Gender and the use of technologies in the face of drought among smallholder farmers in Karamoja sub region, North Eastern Uganda

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Abstract

In this paper, we discuss gender and the use of technologies in drought conditions. Our focus for the paper is the smallholder farmers in Karamoja Subregion, North Eastern Uganda. Studies have shown that drought significantly impacts livelihoods of smallholder farmers. For this study, we used a mixed-methods approach-(quantitative and qualitative) to compare the use of technologies by gender in drought situations among smallholder farmers in Karamoja Sub Region, North Eastern Uganda. Data were collected from a random sample of 161 men and 231 women in Nabilatuk district, including purposively selecting Key informants, focus group discussions and using an observations guide. Our findings indicate that drought has destroyed livelihoods, reduced crop yields and caused pests and diseases. For men and women to adapt to the drought effects, women have adopted the use of traditional technologies like the use of detergents to control crop pests

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and diseases. While other women have adopted kitchen gardens and the use of grinding stones to grind sorghum. The men use acaricides to spray livestock while others use herbs to treat livestock. We argue for strategies in agriculture that can lead to gender equality in the use and adoption of technologies that can enhance adaptive capacity among smallholder farmers whose livelihoods are threatened by the drought.

Keywords: Gender, Drought, Technologies, Smallholder farmers.

1. Introduction

In this paper, we compare the use of technologies by gender in drought situations among smallholder farmers in Karamoja Sub Region, North Eastern Uganda. Smallholder farming includes small farmers who own/control the land they farm and those who do not (Renard, 2015). It is an important source of livelihood in many low- and middle-income countries (LMICs) (Doss & Quisumbing, 2020). However, the drought – manifested in an increase in temperatures – has significantly affected the predominantly agrarian populations (Nagarajan et al., 2020). The Intergovernmental Panel on Climate Change (IPCC) notes that the global mean surface temperature has increased by approximately 1°C above the pre-industrial levels and is likely to rise to 1.3–4.8 °C by 2081–2100, resulting in regional warming with a strong impact on agriculture (IPCC, 2018). The increase in the average temperature in Africa (from 2°C to 4°C) poses a threat to agriculture, especially to the smallholder farmers (Egbebiyi et al., 2020; Sandstrom & Strapasson, 2017). In Uganda specifically, the incidences of drought are reported to have increased from 1 in 10 years to 1 in 6 years, (Lwasa et al., 2017). Overall, drought episodes have been on the increase, leading to crop failure and

livestock mortality in the Karamoja Sub region. This has resulted in vulnerability among the men and women in smallholder farming (Akwango et al., 2016).

To adapt to the drought problem, the men and women in smallholder farming use drought adaptation technologies. By drought adaptation technologies, we refer to "the application of technology in order to reduce the vulnerability, or enhance the resilience, of a natural or human system to the impacts of climate change" (Mfitumukiza et al., 2020). A World Bank study in Bolivia established that men focus on certain technologies like irrigation, while women prefer planting new crop varieties (Sophia & Samuel, 2020). Notably, when women are able to access Climate Smart Agriculture (CSA), they are in fact just as apt to implement CSA practices as men (Gumucio & Schwager, 2019). However, Mutenje et al. (2019) found that in South Africa, women adopt to technologies which are labour intensive and consequently increase their work burden. Similarly, Okot et al., (2020) revealed that the inhabitants of Karamoja were using several traditional technologies like Microglossa pyrifolia, a wild plant for treating diseases, to be able to survive during the dry season. Caravani (2019) furthermore shows that during the drought of 1980s in Karamoja sub region, many farmers died of hunger because they did not have the modern technologies to acquire more livestock to withstand the drought. Evidence shows that the men in pastoralism have adapted to technologies of rearing camels which can withstand the drought (Salamula et al., 2017). Each of the studies referred to shows that men and women adapt differently to the drought problem. Furthermore, these adaptations determine the course of survival in times of drought, not only in the Karamoja region, but on the global scale too.

While there have been several studies done on gender and drought adaptation technologies in Karamoja sub-region in Uganda, there is a paucity of information on how men and women use indigenous and modern technologies to withstand the drought in Nabilatuk district found in Karamoja Sub region. While indigenous knowledges refer to the local knowledge that is unique to a given culture or society (Stigter, Dawei, Onyewotu, & Xurong, 2005), modern technologies are technologies which lead to increased efficiency in agricultural production (Jain et al., 2009).

Drawing on Natural Disasters Risk theory by (Blaikie et al.,2005) which argues that natural disasters like drought have tremendous effects on livelihoods and feminist political ecology by (Rocheleau et al.,2013), that note that, access and decision making are crucial variables in adaptation to drought. The paper compares how men and women use technologies to withstand the drought.

2. Research Objective

To compare the use of technologies by gender in drought situations among smallholder farmers in Nabilatuk district Karamoja Sub Region, North Eastern Uganda.

3 Methodology

This section explains the research design, study site, and participants, and goes on to present the data collection methods, tools, data management, and analysis.

3.1 Research design, study site, participants

The paper draws on a mixed method approach and a cross-sectional study design. A mixed method approach was used to give a better

understanding of the problem and yielded more complete evidence on gender issues in the study area.

3.1.1 Research site

Lolachat and Nabilatuk Sub-counties in Nabilatuk district are located in North-Eastern Uganda. Nabilatuk district is a semi-arid area in East Africa, found in North Eastern Uganda between Latitude 1° and 4° North and Longitude 33° and 35° East (Byaruhanga et al., 2015). The district has one rain season from April to September that ranges between 350-1000 mm per annum. Temperatures vary between 32°C to 35°C in the dry season (Atuhaire et al., 2018). Basing on the Normalized Difference Vegetation Index (NDVI), Nakalembe et al., (2017) concluded that the district is prone to so many droughts causing loss of livelihoods. By 2019, the total population of Nabilatuk district was 85,700 people. Of these 40,800 were women and 44,900 were men (UBOS, 2020).

3.1.2 Quantitave; Population and Sample

The majority of the people (80%) live in rural settlements called '*Manyatta*' which are composed of huts made out of mud walls and grass thatched roofs (Cau, Lochiam, Merlo, Rossanigo, & Steffan, 2018). The biggest proportion of men and women in these communities are engaged in smallholder farming (Akwango et al.,2017). Data were obtained from smallholder female and male farmers in the two sub-counties of Lolachat and Nabilatuk in Nabilatuk district. The two sub-counties were purposively sampled because they experience droughts that destroy livelihoods of men and women in smallholder farming (Akwango et al., 2017). For the survey participants, we used Cochran's formula to determine the sample size. A total of 392 respondents was randomly selected from villages practicing crop farming. 231 were women, while 161 were men.

3.1.3 Research tools

A structured questionnaire with both open and close ended questions was used to collect data on demographic characteristics of the respondents, farming practices, effects of drought on crop and livestock farming, the available resources, infrastructure and technologies for adaptation. The interviews took between forty-five minutes and 1 hour.

3.1.4 Data collection and analysis

The study mainly used guided semi-structured questionnaires with only a few self-administered questionnaires to collect data. Guided questionnaires were used because of high illiteracy rates: 79.8% among females and 64.8% among males (Datzberger, 2017). Under such conditions, it is inconceivable to undertake self-administered questionnaires in data collection as the response rate and data quality would be extremely low. Data were collected through a survey method by research assistants who knew the local language (Karamojong).

Quantitative data were analysed using STATA software and Microsoft Excel 2013 to produce descriptive statistics. A Multinomial Logistic Model (MNL) was used to examine the determinants of the adoption of technologies for adaptation to drought.

3.1.5 Qualitative data collection methods and tools

With the help of the Local Council 1s, purposive sampling was used to select participants for the Focus Group Discussions (FGDs). We conducted 8 FGDs: 4 for men and 4 for women, each with 9 to 12 participants, giving a total of 48 women and 36 men. For key informants (KIIs), we purposively selected and interviewed 3 Government officials (from the district production unit) and 7 NGO representatives that were working on climate change and livelihood issues in Lolachat and Nabilatuk Sub counties. The key questions addressed in the qualitative data collection process were

how men and women use the technologies to withstand the drought, and who controls the technologies between men and women. Key informants were asked questions concerning how the technologies were introduced among farming communities. The FGDs and KIIs were also administered to different people in different villages. Most of data collection process for FGDs and KIIs lasted between 45 minutes and an hour. We obtained informed consent from the participants. This study is part of a PhD study that broadly focuses on examining gender and the adaptive capacity of smallholder farmers to effects of drought in Nabilatuk district.

3.1.6 Data management and analysis

Analysis of qualitative data followed the transcription of audio recordings verbatim, and translating the transcripts from Ngakarimojong into English for thematic analysis. A thematic analysis approach helped to classify code and categorize the codes into relevant emerging themes and sub-themes.

Qualitative data provided insights into smallholder farmer's gendered access to and control over technologies for adaptation amidst drought. The qualitative findings were then corroborated with the quantitative findings to show men and women's use of technologies to withstand the drought in the study site. The subsequent section shows the results from our fieldwork.

4. Results

All participants, regardless of their sex, age, and farming systems, agreed that drought episodes had hit Nabilatuk district over the last years (See Table 1).

Table.1: Drought in Nabilatuk by sex

Drought	Men No (%)	Women No (%)	Total No (%)
Severe	68 (42.2)	147 (63.6)	215 (54.9)
Moderate	75 (46.6)	56 (24.3)	131 (33.4)
Mild	18 (11.2)	28 (12.1)	46 (11.7)
Total	161(100)	231(100)	392 (100)

Source: Fieldwork (2019).

Over half of the respondents (63.6% of women and 42.2% of men) mentioned how the drought had been severe, with negative consequences on crops and livestock farming. This resulted in negative effects on their wellbeing. A larger proportion of men (46.6%) than women (24.3%) perceived drought as moderate, while a small proportion of both men and women (11.2% of men and 12.1% of women) noted that it was mild. Both the women and men in smallholder farming expressed during the focus groups discussions how they had experienced more droughts in the last 10 years. As a participant explained, "Don't talk of the drought, it has led to stunted growth of crops, resulting in decline and quality of produce." Meaning that both men and women were experiencing food insecurity problems. To adapt to the intermittent droughts, the men and women in smallholder farming use both indigenous and modern technologies.

4.1 Smallholder farmers: Gender and use of indigenous technologies

The study sites had indigenous technologies like broadcasting, grinding stones and compost manure which men and women use to adapt to the drought problem. Using a multinomial analysis on use of broadcasting

method and compost manure between men and women, findings reveal, in Table 2, that the overall model is significant (P<0.009).

Table 2: Background characteristics, Broadcasting method and use of compost manure

Variable	Coefficient	P-value
Female	-0.459	0.200
Age		
31-40	0.937	0.140
41-50	1.880*	0.002
Over 50	1.192	0.070
Marital status		
Married	0.251	0.820
Widowed	-0.535	0.656
Separated	-16.277	0.995
Highest Level of formal Education		
Primary	-0.344	0.472
Secondary	-0.795	0.470
Diploma	22.829	1.000
Bachelor's degree	-1.082	1.000
Master's degree	-17.037	0.998
Others (ABEK)	-27.327	1.000
Constant	-2.844	0.014

* Represent 5% significant level

Further analysis of Table 2 shows that men in the age bracket of 41-50 are more likely to use compost manure rather than broadcasting (P <0.005) and coefficient (1.880*). The men in the age category of 41-50 use indigenous technologies because they have knowledge of how to use the different technologies. In FGDs of men, the men revealed that they had knowledge on how to use castration stones to castrate bulls as a participant attested,

It is only those elderly men who have the knowledge of using castration stones to castrate bulls. I remember last year when I wanted to castrate the bulls I took them to Mzee Damachie to castrate using a stone. For us young boys we don't know how to use stones (Participant, FGD, shepherd, Lolachat, 2019).

This was supported by an FGD participant who noted,

Yes, that is our work here to castrate bulls using stones, but you must be knowledgeable to know exactly how to castrate, if you miss the point you might harm the cattle or it will kick you. Sometime back when I was castrating a bull I mistakenly hurt my fingers in the process, I had to stop the activity (Participant, men, FGD, Nabilatuk,2019).

Castration of bulls and he-goats using stones is a risky exercise, as the respondent above shows. Men in livestock farming hurt their fingers resulting in long time injuries. This increased men's vulnerability more than women's during the drought.

Findings further show that the women involved in crop farming use grinding stones to process foodstuffs like *attaap* (sorghum floor). From observations, the use of grinding stones for processing foodstuffs is a labour-intensive activity. It results in an increased work burden of women farmers. From observation, it could be seen that women spent 4 hours pounding the grain manually or rubbing it between stones. This affects and or limits their capacity to carry out other roles like cooking and fetching

water for their small gardens. The hardship women undergo while processing foodstuffs through use of indigenous technologies was explained,

During the process of crushing maize, I must hold the flat- stone with one hand and bring it down repeatedly on the maize until it is reduced into small particles, then continue crushing it with a stone until the maize is reduced to flour (Participant, FGD, Women, Lolachat, 2019).

To protect the livestock from diseases, the men involved in pastoral farming resort to using herbal medicines like Albizia Anthelmintica (*Ekapangiteng*). This was revealed in FGDs of men, "I remember that drought of 2017. My bull got intestinal worms, but I just pounded *Ekapangitent*, gave it and it recovered." The men involved in pounding herbal medicines to treat livestock lamented that this kind of laborious work uses a lot of energy. Additionally, one noted, "I have to walk between 4 – 7 kms distance to get *Ekapangiteng* to treat my goats." Therefore, one can argue that the indigenous technologies increased men's work burden, resulting in vulnerability as they struggle to protect their livelihoods during the drought.

Quantitative data in Table 2 concurs with qualitative results that the women in crop farming use broadcasting methods in their small gardens during the drought period. The women broadcast different types of crops ranging from Sorghum to seeds of vegetables, including groundnuts. As a woman farmer observed during an FGD: "Since I was a young girl, broadcasting is the only method I use for planting my crops here. It saves my time and when I broadcast I get high yields." Another respondent explained, "With broadcasting I can plant 1 to 2 acres a day (more) than other methods of planting in lines." Women broadcast seeds of "Sukuma wiki," a lush green vegetable grown in kitchen gardens for food or for sale to get income. The broadcasting method used by women in their gardens helps them to withstand the drought. However, the broadcasting method is

associated with problems. Women, during the FGDs, noted that they found difficulties weeding crops which have been broadcasted. One revealed, "Last year, I broadcasted green vegetables in my gardens, but at the stage of weeding, I found many difficulties. I had to weed by hand every morning and evening." Weeding using hands wastes women's time and increases their work-burden.

Further analysis of qualitative data revealed that the drought was associated with pests and crop diseases. For women to control pests like the army worm, they use indigenous technologies of ash mixed with water to spray crops. A female participant observed in an FGD, "In 2018, armyworms came and attacked my crops. I spent all my time during the day working in the gardens mixing ash with water, sometime OMO detergent with water, then spraying using grass." Women were spending more hours mixing the ash and water, followed by spraying the crops with grass. These activities not only increase their work-burden, but leave them with less time to concentrate on their vegetable gardens.

Furthermore, the women reported that some of the techniques of mixing ash and water could not adequately eliminate the pests. They resorted to the use of red chilies and onions. Women in FGDs revealed that they cut onions and red chilies which they mix with water to spray crops pests. Others use Neem tree leaves and powder as a preservative for grains stored in granaries. During a women's FGD, one said, "When I store my Sorghum in the granary, I make sure I put in Neem leaves to protect the cereals against pests which are so many here." However, the women reported that the process of cutting neem leaves and onions to protect their plants is a cumbersome activity. Others argued that the indigenous methods of controlling crop pests and diseases exposed them to eye and chest diseases. One woman farmer expressed, "Cutting onions and chilies is not easy.

The last time I cut my finger while cutting those chilies. They also made my eyes very red and painful the whole week."

From the foregoing, women's fingers get cut while their eyes get irritated. This results in injury and long-time sickness. This means that the women's capacity to be productive in agricultural activities gets compromised as they adapt to the challenges of drought. Qualitative data further showed that for women in livestock farming to preserve milk and make ghee for use during the drought spell they use gourds. Women, during the Focus Group Discussions, echoed the fact that gourds keep milk for two weeks, and ghee for two months. In the words of one-woman participant, "The only method I can use to preserve ghee for a long time is using a gourd. If you don't use a gourd the ghee will go bad after few days." The ghee was used as cooking oil and for sale by women. However, preserving milk to make ghee in gourds is tedious for women, and as one woman narrated, "I have to spend the whole day churning milk inside the gourd to turn it into ghee for preservation." The study findings further show that the women in control of gourds have the task of keeping them safe from the reach of children, rats, and other predators. As a cumbersome activity for the women, the task of keeping gourds safe forced some women to resort to the use of modern technologies.

4.2 Smallholder farmers: Gender and use of modern technologies

Our study findings show that there are different types of modern technologies that men and women in crop and livestock farming use for adaptation to drought. These include spraying and treatment using allopathic medicines, use of improved crop yields, planting in lines and grinding machines. Using a multinomial analysis, the overall model (as shown in Table 3) is significant ($P<0.005$).

Table 3: Background characteristics, Spraying livestock and use of acaricides

Variable	Coefficient	P-value
Female	-1.193*	0.000
Age		
31-40	0.864	0.053
41-50	0.516	0.293
Over 50	0.797	0.102
Marital status		
Married	1.010	0.351
Widowed	-0.589	0.654
Separated	-14.965	0.996
Constant	-2.204	0.042

**Represents 5% significant level Source; Field work, (2019)*

Table 3 further reveals that the women are less likely (Coefficient-1.193*) to use Acaricides for spraying as a modern method of disease control in livestock farming than men. This was attributed to cultural norms in the study sites that dictate that the use of Acaricides for spraying livestock is a male activity. One woman during an FGDs noted, "It is a culture of men to spray animals here in Karamoja, not women. Men own cattle, and culturally they have to take care of the cattle." This means that the culture denies women the opportunity to use technologies that increase adaptive capacity. This results in women's vulnerability during the drought due to the fact that livestock is one of the viable livelihoods in the droughts of Karamoja. Men in livestock farming use acaricide to spray cattle against ticks which cause tick borne diseases. As one male livestock farmer revealed, "Spraying using

acaricide helps my animals to survive the ticks in this area. I mix water in acaricide and use the foot pump sprayer to spray animals." This implies that the use of acaricides to spray livestock helps livestock to survive during the drought period. Further probing on how men acquired knowledge on the use of spraying showed that the men unanimously agreed that NGOs like Karamoja Christian Ethnoveterinary Program (KACHEP) have been training them on the use of acaricides and other medicines like Tylosin, Penestren, Hitet and Long Acting to treat livestock.

Key informant interviews corroborated the results from the FGDs showing that NGOs have been sources of knowledge on the use of modern methods to treat livestock in Karamoja. Men use the knowledge on treatment of livestock against diseases like East Coast Fever (ECF), Heart Water and worms. Data from key informants revealed that men mis-use the modern medicines while treating livestock, with some giving over or under the proper dosage. As a male key informant stated, "The problem with men in this region is that they don't know how to administer the medicines. Some are just guessing on diseases and injecting the animals with the wrong medicine"

Further analysis of qualitative results shows that more men than women use hybrid crops like SESO-3 sorghum. During focus groups discussion of both men and women, it was pointed out that these are men in the age brackets of 31-40, 41-50 and over 50. This category of men had connections with NGO and government workers who supply improved seeds varieties to farmers. As it was attested to in one of the men's FGDs,

> I used to plant indigenous seeds but I have stopped. My friend in Northern Uganda Social Action Fund (NUSAF) came here last season and gave me SESO-3 Sorghum. This type of Sorghum is good for food and even birds don't disturb it so much. So, this is what I am growing currently (Participant, Men, FGD, Nabilatuk, 2019).

Men used improved seeds that are drought resistant and withstand the drought more than the women did. Contrary, in other FGDs it was revealed that it was not only men using improved seeds. Women during FGDs pointed out that they were also planting improved seed varieties. Examples of these included groundnuts, SERENUT 2, and Maize Longe 10. The different types of improved crop varieties resulted in food security and enabled women to adapt to the drought problem. Further probing revealed that women planted some of the improved crop varieties in lines, but never harvested anything. This was attested to by a woman in crop farming, "Last time I planted in lines, I wasted a lot of time measuring with a rope and I even never harvested anything." This means women create new work while measuring during planting.

For women to process their foodstuffs, they use grinding machines. These are power tools or machine tools used for grinding maize, sorghum or maize mixed with sorghum to make posho or sorghum flour. During the FGDs, women revealed that grinding machines make it easy to process sorghum within a short period of time, and as one narrated, "After sorting my Sorghum, I take it to grinding machines in a nearby village, they grind for me *attaap* (also called Sorghum meal flour), come back and immediately cook." The grinding machines increased food security during the drought period in the Nabilatuk district. Further analysis of data revealed that grinding machines had problems because they ground posho smelling of diesel fuels, and this posho was unfit for human consumption. One-woman FGD participant narrated, "I took my Sorghum to grind at the machine, but it came out smelling of diesel. I had nothing to do but to take it the way it was." Another woman, operating a grinding machine, attested in one of the FGDs, "...those grinding machines are very dangerous. I remember one day I was operating a grinding machine and the motor belt jumped off. It almost

killed me." Notably, grinding machines processing Sorghum into Sorghum meal flour that smells of diesel means that the machines are unfit for processing foodstuffs. Additionally, they expose women's lives to risks of death when motor belts jump off.

5. Discussion and Conclusion

5.1 Smallholder farmers: Gender and the use of indigenous technologies

Studies agree with our findings that indigenous technologies are important for smallholder farmers. They help men and women to withstand the drought (Mfitumukiza et al., 2020). As our study shows, farmers, both men and women, use different indigenous technologies to withstand the drought. For example, women broadcast as they plant the seeds in their gardens. A similar finding was found in Pakistan by Ishaq and Memon (2016) where the broadcasting method of planting seeds is a women dominated activity. The women broadcast different crops like sorghum and "Sukuma wiki" in small gardens. The study findings go on to show that drought causes crop pests and diseases, i.e., army worms, causing women to mix ash and water or red chilies to protect their livelihoods. The mixing of ash and water is a laborious activity that takes women's time, leaving them with limited time to juggle other traditional roles. A study in Western Uganda had similar findings, showing that the drought wastes the time of women and increases their work burden as they struggle to protect their livelihoods (Nagasha, Mugisha, Kaase-Bwanga, Onyuth, & Ocaido, 2019).

Indeed, other women farmers from the study sites make concoctions like cutting onions and red chilies to mix with water and spray crops, but this expose women to health problems. This coincides with other scholars in Sub Saharan Africa who observed that farmers have tried

to control pests using other indigenous methods such as cutting chili pepper and neem tree leaves (Baudron, Zaman-Allah, Chaipa, Chari, & Chinwada, 2019). The use of red-chillies to control crop pests has been reported to have a high probability of pre-disposing crops to risk of contamination, which can result in human diseases (Matova et al., 2020). Additionally, as this study has shown, women in crop farming use indigenous technology of stones to process foodstuffs for consumption during the dry spell. In agreement with the study's findings, Shoemaker, Davies, and Moore (2017) observed that the grindstone has been used in Africa for the last 100,000 years among smallholder farmers, but the use of grinding stones by women makes them physically fatigued, resulting in maladaptation. In contrast, Katengeza, Holden, and Lunduka (2019) found that the technologies women use help them to adapt to the drought problem. This study shows that women in livestock farming used gourds to preserve milk and ghee. The ghee used for different purposes helps women to withstand the drought period. A study on traditional methods of milk processing and preservation in Kiruhura district of Western Uganda agrees with the fact that pastoral communities churn milk from calabashes, despite the increase of the work burden on women (Gershom & Edward, 2017).

The findings go on to show that when the drought intensifies and livestock diseases increase, men in livestock farming resort to herbs to protect their livestock. The male domination in the use of herbs for livestock treatment was associated with age and knowledge. A similar finding was noted by Abebe (2021) who showed that men dominated in knowledge on herbal medicines. The men use other traditional methods such as castration-stones to castrate bulls. However, this was a laborious and time-consuming activity that injured men and made them vulnerable during the drought. Contrary to this finding, Hötzel, Yunes, Vandresen,

Albernaz-Gonçalves, and Woodroffe (2020) found that in Brazil, the methods men used for castration were easy to perform, without pain, discomfort, or stress.

5.2 Smallholder farmers: Gender and use of modern technologies

Our study findings have shown that there are different types of modern technologies in the study sites that men and women in smallholder farming use to adapt to the drought problem. These range from spraying and the use of modern medicines in livestock, planting improved crop varieties, planting in lines and grinding machines. In agreement with our study's findings, Mfitumukiza et al. (2020) argue that different types of technologies are useful for adaptation of men and women to drought. Findings further indicate that the men dominate in the use of acaricides and antibiotics like Tylosin to protect their livestock against ticks and tickborne diseases, resulting in the resilience of livelihoods owned by men. A similar finding was observed elsewhere in Uganda (Acosta, 2019) that men in smallholder farming dominate in modern technologies for adaptation. The men's domination in the use of drought adaptation technologies was manifested in the use of acaricides to spray cattle, making them able to withstand the drought more than the women. Indeed, women who never used the improved technologies in livestock farming ended up being more vulnerable than men. In agreement with this study Sarker, Wu, Alam, and Shouse (2020) note that in disaster, women end up being more vulnerable than men. Additionally, women who tried to use techniques of planting crops in lines had their workload increased with some abandoning the technology. This worsened the women's conditions in terms of food security during the drought spell. Contrarily, Huyer and Partey (2020) found that women who adopted new technologies in crop farming secured their livelihoods. Lasty, this study has shown that women farmers take cereals to

grinding machines to make *attaap,* or posho (maize flour), for household consumption, resulting in food security. This finding coincides with Twagira (2020) who observed that African women use machines for grain processing. However, some of the machines were unfit to process food for human consumption in Karamoja.

5.3 Conclusion

Evidence from this study has demonstrated that there are various technologies used to enhance adaptations for both men and women in smallholder farming. Women use indigenous technologies like grinding stones and gourds to withstand the drought. Additionally, women dominated the indigenous technologies. This has resulted in an increased work burden and exposure to injuries. Some women were forced to abandon some technologies, and this increased their vulnerability. The modern technologies, like the use of acaricides to spray livestock and the planting of SERENUT 2 and Maize Longe 10 in gardens, were generally male dominated. This resulted in more men than women using modern technologies in the study sites, causing gender inequality in access and the use of technologies. Based on this, we recommend to policy makers to use drought adaptation technologies which are gender sensitive to reduce the work burden of women and increase the adaptive capacity among smallholder farmers.

5.4 Recommendations

There is need for the different actors both state and none state actors to support the men and women smallholder farmers to access and use the different indigenous technologies to better their livelihoods and ensure that the gender disparities are addressed, since women are the dominant uses of these technologies.

There is need to reduce the vulnerability levels caused by increased work burden associated with these indigenous technologies I the communities that the Karamojong live in.

Communities need to embrace these technologies in order to better the agriculture outputs and resulting into food insecurity and hunger cause by the vagaries of climate. There is need to investigate the influences of gendered roles and responsibilities on the adoption of technologies that mitigate drought risks in Karamoja sub region

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