Research on World Agricultural Economy
https://journals.nasspublishing.com/index.php/rwae

ARTICLE

Appraisal of Transforming Structures and Processes that Influence the Adoption of Climate-Smart Livelihood Strategies in Mutare District, Zimbabwe

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ABSTRACT

This study presents the role of policy frameworks and institutional underpinnings that interact with prevailing climate factors, human-induced constraints, and asset portfolios to influence the adoption of innovative farming practices. A mixed-methods approach, combining qualitative interviews, focus group discussions, and quantitative surveys, was employed to explore the impacts of policy frameworks and institutional arrangements on climate-smart practices among smallholder farmers. Purposive sampling was used to select the questionnaire survey respondents. Additional data was gathered through semi-structured interviews with key informants, including officials from the central government, local government, extension services, traditional leaders, and nongovernmental organizations. Descriptive statistics were applied to identify basic patterns drawn from the quantitative surveys. At the same time, content analysis was used on qualitative data to identify themes, patterns, and other relevant features and interpret their meanings and implications. The results revealed that agricultural extension services significantly influence smallholder farmers' ability to cope with the consequences of extreme weather events. Farmer field schools and unions were heralded for their pivotal role in promoting climate-smart practices among smallholder farmers. Conflicts of interest between urban authorities' environmental sustainability and households' basic survival strategies involving urban agricultural practices were highlighted. Female-headed families were predom-

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ARTICLE INFO
Received: 8 August 2024 | Revised: 14 November 2024 | Accepted: 26 November 2024 | Published Online: 7 July 2025
DOI: https://doi.org/10.36956/rwae.v6i2.1230

CITATION
Muzorewa, W., Chitakira, M., 2025. Appraisal of Transforming Structures and Processes that Influence the Adoption of Climate-Smart Livelihood Strategies in Mutare District, Zimbabwe. Research on World Agricultural Economy. 6(3): 159–169. DOI: https://doi.org/10.36956/rwae.v6i2.1230

inant in rural areas, so the study recommends prioritizing resources for developing innovations that improve the adoption of smart livelihood strategies by female smallholder farmers. Besides, the study recommends capacity-building interventions, such as orienting smallholder farmers to climate-smart livelihood options, including planting basin methods that are cost-effective and sustainable.

Keywords: Climate-Smart; Livelihood Strategies; Community Engagement; Policy Frameworks; Adoption

1. Introduction

Given the low adaptive capacity of Sub-Saharan Africa (SSA) to the challenge of climate, the region's agricultural system is at risk, mainly because it is inherently dependent on precipitation [1, 2]. Consequently, the region's efforts to attain poverty reduction and food security targets under the Millennium Development Goals are crucial but difficult to achieve [3]. Food insecurity manifests in famine, undernourishment, hunger, malnutrition, and unhealthy lifestyles [4]. The unprecedented challenges are exacerbated by, among other things, a lack of adequate policy instruments that regulate the price of agricultural products and a lack of institutional capacity for economic incentives that enhance agriculture-based activities [5]. Although SSA is vulnerable to climate variability and change, the magnitude of vulnerability depends on adaptation interventions. Some interventions address specific climate challenges, such as rising sea levels. In contrast, others address broader drivers of vulnerability, such as economic inequalities, households' livelihoods, and poverty alleviation [6]. Besides, livelihood diversification is another intervention that can increase the ability to adapt to the risks of climate extremes [7]. The strategies require major transformative policy interventions that support smallholder farmers' adaptation capabilities. However, the call for transformative approaches presents challenges because livelihood conditions can be unfavourable, so much so that for some, embracing any livelihood opportunity, including coping interventions that cannot improve agriculture practices in ways that can be considered positive transformation [8].

It is paramount for stakeholders to implement a wide range of robust livelihood strategies focusing on capacity building that mitigates the challenge and intensity of extreme weather events [9]. Livelihood strategies refer to using asset portfolios in a preferred occupation to earn a living. Smallholder farmers respond to climate variability and change by applying innovative agricultural practices that include crop rotation, intercropping, Planting basins, horticulture, cultivation of drought-resistant crops, water harvesting, precision irrigation, and agroforestry [10]. These initiatives aim to reduce risks and capitalize on opportunities to ensure the sustainability of agricultural production systems and sound environmental stewardship [11]. Essentially, since agriculture remains the linchpin for earning a living in climatically challenged countries in SSA, taking action is vital because the region is perpetually vulnerable to persistent droughts, rising annual temperatures, veld fires, ruinous floods, crop pests/diseases, and environmental degradation [12]. Additionally, anthropogenic activities, poor governance, corruption, conflicts, political repression, and limited adaptive capacity of agricultural production systems heighten livelihood vulnerability, especially in rural economies [13].

Southern Africa (SA) is equally vulnerable to the impacts of climatic changes. The impacts are aggravated by political instability, corruption, environmental degradation, famine, poverty, tropical cyclones, wildfires, and increased temperature. The temperature in semi-arid regions of SA is projected to grow by between 1 and 4 degrees Celsius by 2050 [14]. The mainstay for subsistence is agriculture, which is susceptible to climatic conditions. Invariably, this makes communities vulnerable to food insecurity and unstable livelihoods [15].

Like most countries in SA, Zimbabwe is exposed to extreme weather events such as floods, cyclones, drought, erratic rainfall patterns, and hot weather [16]. The country is vulnerable because the main economic activities are based on producing a variety of grains, forestry, and livestock [17]. Smallholder farmers strive to achieve food security through various asset portfo-

lios shaped by institutions, prevailing policies, cultural beliefs, and laws. Smallholder farmers' understanding of policy and institutional arrangements impacting innovative farming methods is paramount. Societal norms and power relations also determine access to financial resources, land tenure, and quality inputs necessary to achieve the desired livelihood outcomes [18].

This study identified gaps in the body of literature, including inadequate policy instruments and institutional capacity-building that promote climate-smart livelihood practices in remote agricultural regions of Zimbabwe. Besides, research revealed that access to agricultural production resources remains gendered [19]. Although women constitute the most significant smallholder farmers, they face discriminatory beliefs and differential access to capital assets [20]. In Zimbabwe, women are prone to becoming food insecure, and their societal contributions are often suppressed in decision-making arenas [21]. As such, the study identified gaps arising from limited literature that specifically promotes climate-smart livelihood strategies targeting the enhancement of the farming endeavours of female smallholder farmers. The present study uses Mutare district, Zimbabwe, as a case study to investigate the influence of enabling policy, socioeconomic factors, and institutional arrangements on adopting climate-smart livelihood strategies. Besides, the study seeks to bridge the gender bias that marginalizes vulnerable rural women smallholder farmers.

Study Rationale

Transforming structures are categorized into public and private organisations that enforce policy and legislation at different levels and monitor the conduct of other functions that affect livelihoods [22]. On the other hand, transforming processes represent macro and sectoral policy arrangements specific to that particular social group, including regulations, laws, agreements, operational arrangements, societal norms, and practices that, in turn, determine how structures operate [22, 23]. The enabling structures and processes determine how smallholder farmers access essential livelihood assets and the practical strategies to achieve desired livelihood outcomes, including improved income, food security, reduced vulnerability, sustainable natural resources management, and improved well-being.

Smallholder farmers' livelihoods are becoming more precarious owing to limited capabilities to respond to the impacts of climate variability and change [24]. Despite the challenges, the farmers must maintain a livelihood to support their families and continue producing food. Policymakers and stakeholders with a more comprehensive and systemic influence urgently need to prioritize enhancing sustainable livelihood practices in agriculture. A holistic understanding of community engagements and policy frameworks that construct and enhance micro-scale livelihoods is paramount. Additionally, the influence of institutional arrangements must be investigated locally to help determine context-specific resilient strategies adopted by resource-poor farmers. As smallholder farmers grapple with the vagaries of extreme weather events, exploring how they perceive policy and institutional influence on the choice of sustainable farming practices is essential.

2. Methodology

2.1. Study Area Description

The study was undertaken in Mutare district in Manicaland Province, Eastern Zimbabwe. The district shares a border with Chimanimani district to the southeast, Buhera district to the southwest, Makoni district to the northwest, Mutasa district to the northwest, and Mozambique to the east. Mutare district comprises Mutare Urban, which is in the northeastern corner of the district on latitude 18°58′0″ S and longitude 32°40′0″ E, and Mutare Rural, which represents subsistence communities. The topography distinguishes itself by immense and rugged mountains, steep slopes, valleys, a network of streams and rivers, high rainfall, and a cool climate. Zimbabwe is classified into five natural regions (NR), determined by rainfall regime, soil quality, and vegetation [25]. The study area was selected because it is in NR I and II, the most agriculturally productive region. People's dominant occupations are livestock farming, forestry, and crop farming, which include cultivating millet, sorghum, maize, fruits, cowpeas, beans, and maize.

2.2. Study Design

The study applied a concurrent mixed method involving qualitative and quantitative approaches to produce a credible and thorough data source. A mixed-methods approach helps to understand the phenomenon that would otherwise be complex from a single-dimensional approach [26]. The combined data collection approach improved validity by cross-checking the results. Equal weighting was given to both data sources, which included a semi-structured questionnaire survey distributed to 266 households, four focus group discussions, and 23 key informant interviews. These were applied to gather information, including demographics and characteristics of structures and processes active in the study area. The household sample size was determined using Cochran's sample size formula: $n0 = Z2 \cdot p \cdot (1-p)\, e2n0 = e2Z2 \cdot p \cdot (1-p)$, where $n0$ = Sample size, Z = Z-value (Z = Z-value(standard error = 1.96 for a 95% confidence level), p = estimated households (p = 0.5) and e = margin of error (6%)). Purposive sampling was used to select the questionnaire survey respondents' knowledge of livelihood strategies. In addition, willingness, availability, and the ability to communicate experiences were considered. The targeted respondents were household heads and, in some instances, household representatives over 18 years old. Despite purposive sampling's limitation of a lack of generalizability, it was considered a powerful tool to obtain credible data.

Additionally, valuable insights were gathered through semi-structured interviews, which included key informants such as the central government, the local government, extension services, traditional leaders, and nongovernmental organizations. Network-based snowball sampling was applied to choose the key informants. This sampling method was preferred to others because it was cost-effective and easy to recruit participants through referrals. An initial ten informants were purposively selected, and snowball sampling was applied until saturation was achieved at twenty-three. The saturation point is when further data becomes repetitive, not yielding new insights and themes. Key informants better understood scientific viewpoints on local climate variability and socioeconomic, cultural, and policy responses. Based on participants' lived experiences, focus groups were chosen using convenience sampling. The discussions were instrumental in comprehending community engagements and the impacts of policy and institutions that enhance technological awareness in rural and urban farming communities.

Because this study involved vulnerable individuals and groups, it was essential to consider the ethical ramifications. These included confidentiality, anonymity, and the sensitivity of participants, upholding human rights, and harm prevention. The Ministry of Lands, Agriculture, Water, Fisheries, and Rural Resettlement was consulted, and permission to interact with respondents was granted. In addition, councils, chiefs, elders, and respondents were consulted, and they gave consent to be part of the study. The respondents signed a consent form as evidence of acceptance.

Ethnographic research techniques were employed to develop personal communication and build interrelationships and confidence with respondents. This was achieved by engaging in the respondents' daily activities and observing them in their natural settlements while taking notes. The engagement provided a perfect opportunity to watch, listen, and ask questions about the consequences of extreme weather events in their communities. Austin and Sutton [27] posit that ethnographic research techniques have the advantage of seeking additional information from local people because they stimulate dialogue and participation among local people and between the researcher and the local people.

Content analysis was used to identify themes, patterns, and other relevant features for qualitative data and interpret their underlying meanings and implications. The procedure transferred discrete information into an organized format that allowed deductive inference. Coding was applied to attach labels to lines of text to compare similar or related information collected from key informants and focus groups during interviews. On the other hand, descriptive statistics was applied to summarize the quantitative data into meaningful narratives. The procedure involved entering the data into the Microsoft Excel spreadsheet and analyzing it to identify trends, patterns, and standard central tendency mea-

sures, including the mean and standard deviation. Two components of descriptive statistics (measure of central tendency and exploratory analysis) were applied. Microsoft Excel was used to calculate standard measures of central tendency, including the mean and standard deviation.

3. Presentation of Results

The questionnaire survey produced socio-demographic information analyzed using descriptive statistics, as shown in **Table 1**. Self-reported information was based on knowledge and lived experience of policy and institutional structures that affect the adoption of climate-smart livelihood strategies. The data was inputted in Microsoft Excel, and the results indicated that females (55%) constituted the highest demographic characteristics. Age was divided into five groups, and the '42 and above' category constituted the highest number of participants (35%). Age was necessary because, in most households, the eldest members were allowed/prepared to participate in the survey. This was apparent in cases where research assistants were advised to return when the head of the family, usually the oldest member, returned from their daily occupations outside the homestead. The study revealed that most households were headed by women (51%). This was prevalent in remote rural settings where men migrated to urban areas for alternative sources of livelihood. An overwhelming number of households (73%) indicated that they had no formal training in farming but relied on experience passed from generation to generation. Most farmers (35%) indicated they had lived on their farms for 20 years or more, representing considerable years of lived experience.

Table 1. Demographic Characteristics of Farmers who Participated in the Study.

Variable	Respondents (%)
Gender	
Male	45
Female	55
Age in years	
18–23	5
24–29	9
30–35	20
36–41	31
42 and above	35
Family size	
1–2	16
3–4	27
5–6	23
7–8	18
9–10	14
11 plus	2
Head of Household	
Woman	51
Man	43
Child	6
Highest level of education attained	
No formal education	12
Primary education	44
Secondary education	31
Tertiary education	13
Acquired formal education in farming	
Yes	27
No	73
Length of time as a farmer (years)	
0–4	15
5–9	16
10–14	20
15–19	16
20 or more	33

Source: Survey results.

The questionnaire asked respondents to rate their perception of the influence of policy and stakeholders on livelihood strategies in their communities. Possible levels of agreement were captured based on a 5-point Likert scale range: 1 = very dissatisfied, 2 = dissatisfied, 3 = neither dissatisfied or satisfied, 4 = satisfied, and 5 = very satisfied, as shown in **Table 2**.

Table 2. Respondents' Perceptions of the Influence of Transforming Structures and Processes.

	1	2	3	4	5	Total	Mean	Standard Deviation (SD)
Transforming structures					**Respondents**			
Rural council	15	6	4	5	1	**31**	3.94	3.62
City council	13	10	7	3	2	**35**	3.83	3.50
Parastatal organisations	9	3	1	9	7	**29**	2.93	2.88
Extension services	0	2	0	21	13	**36**	1.75	1.35
Meteorological services	5	9	11	7	5	**37**	3.05	2.79
Judiciary	22	17	7	0	0	**46**	4.33	3.86
Police	26	12	14	0	0	**52**	4.23	3.79
Total	**90**	**59**	**44**	**45**	**28**	**266**		

Table 2. *Cont.*

	1	2	3	4	5	Total	Mean	Standard Deviation (SD)
Transforming processes								
Commercial Farmers Union	1	2	2	8	5	**18**	2.22	2.00
Zimbabwe Farmers Union	1	3	1	12	8	**25**	2.89	1.62
NGOs	0	0	2	19	15	**36**	3.28	1.65
*Agriculture finance	20	19	15	6	9	**69**	13.80	6.14
Farmer Field Schools	0	1	2	12	8	**23**	2.33	1.26
Community groups	2	2	3	13	7	**27**	3.33	1.70
Customary norms	3	4	2	10	9	**28**	3.67	1.92
Traditions	1	3	2	7	6	**19**	2.39	2.05
Power relations	1	2	4	9	5	**21**	2.67	1.93
TOTALS	**29**	**36**	**33**	**96**	**72**	**266**		

* Remove as an outlier.
Source: Survey results.

Essential transformations in the dataset were performed before performing non-parametric tests. This involved observing patterns in the response cases and applying the appropriate method to maintain valid variables that best represent the population. As a result, the variable "Agriculture finance" was not used to draw meaningful and practical conclusions because it was an outlier.

Extension services had the lowest standard deviation (1.35), indicating participants had the most consistent and confident responses about their effectiveness. This implies that the consistent impact of extension services highlights their crucial role in helping farmers adopt climate-smart livelihood alternatives. These services help bridge the gap between smallholder farmers and modern farming practices, enhancing resilience against climate variability. The broader implication is that investment in extension services, primarily through government-funded programmes like AGRITEX, should be increased, as they directly enhance agricultural yields and food security.

FFSs were recognized as impactful structures, with a mean score of 2.33 and a standard deviation of 1.26, underscoring their effectiveness as learning platforms for farmers. These schools improve technical skills and promote peer learning, essential for adapting climate-smart practices such as crop diversification and agroforestry. Their structured yet participatory approach allows farmers to test and implement innovative practices. For example, farmers participating in FFSs reported gaining practical skills, such as poultry farming, which enabled them to generate income. With only 23 responses acknowledging the influence of FFSs, there is significant potential to expand these schools across Zimbabwe. Increasing their reach can ensure equitable access to essential agricultural knowledge and foster community-driven innovation in rural and urban settings. Key informants concurred that farmer field schools provided platforms for information dissemination on how and when to adopt the latest technologies that maintained and strengthened livelihood security. Respondents highlighted farmer field schools' impact on the successful and efficient delivery of information and knowledge on new technologies that allowed them to improve their productivity. This was underscored by a respondent who stated:

> *The information and knowledge I acquired during a tour of a poultry farm in Muchena community helped me to start a broiler chicken project because I learned that they are a hybrid of breeds designed to increase, which is ideal for generating income.* (24-year-old smallholder farmer)

NGOs complement government efforts by providing essential support, especially to marginalized groups such as female-headed households, representing 51% of the surveyed households. Strengthening partnerships between NGOs, farmer unions, and traditional institutions can help address resource disparities. Ensuring equitable distribution and tailored training programs can bridge gender gaps and enhance agricultural resilience among the most vulnerable populations.

Urban respondents, constituting 27% of households, expressed dissatisfaction with local authorities, citing issues like crop destruction and lack of access to

farming land due to conflicting urban policies. Many have resorted to cultivating small plots illegally on undeveloped land to meet their food needs. Urban agriculture is a survival mechanism for many households, particularly women, who primarily participate in urban farming activities. A 62-year-old female respondent stated:

> *I find it difficult not to cultivate undeveloped land as I seek to supplement food demands for my grandchildren. I cultivate sweet potatoes, a worthwhile substitute for exorbitantly priced bread. In addition, I grow tomatoes, leafy vegetables, and onions. I am aware of the risks of losing my crops should local authorities decide to destroy them because they say I am farming illegally. I am hard-pressed by poverty and hunger, so I have no choice but to take the risk.* (62-year-old grandmother in Mutare urban)

Despite facing challenges, urban farming contributes to food security by reducing dependence on expensive maize meal, offering nutritious alternatives like leafy vegetables, and generating income for families. Local authorities, such as the Mutare City Council, should implement inclusive policies to allocate land for regulated urban agriculture. Collaborating with organizations like Caritas International, which already supports backyard smart farming, could formalize these efforts while ensuring compliance with urban planning objectives.

4. Discussion

The study explored smallholder farmers' perceptions of policy frameworks and institutional arrangements that improve the adoption of climate-smart livelihood strategies. The literature revealed that climatic challenges require implementing a wide range of interventions that strengthen the adaptive capacity of smallholder farmers who are vulnerable due to a lack of farm inputs, skills, efficient markets, and information that influence meaningful adaptation interventions [28]. Contrary to this assertion, the study results revealed concerted efforts from NGOs and other stakeholders implementing development programmes targeting smallholder farmers. Notwithstanding, the farmers remain exposed to the risk of experiencing extreme weather events such as floods, droughts, erratic rainfall patterns, and hot weather because of their heavy reliance on rain-fed agriculture as their main economic activity. The farmers' predicament entails identifying meaningful interventions that continue to be backed by policy and institutional mechanisms that focus on addressing the main characteristics of climate variability and change impacts [29].

According to [30], smallholder farmers work hard to achieve livelihood outcomes, including improved food security, nutrition, income, poverty alleviation, and natural resources management. These goals are achievable through asset portfolios that interact with institutions, policies, culture, and laws. Understanding societal engagement with enabling structures and processes is crucial. Serote et al. [31] posit that recognizing community engagement is essential for comprehending social relations and organizations. The ability of communities to adopt coping strategies is hindered by limited socioeconomic, political, and lack of technical resources [32]. This study argues that it is insufficient to implement meaningful adaptation policies without considering the unique needs of remote, inaccessible communities. Thus, it's essential to be cognizant that community engagement between smallholder farmers and enabling institutions in those areas needs a more robust approach to successfully promote the adoption of climate-smart livelihood strategies [33]. Researchers propound that to mitigate the challenges of climate variability and change successfully, there is a need for the implementation of a comprehensive collection of robust climate-smart livelihood strategies [34, 35]. Robust livelihood strategies reduce risks and capitalize on opportunities to ensure the sustainability of agriculture production systems and sound environmental stewardship. Since agriculture remains the linchpin for earning a living in Zimbabwe, acting is vital given the country's vulnerability to climate-induced risks [12, 36]. More comprehensive action is needed at the policy level to combat these pressing issues resulting from climate variability and change impacts. As [37] noted, the government and stakeholders should prioritize educating smallholder farmers about the significance of modern farming technologies. The study prof-

fered that agricultural extension services are equipping farmers with essential life skills to choose appropriate climate-smart livelihood strategies that could improve food security and alleviate poverty. Besides, they provide platforms for bridging the gap between technological advancement and smallholder farmers in rural and urban communities [38]. Other scholars postulated that agricultural extension services are necessary for disseminating information and knowledge of the key drivers of climate variability and change [39].

Collaboration between policymakers, the private sector, and smallholder farmers is paramount to bolstering climate-smart livelihood strategies. If policymakers persist with business as usual, irreversible harm will be inflicted upon ecosystems that support livelihoods. However, not only does the need for transformation extend beyond policy frameworks, but it also necessitates systemic changes supported by all stakeholders. Governments and stakeholders in the private sector must acknowledge their roles in contributing to changes through policies and practices prioritizing climate-smart practices over profit. Robust government leadership at national levels is essential while being supported by effective institutional frameworks. Thus, collaboration among all sectors, including urban communities, becomes paramount in attaining sustainable solutions [40]. Urban small-scale farming is a vital source of living in many cities and towns [41]. Besides providing food security, urban agriculture offers vegetation cover that enhances water quality and carbon sequestration [42]. However, the study underscored the conflict of interest between urban authorities' environmental sustainability policies and households' basic survival strategies.

5. Conclusion and Recommendations

Applying mixed methods approaches gave a nuanced understanding of how policy frameworks, institutional arrangements, and community engagements interact to influence the adoption of climate-smart livelihood strategies. Females constituted the most significant demographic group in rural settings, while men migrated in search of alternative sources of livelihood. As such, female-headed households faced the challenges of ensuring poverty alleviation and food security. Extension services created the most conducive conditions and platforms for information dissemination and technological transfer. They developed linkages with stakeholders and collaborated with smallholder farmers to improve food security and poverty alleviation. The government-funded Agricultural Technical and Extension Services was pivotal in coordinating training that strengthened innovative processes and positively impacted agriculture yields. Besides, farmer field schools provided a learner-focused approach where farmers played a crucial role in planning and test-driving new technical skills that improved food security. On the other hand, NGOs collaborated with traditional leaders to strengthen community engagements, resulting in the adoption of climate-smart livelihood strategies.

This study was essential to improving knowledge of climate-smart livelihood options. Female-headed smallholder farmers face challenges in ensuring poverty alleviation and food security. This study recommends prioritizing innovations that enhance climate-smart livelihood strategies for female households. Policymakers and accompanying development-oriented underpinnings focus on prescriptive strategies to address prevailing food shortages. There is a need for a cost-effective and sustainable capacity-building approach, such as planting basins. Capacity-building entails actively planning context-specific climate-smart livelihood options. To this end, the study recommends further research that involves a comparative analysis of the impacts of policy and institutional arrangements that promote bottom-up development options in deprived rural communities.

5.1. Limitations of the study

The study findings are not generalizable to the broader inhabitants of Zimbabwe because of non-random sampling and unique natural regions that determine livelihood options.

Author Contributions

Conceptualization, W.M. and M.C.; methodology, W.M. and M.C.; data curation, W.M.; writing–original

draft preparation, W.M. and M.C.; writing–review and editing, W.M. and M.C.; supervision, M.C. All authors have read and agreed to the published version of the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Institutional Review Board Statement

The University of South Africa's College of Agriculture and Environmental Sciences Ethics Committee approved the study.

Informed Consent Statement

Informed consent was obtained from all participants involved in the study.

Data Availability Statement

Not applicable.

Acknowledgments

The researchers acknowledge the survey respondents who sacrificed their busy daily schedules to attend to the questionnaires and the key informants, who included government officials at national and local levels, extension services, and NGOs.

Conflict of Interest

The research project did not receive financial support from any institutions. The authors declare no known competing financial or personal interests that could have influenced the collection, analysis, and interpretation of data and the writing of the manuscript.

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