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Khoza, S., D. Van Niekerk and L. D. Nemakonde. 2022. Gendered vulnerability and inequality: understanding drivers of climate-smart agriculture dis- and nonadoption among smallholder farmers in Malawi and Zambia. Ecology and Society 27(4):19. https://doi.org/10.5751/ES-13480-270419

*Research*, part of a Special Feature on Everyday Adaptations to Climate Change

# Gendered vulnerability and inequality: understanding drivers of climate-smart agriculture dis- and nonadoption among smallholder farmers in Malawi and Zambia

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ABSTRACT. In this study we explore gender-differentiated drivers of disadoption and nonadoption of climate-smart agriculture (CSA) technologies among smallholder farmers for everyday adaptation and resilience building in the face of the increasing threat of climate risk. We apply theoretical perspectives from mainstream technology adoption and gendered vulnerability to identify underlying vulnerabilities and inequalities that drive disadoption (the decision to discontinue any CSA technology previously practiced) and nonadoption (the decision not to use any form of CSA technology). We used an exploratory-sequential mixed methods design at the local level in Chikwawa, Malawi, and Gwembe, Zambia, to understand gender-differentiated drivers of CSA disadoption and nonadoption. Key interviews were conducted with identified critical informants at the district level, followed by focus group discussions with men and women at the village level to obtain qualitative data. We collected quantitative data through a cross-sectional household survey. Findings show that gender-differentiated drivers of CSA disadoption and nonadoption fall within social, economic, institutional, and environmental categories and underlying gendered vulnerability and inequality shape these drivers. CSA is introduced within preexisting gendered vulnerability and inequality, shaping adoption decisions by diverse groups of female and male smallholder farmers. Consequently, CSA outcomes of improved agricultural productivity, adaptation, and resilience building may not be equally achieved because of gender inequalities and vulnerabilities that demotivate diverse households from adopting CSA. This work contributes to a contemporary gender-transformative paradigm in climate change adaptation and disaster risk reduction by focusing on CSA adoption in climate-sensitive regions.

Key Words: *adaptation; climate-smart agriculture; disaster risk reduction; everyday realities; gendered vulnerability; inequality; resilience building*

## INTRODUCTION

Previous climate-smart agriculture (CSA) adoption studies display a generalized focus on adoption, in some instances ignoring gender-differentiated drivers that hinder adoption by smallholder farmers (Asfaw and Maggio 2016). Some econometric studies, mainly using Tobit, Logit, and Probit models, have concluded that gender is not a significant factor in technology adoption, although differentiated access to resources and institutions drive men and women's different adoption decisions (Doss and Morris 2000, Akudugu et al. 2012, Kpadonou et al. 2017). Other studies have focused on generating knowledge of drivers of CSA adoption. They could help provide an essential understanding of adoption rates and further pointers to where CSA adoption still requires improvement (see Makate et al. 2018a, 2019, Gallant 2019, Khoza et al. 2019, Mutenje et al. 2019). However, how smallholder farmers arrive at different adoption decisions remains unexplained, with Ragasa (2012) alluding to a lack of analysis of the root causes of gender-differentiated adoption challenges. There is a gap in the literature exploring the gendered dimensions of CSA disadoption (those who had decided to discontinue use of any CSA technology they had practiced before) and nonadoption (those who have never used any form of CSA technology). Calls for studies that probe into the tensions between gender and CSA nonadoption and disadoption in both research and practice are increasing (Fisher and Kandiwa 2014, Collins 2017, Amadu et al. 2020).

This study considers CSA based on the interconnectedness of climate change adaptation (CCA) and disaster risk reduction (DRR; FAO 2013, Lei 2014, DasGupta and Shaw 2017, Khoza et al. 2020). We explore gender-differentiated CSA disadoption and nonadoption drivers among smallholder farmers in Malawi and Zambia through a gendered vulnerability and inequality lens (Hai and Smyth 2012, Makondo et al. 2014, Zulu 2017). Gender-differentiated disadoption and nonadoption drivers identify men and women's vulnerabilities that need to be addressed to improve adoption. Gendered vulnerability considers the characteristics of men and women in society and the distinctive situations that shape their capacity to anticipate, cope with, mitigate, respond to, and bounce forward from a hazard (Malcomb et al. 2014, Manyena 2016). It results from a combination of interconnected events anchored by underlying root causes, dynamic pressures, and unsafe conditions, which further interact with climatic hazards and increase the risk of climate-related disasters (Hai and Smyth 2012, Wisner et al. 2012).

Exploring adoption decisions from a gendered vulnerability and inequality paradigm will improve our understanding of the everyday realities and contexts within which farmers make disadoption and nonadoption decisions. Considering gendered vulnerability in disadoption and nonadoption helps alleviate challenges associated with mistargeting, promoting locally inappropriate CSA, and maladaptation (Nyasimi et al. 2017, Makate et al. 2018b). Vulnerability reduction can be achieved by creating gender-responsive conditions and remedying gendered vulnerability and inequality's dynamic pressures and root causes. Such understanding is vital because it facilitates a transition from a myopic focus on climate-related hazards and CSA as a technical fix to a panoramic perspective that considers gendered vulnerability and risk arising from complex interactions between hazards, exposure, vulnerability, and coping capacities.

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### Framings of CSA adoption and everyday realities

In this paper we conceptualize that technology adoption concepts can be applied to understanding gendered vulnerability and inequality underlying disadoption and nonadoption decision-making contexts and realities. Adopting new technology is a two-step decision-making process (Neill and Lee 2001). The initial step is deciding whether or not to adopt a technology, often by determining whether adopting that new technology would offer significant benefits or profitability compared to nonadoption (Ragasa 2012, Pierpaoli et al. 2013, Simtowe and Mausch 2018). If farmers decide to adopt, they also have to determine whether they will continue or discontinue using the technology (disadoption). Technology adoption is transitory at any given time, with farmers likely to move from nonadoption to adoption and then from adoption to disadoption (Simtowe and Mausch 2018).

Various scholars have classified drivers of technology adoption differently. Pierpaoli et al. (2013) suggest four categories of drivers: economic, entrepreneurial, environmental, and sociological. Other suggested categories include social, economic, and institutional (Akudugu et al. 2012); or accessibility, liquidity, profitability and suitability, and socio-cultural (Ragasa 2012). We can identify commonalities among such diverse categorizations, and on that basis, this study adapted the drivers as economic, environmental, institutional, and social. Economic drivers include the cost of technology, farm size, cost of adoption, access to credit, expected economic benefits from the adoption, and income-generation activities that farmers may engage in (Akudugu et al. 2012). Environmental drivers are those related to the ecosystem, biophysical, and geographical contexts (Barnard et al. 2015), whereas institutional factors include access to extension services and support availed to farmers by various institutions (Akudugu et al. 2012). Social factors have to do with community organization and personal characteristics (Ragasa 2012).

Disadoption drivers negate previously identified benefits of a technology (Aleke et al. 2011). A farmer reaches a point where they no longer enjoy optimal benefits of a technology they had initially adopted and decides to discontinue further use. Drivers of nonadoption refer to those conditions or challenges that demotivate or constrain a farmer from adopting a particular technology. Understanding the drivers of nonadoption and disadoption is essential for engaging with farmers who face constraints in adopting to articulate their demands and needs (Ragasa 2012). The adoption decisions of smallholder farmers are shaped by more than just technological benefits. They are also shaped by economic, environmental, institutional, and social dimensions and the context of everyday realities of gendered vulnerability and inequality. The concept of everyday realities has been considered in climate and disaster studies by Artur and Hilhorst (2012) and Funder and Mweemba (2019) in Mozambique and Zambia, respectively. Artur and Hilhorst (2012) state that at the local level, government-led CCA and DRR efforts are shaped by different day-to-day factors that influence the intended outcomes of interventions. They acknowledge that in the everyday discourse, although adaptation and risk reduction programs may be designed for vulnerable people, these individuals may fail to adopt and benefit from some of the programs because of vulnerability and inequality factors that put them at a disadvantage. McMichael et al. (2019) consider everyday agency in Fiji, shedding light on how policies are negotiated, accommodated, or resisted in relation to people's day-to-day living realities, including everyday adjustments to farming practices. The conceptual lens of everyday aligns with increasingly audible calls to recognize the agency, perspectives, experiences, and resilience of people living in climate-vulnerable places. In this study, gendered vulnerability and inequality are considered within the framings of everyday realities, the day-to-day interactions within communities and the precarious contexts that make groups differentially vulnerable to climate risk. We apply a conceptual lens of everyday realities to CSA technological adoption, seeking to understand adoption dynamics beyond the linear technological solutions that CSA is said to bring.

## METHODS

### Study sites

Chikwawa is located in the Lower-Shire Valley, which forms part of the Great East-African rift valley, with an elevation below 150 m above sea level (Lumumba et al. 2009). The district is one of Malawi's most vulnerable regions in the context of climate change, with smallholder farmers' livelihoods also dependent on natural resources (Malcomb et al. 2014). The rainfall season supporting subsistence agriculture lies between November and April, with low annual rainfall between 600 and 750 mm during the peak rainfall period. Chikwawa's population is approximately 566,283, almost half of which are female, considered one of the most vulnerable groups to hazards, including disease outbreaks, dry spells, floods, and pests. Male-headed households own 78% of the farming land, which chiefs hold in customary trust. Food insecurity and disaster risk are identified as the top two challenges for the district (GoM 2020).

Gwembe district is located in the middle Zambezi River valley, sharing a watercourse with Zimbabwe's Binga and Kariba districts. The district lies in Zambia's semi-arid Agro-ecological Region 1, one of Zambia's most vulnerable regions, whose average annual rainfall is below 800 mm (Gender in Development Division 2005). Smallholder farmers in Gwembe practice subsistence farming, and the communities on the shores of Lake Kariba also depend on fishing. Average farming land ownership is approximately 2 ha, and most households are male headed. Gwembe is prone to food insecurity. For instance, in the 2019–2020 season, staple maize production was reduced by 98% (United Nations Office for the Coordination of Humanitarian Affairs 2019). Significant commonalities between these two sites are that both lie in major river valley systems where communities are already affected by poverty, severe weather events, and changing climatic conditions, leading to food insecurity. Hazards such as floods, dry spells, and droughts are fairly common, consequently rendering communities vulnerable (Arslan et al. 2018). In both sites, CSA is promoted to help farmers adapt to climate change and strengthen their resilience. However, previous studies have established that men are more likely to adopt CSA than women, who face several challenges that militate against their adoption decisions (Murray et al. 2016, Khoza et al. 2019)

### Research design and sampling techniques

An exploratory–sequential mixed-methods study design (Creswell and Creswell 2017) was applied, with a deliberate bias toward qualitative data (Johnson and Onwuegbuzie 2004). With this study, we seek to contribute toward a transformative paradigm in CSA adoption and local adaptation, which justifies the deliberate elevation of the textual narration of the real-life experiences of the farmers. Sequential mixed-methods sampling strategies were used (Tashakkori and Teddlie 2010). The study identified participants for key informant interviews (KIIs) and focus group discussions (FGDs) in the qualitative phase through purposive sampling. Respondents were selected on the basis of their knowledge of gender, CSA, hazards, and disasters that affect them. Study participants were purposively selected on the basis of the institutions and offices they represented and whether they belonged to any relevant community group such as women's groups or farmer groups. The quantitative phase involved a cross-sectional household survey where participating households were randomly sampled. Household heads (HHH) were interviewed during the survey.

### Data collection and analysis

Data were collected from a total of 172 study participants from the two study sites and analyzed separately. First, we gathered the first set of qualitative data at the district level through a total of 16 KIIs with district-level government and NGO officials and local leaders at the two sites. Three FGDs, each with an average of nine people, were held per district at the traditional authority or ward level, one for women only, one for men only, and one for men and women combined. FGDs comprised CSA adopters and nonadopters, and 54 farmers participated, at least 50% being women, because the study deliberately sought to engage women. We then conducted a preliminary thematic analysis of qualitative findings from KIIs and FGDs in the field to establish themes to be explored in the quantitative survey (n = 51 in each study site). Based on the identified themes, we designed the survey questionnaire and, in both locations, we pilot tested the questionnaires before administering them to sample households at the village level. Descriptive statistical analysis of quantitative data established frequency distributions, followed by integration with qualitative findings.

## FINDINGS

Qualitative findings from KIIs and FGDs in Chikwawa and Gwembe established that drivers of disadoption and nonadoption were similar between the two sites. Differences were observed between the sites in the quantitative cross-sectional household survey. Table 1 summarizes the identified drivers of CSA nonadoption and disadoption. These drivers were further examined to quantitatively establish how they differed across different social groups of men and women smallholder farmers. We explain the in-depth findings in the following sections.

### Drivers of CSA nonadoption

Constraints that could be categorized as economic, social, and institutional (Table 1) were reasons for nonadoption at both sites. Identified economic constraints included a lack of viable markets and tangible benefits that made nonadopters perceive their conventional practices were better than CSA, affordability, and lack of CSA-relevant resources. CSA-relevant resources were

**Table 1.** Summary of identified drivers of CSA nonadoption and disadoption.

| | |
|---|---|
| Drivers of nonadoption | Lack of viable markets |
| | Lack of tangible benefits |
| | CSA affordability |
| | Inadequate technical support |
| | Limited access to information |
| | NGO projects |
| | Lack of CSA-relevant resources |
| Drivers of disadoption | Lack of CSA-relevant resources |
| | Discontinuation of NGO CSA projects |
| | Lack of tangible benefits |
| | CSA affordability |

identified as labor (also social) and appropriate farm implements. For example, in Gwembe, the government-distributed equipment for mechanized conservation farming (a form of CSA) was insufficient to reach a comprehensive number of farmers, contributing to nonadoption by limiting the number of farmers who could adopt CSA. The following statements from respondents from different institutions encapsulate the existing situation regarding the drivers of nonadoption of CSA technologies:

> *[T]he equipment package distributed to 64 lead farmers comprised one ripper and five sprayers and was supposed to support more than 400 follower CSA adopters* (Government worker, Gwembe).

> *Our impact is minimal because our projects require huge investments such as irrigation schemes, which farmers cannot afford* (NGO worker, Chikwawa).

> *Without input subsidy programs, most of our farmers would not afford to purchase these varieties...they have to contribute an amount towards the inputs package* (Government worker, Gwembe).

We identified institutional drivers of nonadoption as inadequate technical support, limited access to CSA information, and humanitarian NGO projects. Farmers cited extension officers as one primary source of CSA information, alongside lead farmers specially trained in CSA to train and support other farmers in their localities. However, in both KIIs and FGDs, insufficient coverage of farmers by the government and NGOs was lamented. Although viewed as better resourced by government departments, NGOs also stated their projects could not reach more farmers. One respondent summarized the situation as follows:

> *Our project target is to reach more than 9000 farmers, and for that, we have 72 lead farmers...clearly, this is not enough to reach more farmers with CSA* (NGO worker, Chikwawa).

Both farmers and practitioners identified farmers' mindsets and ideologies on food-aid distribution through humanitarian NGO projects as social drivers. KIIs and FGDs participants echoed similar sentiments at both sites, and the following statement aptly summarizes these perspectives: "we know that even if we do not harvest much from our fields, NGOs will come and give us food, so why work so hard in these practices yet we know we will not starve" (men and women FGD, Chikwawa).

Nonadopters had limited access to CSA information, such as benefits and drawbacks of CSA and specific CSA options for farmers. Without readily available information and its dissemination to farmers, nonadoption was likely. Practitioners and farmers did not identify environmental drivers for CSA nonadoption. However, respondents identified a close relationship between social and economic drivers, consistent with previous studies (Barnard et al. 2015), highlighting the adverse effects of socioeconomic constraints on adoption.

In Chikwawa, quantitative results (Fig. 1) upheld qualitative findings that nonadoption resulted from a lack of CSA-relevant resources (67% of respondents), and 11% of nonadopters indicated that their conventional practices seemed more beneficial (lack of tangible benefits of CSA). Another 11% stated that their constraint was the lack of access to information. Some respondents cited no tangible benefits (7%), whereas 4% indicated that humanitarian food assistance by NGOs demotivated them to adopt CSA.

**Fig. 1.** Drivers of climate-smart agriculture (CSA) nonadoption Chikwawa.

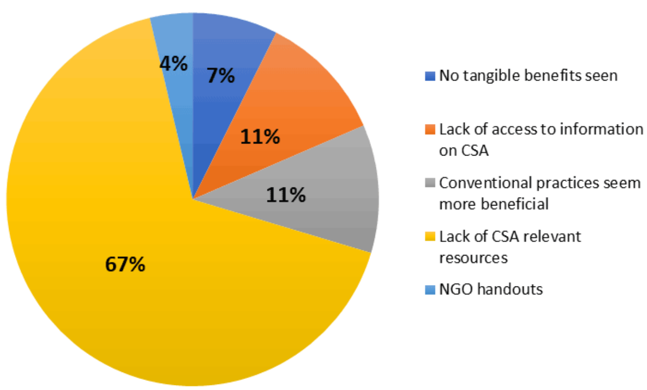
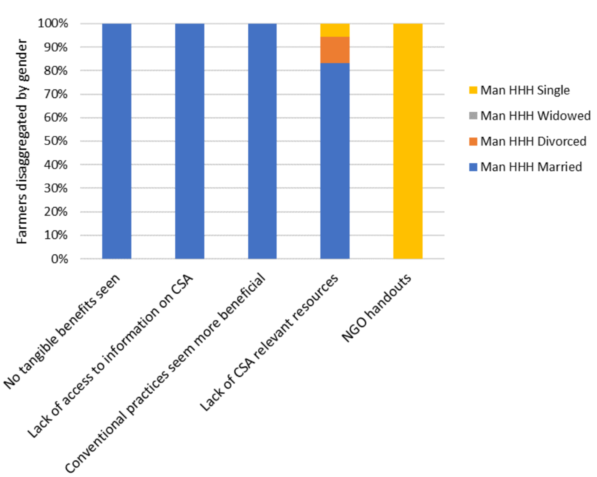



**Fig. 2.** Drivers of CSA non-adoption disaggregated by gender Chikwawa. HHH denotes Household Heads.




All nonadopters encountered in Chikwawa were married, divorced, or single men (Fig. 2). This scenario could result from deliberate women-specific targeting in CSA, especially by NGOs, which excluded men who engaged in domestic roles if unmarried. Nonadoption drivers were identified as lack of tangible benefits and lack of access to information on CSA, leaving farmers to think that conventional practices were more beneficial than CSA. Over 80% of married men also cited a lack of CSA-relevant resources as a reason for nonadoption of CSA. Divorced and single men (approximately 12% and 5%, respectively) expressed a lack of CSA-relevant tools as their major constraint. Single men were the only nonadopters who cited NGO donations as their reason for not adopting any CSA technology, because humanitarian food assistance focused on all food-insecure households.

In Gwembe, 31% of farmers cited the lack of access to CSA information as a reason for nonadoption of CSA (Fig. 3). Lack of CSA-relevant resources was identified as a constraint by 23% of the farmers, whereas 21% stated that their conventional practices seemed more beneficial. Twenty percent attributed nonadoption to the lack of tangible benefits. A small proportion (5%) attributed nonadoption to NGO donations, stating that they knew that even with poor harvests, they would receive food assistance from NGOs.

**Fig. 3.** Drivers of climate-smart agriculture (CSA) nonadoption Gwembe.

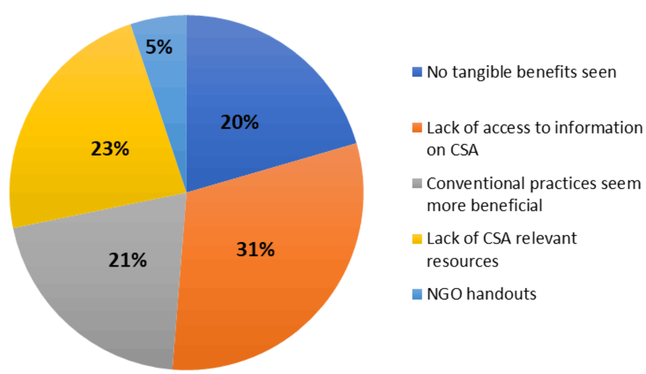
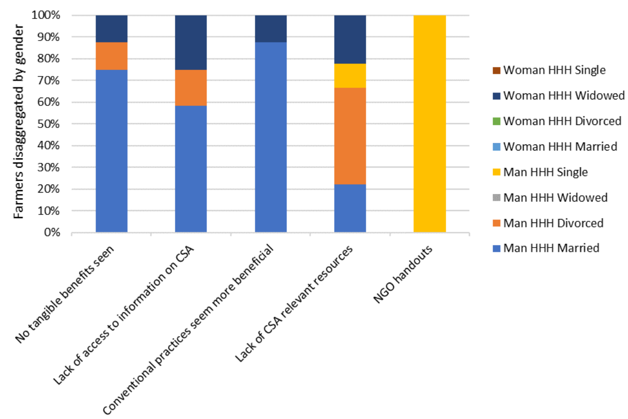



Figure 4 shows that among widows, who were the only category of women HHH among nonadopters, almost 25% cited the lack of access to CSA information as the reason for nonadoption. In comparison, 22% highlighted the lack of CSA-relevant resources in Gwembe. Approximately 11% identified a lack of tangible benefits, finding their conventional practices to be more beneficial.

Almost 90% of married men indicated that conventional practices were more beneficial, with 72% citing CSA's lack of tangible benefits. Lack of access to information led to nonadoption among 59% of married men, whereas 22% identified the lack of CSA-relevant resources. Forty percent of divorced men also identified the lack of CSA-relevant resources, whereas almost 15% mentioned a lack of CSA information. All single men HHH cited NGO donations (food aid) as a primary reason for nonadoption. The quantitative results generally corroborated qualitative findings, and further exploration of identified nonadoption drivers established that these differed between women and men

**Fig. 4.** Drivers of climate-smart agriculture (CSA) nonadoption disaggregated by gender Gwembe.




of various civic statuses. To our knowledge, previous studies have not assessed gender-differentiated drivers of nonadoption. Still, the broad drivers identified in this study show consistency with what previous studies (Fisher and Kandiwa 2014, Barnard et al. 2015) have established.

### Drivers of CSA disadoption

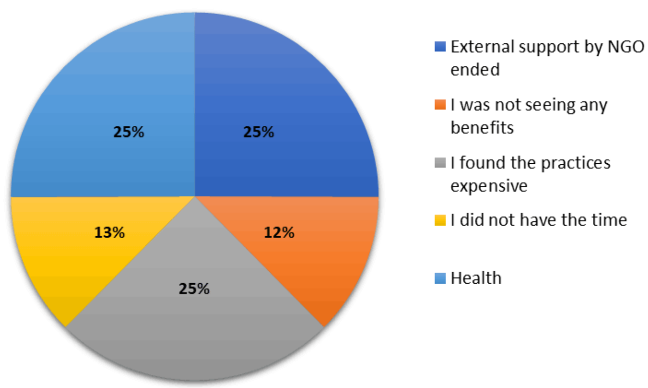
Findings show disadoption of CSA only in Chikwawa. In Gwembe, farmers stated there was no outright disadoption. There is a possibility that farmers' movement from one project to another as different CSA projects ended and new ones commenced masked disadoption. In Chikwawa, the lack of CSA-relevant tools (economic and social drivers), lack of tangible benefits and unaffordability of CSA (both economic drivers), health problems (social drivers), and the termination of NGO projects (institutional drivers) influenced disadoption. Qualitative findings established that women household heads were most likely to encounter challenges that forced them to disadopt CSA, and the following statement exemplifies this:

> *Women are more likely than men to dis-adopt CSA when they face problems in their homes... they fall sick and cannot work in the fields, or they do not have enough money to pay towards subsidized inputs...* (Women-only FGD, Chikwawa).

Disadoption was also likely when CSA failed to meet farmers' expectations of tangible benefits. For conservation farming, disadoption resulted when NGO projects that had been distributing free or subsidized inputs ended, or when farmers were required to contribute inputs costs partially. When farmers could not raise the necessary contribution, they were likely to discontinue.

Exploring identified drivers through a quantitative survey revealed some divergences from qualitative findings. KIIs and FGDs did not identify time constraints as drivers of disadoption, yet the household survey established that 13% of disadopters mentioned it (Fig. 5). Health status was cited by 25% of disadopters because it affected the availability of household labor to engage in CSA, especially conservation farming.

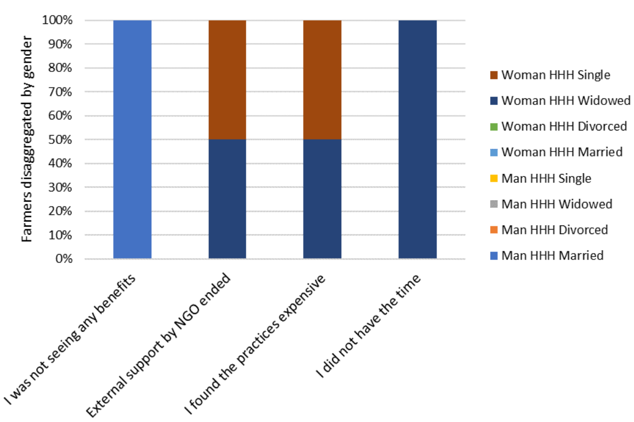
**Fig. 5.** Drivers of climate-smart agriculture (CSA) disadoption Chikwawa.




When NGO-supported CSA projects ended, disadoption was likely, because farmers could not afford expensive CSA technologies (Fig. 5). Disadopters stated they had not realized any tangible benefits from the CSA technologies they had adopted (14%), mainly because they could not earn adequate income that could have helped to improve the quality of their lives.

Disadopters who only cited the lack of tangible benefits were all married men. Women HHH indicated time constraints, CSA unaffordability, and termination of NGO projects (Fig. 6). These findings provide empirical evidence that women HHH face more challenges leading to the disadoption of CSA. Drivers of disadoption also shed light on CSA interventions' sustainability to help communities adapt to climate change and build resilience.

**Fig. 6.** Drivers of climate-smart agriculture (CSA) disadoption disaggregated by gender Chikwawa.




## DISCUSSION

This study confirmed that drivers of CSA nonadoption and disadoption fall within economic, social, and institutional categories as previously highlighted by Neill and Lee (2001), Ragasa (2012), Pierpaoli et al. (2013), and Fisher and Kandiwa (2014). CSA dis- and nonadopters did not cite environmental drivers. Applying a gender lens in analyzing these drivers illuminates different underlying gendered vulnerabilities and inequality, influencing farmers' disadoption or nonadoption decisions. At this juncture, it is essential to make further inferences and discuss the gender-differentiated drivers of CSA nonadoption and disadoption within the framings of gendered vulnerability from a DRR perspective, given suggestions from the literature on the interconnectedness of CSA and DRR (FAO 2013, Lei 2014, Mathews et al. 2018). From a DRR perspective, these findings give insights into existing gendered vulnerability and align with Wisner et al. (2012) on the progression of vulnerability, making some categories of farmers more susceptible to the adverse effects of climate change than others. In line with the gendered vulnerability paradigm, our findings accentuate that if CSA contributes to adaptation and resilience-building, then gender-differentiated drivers of CSA nonadoption and disadoption need to be addressed. When our findings are considered within the purviews of everyday realities in CCA and DRR, we concur with Artur and Hilhorst (2012). They acknowledge that in the everyday discourse, the adaptation and risk reduction programs designed for vulnerable people may fail to bring about the anticipated change because vulnerability and inequality factors limit adoption. Our findings shed light on the day-to-day realities of vulnerable female and male smallholder farmers and the factors that influence them not to adopt CSA or to disadopt. The economic, social, and institutional factors that influence farmers' disadoption and nonadoption decisions are different for men and women, pointing to gender-differentiated day-to-day realities of vulnerabilities and inequality that leave them incapable of adopting CSA or continuing its practice. For CSA adoption to be improved and adaptation and resilience attained, solutions will need to alleviate the identified challenges for different vulnerable groups. Solutions need to tackle gender-differentiated dynamic pressures, address underlying root causes, and create equal opportunities for all men and women in vulnerable communities (Hai and Smyth 2012).

Our findings show that farmers were demotivated by CSA adoption because they felt there would be little income earned from CSA, given that there were no viable local markets where farmers could sell and earn income from surplus produce. CSA did not translate to any meaningful change in quality of life, especially for women HHH. There is a need to promote gender-responsive economic empowerment through meaningful value-chain development in CSA. Innovative approaches should consider different farmer typologies, especially women whose mobility for market services is constrained by reproductive and community roles, whether they are married or not. Value-chain development needs to service all farmers equally, contributing to women's economic empowerment and resilience whereby increased income may reduce gendered vulnerability and poverty.

This study revealed that institutional drivers, such as inadequate technical extension support from government departments and NGOs, encourage the nonadoption of CSA. Conversely, the provision of adequate technical extension support may improve adoption by serving as information dissemination hubs. When practitioners concentrate extension support to convenient locales, this constrains the ability of marginalized women in remote villages to attend training and meetings, limiting women's access to CSA information to guide decision making. There is skewed access to information and knowledge, with women in this study indicating they had no access to CSA information. Equally concerning is evidence that even married men lacked access to CSA information in some cases. Although it may be understandable that resources for implementation are limited, we recommend that CSA actors resourcefully utilize existing community structures, such as community-based DRR committees where farmers can disseminate CSA information and reinforce peer encouragement. When armed with knowledge, decision making becomes easier.

Institutional, economic, and social drivers, particularly the availability of CSA-relevant tools, affordability, tangible benefits, and ideologies around NGO projects and dependency syndrome, were the root causes of gender-differentiated drivers of nonadoption or disadoption. Addressing root causes tackles uneven power dynamics and enables gender-equal opportunities for different groups of smallholder farmers to adopt CSA. For example, although governments provided subsidized input support programs (ISPs), these were gender-neutral and viewed men and women as homogeneous, requiring the same monetary contribution to access inputs. Women HHH have limited ownership and access to CSA-relevant resources, meaning the financial contributions needed in ISPs may be prohibitive. Farmers will adopt CSA if it is affordable with minimum running costs, and when the opposite is the case, farmers will be unlikely to adopt. Disadoption was likely for some women farmers when a subsidy program ended. Thus, understanding gender-differentiated vulnerabilities sheds light on gender-neutral policies that need transformation to cater to all genders adequately. For example, ISP policies may need to be amended to have gender-sensitive contribution requirements.

Reducing dynamic pressures through economic empowerment and viable local markets can create tangible CSA benefits. Tangible benefits of adaptation in food security, improved quality of life, and poverty alleviation may motivate farmers to adopt and shape investment decisions on time, money, and labor. If adoption fails to demonstrate a distinctive competitive edge it may discourage farmers from adopting or encourage disadoption. Addressing root causes for nonadoption and disadoption also needs to tackle the paradox of NGO projects in CSA. On the one hand, NGOs seem to be driving CSA adoption. On the other hand, humanitarian food aid encourages nonadoption or disadoption by farmers. Program harmonization between humanitarian food-aid distribution and longer term adaptation and resilience-oriented projects such as CSA is required (Béné et al. 2016). One possible way would be to diversify CSA options available to farmers, increasing income security and ultimately providing tangible transformation and resilience benefits for heterogeneous smallholder farmers.

## CONCLUSION

In this study we explored gender-differentiated drivers of CSA disadoption and nonadoption among smallholder farmers. We provided evidence of how underlying gender-differentiated vulnerabilities and inequality shape CSA adoption decisions among smallholder farmers in climate-sensitive regions. Findings show that CSA is being introduced within the everyday realities and maintains the status quo of preexisting gendered vulnerability and disparities in climate-sensitive smallholder farming communities. Our work magnifies the need to transform the CSA policy framework and implementation into inclusive, equitable, locally appropriate, and sustainable approaches for adaptation and resilience building. Understanding gender-differentiated drivers of disadoption and nonadoption creates an opportunity to explore ways of pursuing the inclusion of marginalized, heterogeneous social groups of farmers.

Tackling the identified gender-differentiated drivers of nonadoption and disadoption may reduce gender-differentiated vulnerability and climate-related risks affecting smallholder farmers. Framing CSA adoption decision making purely through econometric or simplistic dichotomous analyses is insufficient. Instead, a combined application of intersectionality, technology adoption, and CCA and DRR concepts to understand the everyday realities of heterogeneous female and male smallholder farmers helps to identify areas where transformation of preexisting gender inequalities and vulnerability is required. When interactions of social, economic, institutional, and environmental drivers shaping disadoption and nonadoption decisions are understood, researchers, practitioners, and policy makers can collectively formulate strategies and policies that will curtail impediments.

Domesticating CSA within DRR creates opportunities for more collective action to address complex, gendered vulnerability that otherwise tends to inhibit adaptation and resilience at the local level. Transdisciplinary collective action that enhances collaborations and partnerships is required in research and practice to improve adaptation at the farmer level. Holistic efforts to address gender inequalities that hinder CSA adoption, especially by different groups of women, may enable CSA to be delivered with precision and efficiency. With over a decade in existence, CSA work done thus far presents researchers, practitioners, and policy makers with the opportunity to review the concept critically. Future research may draw larger sample sizes for cross-sectional surveys in different communities, thereby improving the generalizability of findings, a weakness of the mixed methods design applied in our study. However, we warn that researchers should not pursue generalizability at the expense of the farming households' day-to-day realities and perspectives.

*Responses to this article can be read online at:*
https://www.ecologyandsociety.org/issues/responses.php/13480

**Acknowledgments:**

*We extend our profound gratitude to all individuals and institutions who participated in this study in various capacities in the two study sites, Chikwawa, Malawi, and Gwembe, Zambia. We are equally grateful for the constructive feedback from the issue editors and anonymous peer reviewers. This paper was presented at the Everyday Adaptations workshop hosted by the University of Michigan Sustainability and Development Initiative (SDI), and we are grateful to workshop organizers and participants who provided the initial review and feedback on the manuscript. This research was made possible through funding support from the North-West University and the Department of Science and Technology-National Research Foundation (DST-NRF) Centre for Excellence in Food Security. Publication of the paper was made possible through funding support from the SDI and the Initiative on Climate Adaptation Research and Understanding through the Social Sciences.*

**Data Availability:**

*The data/code that support the findings of this study are available on request from the corresponding author, SK. None of the data/code are publicly available because of their containing information that could compromise the privacy of research participants. Ethical approval for this research study was granted by North-West University Faculty of Natural and Agricultural Sciences Research Ethics Committee.*

## LITERATURE CITED

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