globe. *BMC Public Health* **2024**, *24*, 1394. [CrossRef] [PubMed]
30. Ferrant, G. How do gender inequalities hinder development? Cross-country evidence. *Ann. Econ. Stat.* **2015**, *117/118*, 313–352. [CrossRef]
31. Nielsen, J.Ø.; Reenberg, A. Cultural barriers to climate change adaptation: A case study from Northern Burkina Faso. *Glob. Environ. Chang.* **2010**, *20*, 142–152. [CrossRef]
32. Gachathi, F.N.; Eriksen, S. Gums and resins: The potential for supporting sustainable adaptation in Kenya's drylands. In *Sustainable Adaptation to Climate Change*; Routledge: Oxfordshire, UK, 2012; pp. 59–70.
33. Phiri, K.; Ndlovu, S.; Chiname, T. Climate change impacts rural women: Emerging evidence on coping and adaptation strategies in Tsholotsho, Zimbabwe. *Mediterr. J. Soc. Sci.* **2013**, *5*, 1–8. [CrossRef]
34. Alston, M. Gender mainstreaming and climate change. *Women's Stud. Int. Forum* **2014**, *47*, 287–294. [CrossRef]
35. Salingre, A.; Braun, B. Communicating Climate Change and its Impact to Dhaka's Urban Poor–Grassroot Workshops for Adults and Children. In *Risks and Conflicts: Local Responses to Natural Disasters*; Emerald Group Publishing Ltd.: West Yorkshire, UK, 2014; Volume 14, pp. 251–278.
36. Figueiredo, P.; Perkins, P.E. Women and water management in times of climate change: Participatory and inclusive processes. *J. Clean. Prod.* **2013**, *60*, 188–194. [CrossRef]
37. Flora, C.B. Community, climate change, and sustainable intensification: Why gender is important. In *Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa*; Springer: Berlin/Heidelberg, Germany, 2015; pp. 515–531.

38. Hanigan, I.C.; Chaston, T.B. Climate change, drought and rural suicide in New South Wales, Australia: Future impact scenario projections to 2099. *Int. J. Environ. Res. Public Health* **2022**, *19*, 7855. [CrossRef]
39. Vinke, K.; Rottmann, S.; Gornott, C.; Zabre, P.; Nayna Schwerdtle, P.; Sauerborn, R. Is migration an effective adaptation to climate-related agricultural distress in sub-Saharan Africa? *Popul. Environ.* **2022**, *43*, 319–345. [CrossRef]
40. Chumky, T.; Basu, M.; Onitsuka, K.; Raihan, M.L.; Hoshino, S. How Do Left-Behind Families Adapt to the Salinity-Induced Male Out-Migration Context? A Case Study of Shyamnagar Sub-District in Coastal Bangladesh. *Sustainability* **2023**, *15*, 2756. [CrossRef]
41. Jiri, O.; Mafongoya, P.L.; Chivenge, P. Building climate change resilience through adaptation in smallholder farming systems in semi-arid Zimbabwe. *Int. J. Clim. Chang. Strateg. Manag.* **2017**, *9*, 151–165. [CrossRef]
42. Nyathi, D.; Ndlovu, J.; Mare, A.; Dzvimbo, M.A.; Ndlovu, M. Women's vulnerability and adaptive capacity to climate change in Agrarian settings of Zimbabwe. In *Climate Crisis, Social Responses and Sustainability: Socio-Ecological Study on Global Perspectives*; Springer Nature: Cham, Switzerland, 2024; pp. 541–559.
43. Mwadzingeni, L.; Mugandani, R.; Mafongoya, P.L. Socio-demographic, institutional and governance factors influencing adaptive capacity of smallholder irrigators in Zimbabwe. *PLoS ONE* **2022**, *17*, 0273648. [CrossRef] [PubMed]
44. Dube, N. Forty Years of Climate Risk Research in Zimbabwe–1980–2021. *Dev. South. Afr.* **2023**, *40*, 1308–1342. [CrossRef]
45. Sammie, B.; Mupfiga, E.; Mwadzingeni, L.; Chitata, T.; Mugandani, R. A gendered lens to self-evaluated and actual climate change knowledge. *J. Environ. Stud.* **2021**, *11*, 65–75. [CrossRef]
46. Adego, T.; Woldie, G.A. The complementarity and determinants of adoption of climate change adaptation strategies: Evidence from smallholder farmers in Northwest Ethiopia. *Clim. Dev.* **2022**, *14*, 487–498. [CrossRef]
47. Nnadi, O.I.; Lyimo, J.; Liwenga, E.; Madukwe, M.C. Gender Perspectives of Responses to Climate Variability and Change among Farm Households in Southeast Nigeria. *Environ. Manag.* **2023**, *71*, 201–213. [CrossRef]
48. Southard, E.M.; Randell, H. Climate Change, Agrarian Distress, and the Feminization of Agriculture in South Asia. *Rural Sociol.* **2022**, *87*, 873–900. [CrossRef]
49. Wisner, B.; Blaikie, P.; Blaikie, P.M.; Cannon, T.; Davis, I. *At Risk: Natural Hazards, People's Vulnerability and Disasters*; Routledge: Oxfordshire, UK, 2004.
50. Birkmann, J. *Assessing Vulnerability Before, During and After a Natural Disaster in Fragile Regions: Case Study of 2004 Indian Ocean Tsunami in Sri Lanka and Indonesia*; UNU-WIDER: Helsinki, Finland, 2008; Available online: https://www.wider.unu.edu/ (accessed on 8 November 2021).
51. Tanner, T.; Mensah, A.; Lawson, E.T.; Gordon, C.; Godfrey-Wood, R.; Cannon, T. Political economy of climate compatible development: Artisanal fisheries and climate change in Ghana. *IDS Work. Pap.* **2014**, *446*, 1–30. [CrossRef]
52. Jaka, H.; Shava, E. Resilient rural women's livelihoods for poverty alleviation and economic empowerment in semi-arid regions of Zimbabwe. *Jàmbá Int. J. Disaster Risk Sci.* **2018**, *10*, 1–11. [CrossRef]
53. ZimStats. Facts and Figures 2017. Available online: https://www.zimstat.co.zw/wp-content/uploads/publications/Miscellenious/Facts-and-Figures/Fact-Figures-2017.pdf (accessed on 21 April 2020).
54. Chikodzi, D.; Murwendo, T.; Farai, S. Climate change and variability in Southeast Zimbabwe. *Scenar. Soc. Opportunities. Am. J. Clim. Chang.* **2014**, *8*, 21–26.
55. Chikova, H.; Kangalawe, R. *Institutional Framework and Climate Change Adaptation: The case of Sustainable Land Management in Chivi District, Zimbabwe*; Lampert Academic Publishing: Saarbrucken, Germany, 2013.
56. Zimbabwe National Statistics Agency. *2022 Population and Housing Census. Preliminary Report on Population Figures*; Zimbabwe National Statistics Agency: Harare, Zimbabwe, 2022; Available online: https://zimbabwe.unfpa.org/sites/default/files/pub-pdf/2022_population_and_housing_census_preliminary_report_on_population_figures.pdf (accessed on 11 November 2024).
57. Creswell, J.W.; Miller, D.L. Determining validity in qualitative inquiry. *Theory Pract.* **2012**, *39*, 124–130. [CrossRef]
58. Asfaw, S.; Shiferaw, B.; Simtowe, F.; Lipper, L. Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food Policy* **2012**, *37*, 283–295. [CrossRef]
59. Poonyth, D.; van Zyl, J.; Meyer, F. Forecasting the market outlook for the South African maize and sorghum sector using econometric modelling. *Agrekon* **2006**, *39*, 607–619. [CrossRef]
60. Khraim, H.; Shoubaki, Y.; Khraim, A. Factors affecting Jordanian consumers' adoption of mobile banking services. *Int. J. Soc. Sci. Bus.* **2011**, *2*, 96–105.
61. Schneider, L.; Kubis, A. *Are There Gender-Specific Preferences for Location Factors? A Grouped Conditional Logit-Model of Interregional Migration Flows in Germany*; IWH Discussion Papers: Halle, Germany, 2009.
62. Gikandi, J.W.; Bloor, C. Adoption and effectiveness of electronic banking in Kenya. *Electron. Commer. Res. Appl.* **2010**, *9*, 277–282. [CrossRef]
63. Burke, W.J.; Myers, R.J.; Jayne, T.S. A triple-hurdle model of production and market participation in Kenya's dairy market. *Am. J. Agric. Econ.* **2015**, *97*, 1227–1246. [CrossRef]
64. Hoffman, S.D.; Duncan, G.J. Multinomial and conditional logit discrete-choice models in demography. *Demography* **2009**, *25*, 415–427. [CrossRef]
65. Sultan, B.; Roudier, P.; Quirion, P.; Alhassane, A.; Muller, B.; Dingkuhn, M.; Ciais, P.; Guimberteau, M.; Traore, S.; Baron, C. Assessing climate change impacts on sorghum and millet yields in the Sudanian and Sahelian savannas of West Africa. *Environ. Res. Lett.* **2013**, *8*, 014040. [CrossRef]

66. Mahaarcha, W. Factors influencing farmers' adaptation strategies to climate change in Bophloi District, Kanchanaburi Province, Thailand. *Humanit. Arts Soc. Sci. Stud.* **2019**, *19*, 70–86.
67. Datta, P.; Behera, B. Factors influencing the feasibility, effectiveness, and sustainability of farmers' adaptation strategies to climate change in the Indian Eastern Himalayan Foothills. *Environ. Manag.* **2022**, *70*, 911–925. [CrossRef]
68. Kibue, G.W.; Liu, X.; Zheng, J.; Zhang, X.; Pan, G.; Li, L.; Han, X. Farmers' perceptions of climate variability and factors influencing adaptation: Evidence from Anhui and Jiangsu, China. *Environ. Manag.* **2016**, *57*, 976–986. [CrossRef]
69. Gbetibouo, G.A. *Understanding Farmers' Perceptions and Adaptations to Climate Change AND Variability: The Case of the Limpopo Basin, South Africa*; International Food Policy Research Institute: Washington, DC, USA, 2009; Volume 849.
70. Shongwe, P.; Masuku, M.B.; Manyatsi, A.M. Factors influencing the choice of climate change adaptation strategies by households: A case of Mpolonjeni Area Development Programme (ADP) in Swaziland. *J. Agric. Res.* **2014**, *2*, 86–98. [CrossRef]
71. Muzamhindo, N.; Mtabheni, S.; Jiri, O.; Mwakiwa, E.; Hanyani-Mlambo, B. Factors influencing smallholder farmers' adaptation to climate change and variability in the Chiredzi district of Zimbabwe. *J. Econ. Sustain. Dev.* **2015**, *6*, 1–9.
72. Muzari, W.; Nyamushamba, G.B.; Soropa, G. Climate change adaptation in Zimbabwe's agricultural sector. *Int. J. Sci. Res.* **2016**, *5*, 1762–1768.
73. Okoye, C.U. Comparative analysis of factors in the adoption of traditional and recommended soil erosion control practices in Nigeria. *Soil Tillage Res.* **1998**, *45*, 251–263. [CrossRef]
74. Mudzonga, E. Farmers' Adaptation to Climate Change in Chivi District of Zimbabwe. In Proceedings of the TRAPCA Trade Policy Research Forum, Arusha, Tanzania, 7–8 August 2012.
75. Langyintuo, A.S.; Mekuria, M. Assessing the influence of neighborhood effects on the adoption of improved agricultural technologies in developing agriculture. *Afr. J. Agric. Resour. Econ.* **2008**, *2*, 151–169.
76. Adebisi-Adelani, O.; Oyesola, O.B. Socio-economic factors affecting adaptation strategies of selected horticultural farmers to climate change in Osun State, Nigeria. *J. Agric. Sci. Technol.* **2013**, *8*, 344–350.
77. Pello, K.; Okinda, C.; Liu, A.; Njagi, T. Factors affecting adaptation to climate change through agroforestry in Kenya. *Land* **2021**, *10*, 371. [CrossRef]
78. Fosu-Mensah, B.Y.; Vlek, P.L.; MacCarthy, D.S. Farmers' perception and adaptation to climate change: A case study of Sekyedumase district in Ghana. *Environ. Dev. Sustain.* **2012**, *14*, 495–505. [CrossRef]
79. Kabubo-Mariara, J. Climate Change Adaptation and Livestock Activity Choices in Kenya: An Economic Analysis. In *Natural Resources Forum*; Blackwell Publishing Ltd.: Oxford, UK, 2008; Volume 32, pp. 131–141.
80. Nciizah, E. Climate Change Adaptation by Chivi Farmers. In *Everyday Crisis-Living in Contemporary Zimbabwe*; Routledge: Oxfordshire, UK, 2021; pp. 50–62.