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Gendered Uptake of Sustainable Intensification Practices among Maize Commercializing Smallholder Farmers in Eastern Districts of Uganda

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Abstract

Commercialization of food crops, such as maize can dynamically shift control over productive resources or accrued income from women to men. This can restrict women's ability to access or buy productive inputs. However, scanty information is available on how changing gender roles and relations can affect smallholder farmers' use of sustainable intensification practices. This study described how gender inequalities in access to resources and appropriation of gains affect the uptake of sustainable intensification (SI) practices among maize commercializing farmers in eastern Uganda. Qualitative Survey data collected from a random sub-sample of 72 (36 women and 36 men) maize farmers from 584 maize commercializing smallholder farmers survey participants, was subjected to thematic content analysis. It was intended to follow up four unique profiles of farmers; those who did not use SI practices, the ones who used only intensification (improve maize varieties and fertilizers) or sustainable practices (organic manure and maize-legume intercrop), and those who used joint, one or more sustainable intensification practices. Findings revealed all four profiles to be highly gendered. Only women did not use any SI practice, and only men used intensification practices due to gender roles, responsibilities, and tasks shaped by traditions that give men terminal control over productive assets and gained resources. Both men and women used sustainable and sustainable intensification practices because of the negotiation process and opportunities that gave women more rights over resources. Thus, social-cultural histories and values constrain married women from implementing innovations such as SI practices because these values restrict women's authority over productive resources. It is recommended that for inclusive transformative interventions to be introduced successfully in rigid patriarchal contexts, it is vital to enhance the negotiation skills of women.

Keywords: gender roles and relations, maize commercialization, sustainable intensification, smallholder farmer, Uganda

1. Introduction

Gendered decisions have dominated development discourse in the past decades, with the focus of recent developments aimed at using gender lenses to advance inclusive progress. Gender encompasses sex differentials and social constructs that give rise to differences between men and women (Afolabi, 2015; Adaku et al. 2023). Gendering, a concept that later gives rise to gendered outcomes, is a process and practice created and recreated through power relations among differently positioned members of society (Calas and Smircich, 2006). Gendered processes or practices originate from past processes and dominant speeches, norms, routines, and scholarly arguments, which organically came to be accepted as the way men and women are defined (Calas and Smircich, 2006). Gendered outcomes give rise to socially accepted differences in the roles men and women should play as conditioned by one's biological, social economic, race, or religious status. These gendered roles can deter men or women from participating in an intervention equally, simply because one is a woman or a man (Mnimbo, 2018).

While gendered roles affect women in many spheres of life, including business, politics, sports, and in certain professional practices such as engineering, the smallholder farmers are the most affected because they belong to a group of people where resources are so meager to all, which kindle aggressive dynamics that mostly disadvantage women than male counterparts. Djurfeldt and Mawunyo (2017) observe that the prospects for understanding how to deliver socially inclusive interventions require clarity on how variations between power relations and historical conditions of men and women can be leveled to benefit all. Within a household, inequities exist because historically men have more power over productive resources and incomes than their female counterparts (Spring and Rutashobya 2009; Scott and Shu, 2017; Mnimbo, 2018).

Recent efforts have been spent developing the arena to improve smallholder farmers' incomes by commercializing food crops (Epule *et al.*, 2018; Shibata et al., 2020). Commercialization of agriculture, including food crops is defined as the increased delivery of agricultural produce to the market, involving increased use of input, such as improved seed and fertilizers, and other factors of production from the market (Jayne et al., 2011; Xie et al., 2019). Commercialization of food is expected to improve smallholder farmers' well-being and serve the rapidly expanding food demand due to urbanization. Proponents argue that through commercialization, smallholder farmers will take up innovations and tackle the challenges of extreme poverty and food insecurity (Epule *et al.*, 2018). Particularly, the welfare of these food producers can improve as they gain access to consistent meaningful incomes from surplus foods (Carr, 2008; Coles and Mitchell, 2011). However, from a gender perspective, food crop commercialization can be problematic, because the decisions of households are not straightforward. Dynamics around gender roles and relations surrounding food and cash crop production can shift women-controlled resources into the hands of men or can exclude women from acquiring any benefits (Mnimbo, 2018).

Gender roles are the social definition of men and women and vary among societies, cultures, classes, ages, and historical periods (FAO, 1997). Gender relations are ways culture or society defines rights, responsibilities, and the identities of men and women about one another (Bravo-Baumann, 2000; Alistair and Obeng, 2016). Historical patterns of gender relations governing resource access and re-distribution of benefits placed men in a more influential position, especially in public spheres outside farming households. Consequently, this gave women lesser access to opportunities than men and less control over productive resources, often gained by men. Mnimbo, (2018) emphasized the increasing role of gender differences as unresolved tensions over changing roles and the tendency of men to dominate ownership of cash-generating resources, enterprises, and the power over generated cash from any enterprise.

Like many African countries, Ugandan cultural values place the role of food cultivation in the hands of women, and men expectedly run the cash enterprises (Doss, 2001; Alistair and Obeng, 2016). As such the productive resources are allocated to men and women to produce cash and food crops, respectively (Doss, 2001). This raises a near question; are initiatives that commercialize food crops not accelerating women's loss of control over productive resources? Barbier (2015) posits that today it is hard to find a food crop exclusively serving food purposes among smallholder farmers. Arguably, women can be excluded from accessing vital productive practices and resources, if the dynamics surrounding resource allocation and re-distribution of gains from commercialized food crops are not well understood (Doss, 2001; Doss 2003; Alistair and Obeng, 2016; Shibata et al., 2020). Not surprisingly, many scholars of inclusive development have reported that women in Africa face unique challenges than their male counterparts because of differences stemming from their gender status.

In Uganda, the government has prioritized the commercialization of agriculture and gender inclusiveness as part of the policy goals to achieve the country's rapid economic growth and development Adong *et al.,* 2014; MAAIF, 2016). This transformation is intended to improve the livelihoods of close to 70 percent of the population (the majority of whom are women) who depend on the agriculture sector. This political will is well communicated in the country's policies and directives, including the Poverty Alleviation Action Plan (PEAP), Plan for Modernization of Agriculture (PMA), Agriculture Development Strategy and Investment Plan (DSIP), National Agriculture Policy (NAP) and the National development plans (Adong *et al.,* 2014; MFEPD, 2021). Uganda's policies aimed at increasing market-oriented production, including crops, such as maize, cassava, and beans, which are traditionally known by many people to be food crops (MAAIF, 2016). Among the focus of maize commercialization was the quest to deliver sustainable intensification practices, improved seeds, fertilizers, use of organic manure, and maize-legume intercrop. These were expected to ensure that enough food was produced to cater to the food and income interests of the households without damaging the productive resources.

However, scooping studies showed that many female farmers are not using sustainable intensification (SI) practices. The expectation that maize farmers would change their patterns of production and use of inputs, and separate household production and consumption decisions (Leavy and Poulton, 2007), could be problematic given

that disparities between men and women household members concerning access, control, and ownership of resources have for long existed (Fischer and Qaim, 2012). Given that, gender issues are specific to cultural history, roles, and power relations, this study sought to describe how gender inequalities affect the uptake of SI practices among maize commercializing farmers in eastern Uganda. This will be insightful in addressing the persistence of systemic conditions disadvantaging women. It will particularly guide policymakers and change agents to design programs that benefit men and women.

2. Conceptual Framework

This study adopted the population ecology and resource exchange theory, which proposes that entrepreneurs (s) are agents who continuously exchange resources within the business environment (Hannan and Freeman, 1977). Entrepreneurs with less exchange of resources or those who exchange resources within a less supportive environment will attain less of the expected outcomes (Calas and Smircich, 2006). The social system which constitutes part of the business environment, engenders differential access to societal resources, social networks, and the accruing benefits (Fischer and Qaim, 2012), meaning that women are disadvantaged entrepreneurs. Networks that are driven by social-cultural history constrain women and cause them to access less supportive networks to their business than their male counterparts, which in a way counts for differing membership, resource access, and outcomes (Brushetal., 2004; Fischer and Qaim, 2012; Calas and Smircich, 2006; Iradukunda et al, 2019). Women's access to productive resources, such as land, labor, and education is constrained by their limited social networks particularly when embedded in cultural values (Calas and Smircich, 2006). This means that women are less endowed with the resources needed to access funding than men. However, they try to cultivate stronger social relationships which help them to improve access to financing. In addition, while women and men are motivated by expected financial gains, women prefer investing their efforts in flexible enterprise activities that allow them to easily multitask between domestic and work choirs as men go out for ''personal achievement''.

Mayambala et al. (2024) found Sustainable Intensification practice users to be categorizable into four unique user profiles which include: the female "non-adopters; the male farmers using intensification practices and; the men and women who use sustainable practices and those using "sustainable intensification practices. One's belongingness to these profiles depended on their ownership of livestock and sex, education, production goals, and experiences of the farmers. It is possible that farmers' use or non-use of SI practices can differ due to factors related to one's gender role or relations. Nonetheless, gender studies e.g. Fischer et. al. (1993) whose bench-line hypothetical stance had suggested that women's less successfulness than men is due to less access to valuable opportunities, relevant formal education, and experience in running businesses, ended up zeroing to limited opportunities for women as the main constraint. Particularly, the study suggested that performance variations between male and female-run trades can best be obtained by focusing on 'relevant opportunities other than experience or education that are systematically less available to women than men. Calas and Smircich (2006) argue that little is expected to change insofar as attaining inclusive commercialization outcomes if research remains focused on peripheral factors such as women's cognitive, behavioral, or demographic situations in relationship to men without questioning the dominant institutions, and the practices of men and women in these institutions, as complicit in maintaining the current social and economic system. Thus, from this gender perspective, this study begins on the assumption that women's use of sustainable intensification practices may differ from that of male counterparts partly because of variations like resources each group can be able to access through their social networks (for example, Carter et al., 1997; Brushetal., 2004). While we appreciated the profiling of SI practice users as: "non-adopters; those using intensification practices; those who use sustainable practices and those using "sustainable intensification practices, based on their gender/ sex, we particularly question what accounts for women's differential access to resources. Social-cultural histories and values can make it difficult for women to acquire productive resources or significantly gain from accrued incomes from sold maize. This constrains women's access to inputs to implement SI practices. Specific questions were: *1) how do the motives of women and men differ in regards to maize cultivation; 2) does a shift to producing maize as a cash crop result in dynamic shifts in who owns productive resources and gains from sold maize and; 3) how do any dynamic shifts affect the use of SI practice by women and men.*

3. Materials and Methods

3.1 Study Area

The study was conducted in Bulambuli, Namutumba, and Mayuge, some of the rural districts in Eastern Uganda, *Figure 1*. Targeted were the maize commercializing smallholder farmers. All farmers lived in major maize-producing areas where maize commercialization and SI practices, including maize-legume intercrop, improved varieties, organic fertilizers, and inorganic fertilizers had been promoted. This area was targeted because they were

likely to exhibit variability in gender roles and their effect on the use of SI practices.

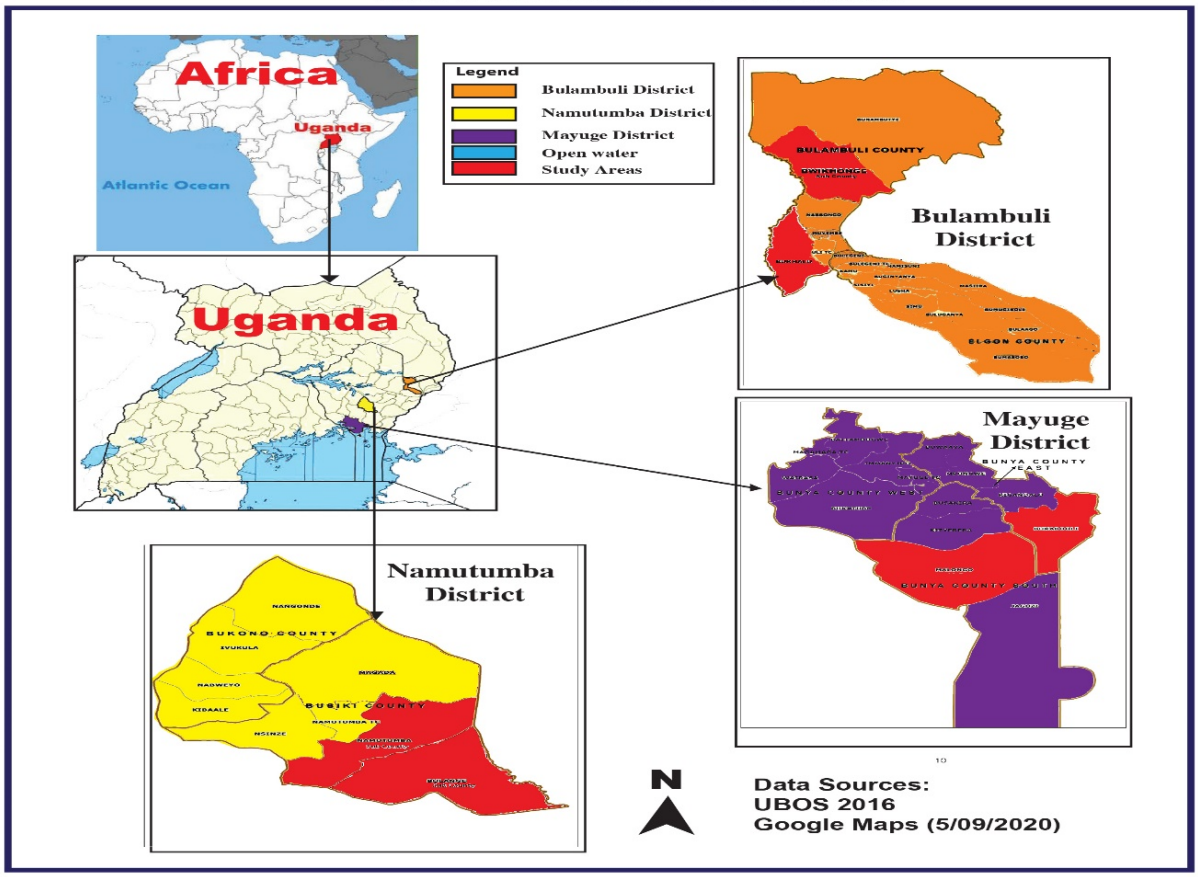

Figure 1. Map of Uganda showing study districts

3.2 Study Design

A qualitative descriptive method was adopted in this study (Manjunatha, 2019). This was because the central focus of the investigation was to describe the role of differing gender power over resource access and use as well as farmers' agency to use or not to use SI practices. This method is common in gender studies because it supports a deeper exploration of underlying reasons (Bullock and Tegbaru, 2019; Manjunatha, 2019; Iradukunda et al, 2019).

Particularly, this study aimed to compare the differing opportunities the 584 (men = 297 and women = 287) farmers in the four user profiles of Sustainable Intensification practices identified in a study by Mayambala et al. (2024) on which the present study builds, *Table 1*. The use of gender lenses on these profiles was necessary because the profiles differed based on sex, sold maize, land size, and reason for using SI practice, *Table 1.* These aspects can vary due to differing opportunities, gender roles, and relations available to women and men (Fischer et al., 1993; Wiggins et al., 2011; Fischer and Qaim, 2012; Iradukunda et al, 2019). Therefore, 584 smallholder farmers were the study population where 86% were married, 7% widowed women, and 3.4% were single or divorced women farmers. These contributed to the formation of the four user profiles

Table 1. Attributes of the profile of users of SI practices

	The mean score of variables			
Beliefs	**Profile 1 (n=64)**	**Profile 2 (n=146)**	**Profile 3 (n=263)**	**Profile 4 (n=111)**
Socio-demographics				
Sex	Female	Male	Female and Male	Female and Male
Age[1]	Middle-aged adults	Young adult	Young adult	Middle-aged adults
% of Sold maize	About 25%	Above 75%	Less than 50%	Above 50%
Education	Primary dropout	Secondary dropout	Primary dropout	Completed Primary
Experience in maize production	Above two decades	About one decade	Half a decade	About 2 decades
Maize acreage	Smallest holding	Largest holding	Medium holding	Largest holding
Ecological goals[2]				
Improve soil fertility	Not considered	Considered	Considered	Considered
Enhance soil volume	Not considered	Not considered	Considered	Not considered
Economic goals				
Enhances crop yield	Considered	Considered	Considered	Considered
Locally available	Considered	Not considered	Considered	Not considered
Minimize recurring cost	Not considered	Not considered	Considered	Not considered
Social goals				
Minimize pest and disease risk	Not considered	Considered	Not considered	Not considered
Used or approved by peers	Considered	Not considered	Considered	Considered

[1]*Horng et al. (2001) classification of age into young adults (30 – 39), middle-aged adults (40 – 59), and old-aged adults (≥ 60) were adopted during typology development.*

[2]*(Never = 1, Seldom = 2, Sometimes) = not considered; (Often = 4 and Almost always) = considered*

Profile 1 = Non-intensifying and Non-sustaining; profile 2 = Intensifying; profile 3 = Sustaining; and profile 4 = Sustainable intensification.

Within their profiles, the "non-adopters in profile 1 (n=64) were married women; the married men in profile 2 (n = 146) were users of intensification practices, and women and men in profile 3 (n = 263, 202 married) who used sustainable practice and those in profile 4 (n =111, 91 married) who used "sustainable intensification practices. In addition, farmers in the four profiles were distinct in some way.

3.2.1 Non-Users of Sustainable Intensification Practices

Pre-dominantly these were female, middle-aged, lowly educated producers of maize for household consumption. They had over two decades of experience in maize production. When making decisions about SI practice, these farmers mostly considered yield enhancement, which they aimed to attain using locally available materials used/ or recommended by peer farmers. The profile constituted the most resource-poor farmers and their land holding used for maize production was the smallest at 0.71 acreage.

3.2.2 Users of Intensification Practices

Pre-dominantly these were male, young adults with the highest education attainment and mainly producing maize intended for the market. They had 10 years of maize production and cultivated maize on about 3 acres. These farmers aimed to maximize yield, improve soil fertility, and minimize pests and diseases when making decisions about SI practice.

3.2.3 Users of Sustainable Practices

Gender composition for this group was balanced and mainly produced maize for household consumption. Most of the farmers were married and constituted the majority (202) and the rest (60 members) were single, divorced, or widowed. These farmers were also young and inexperienced in maize production and hardly completed primary education. The choice of the SI practices largely depended on the practices fulfilling the objectives of improving

soil fertility, increasing soil volume, and maximizing yield using locally available resources and minimum recurring costs. As such, farmers valued peer referrals and the SI measures that they thought peers used.

3.2.4 Users of Sustainable Intensification Practices

Gender composition for this profile was balanced and farmers were middle-aged adults, who had completed primary education. Married farmers were the majority (91), although about 20 members were single, divorced or widowed. These farmers had two decades of experience producing maize for the market and their use. The reason for farmers' use of SI practices was mostly oriented toward attaining improved yields and soil fertility under an arrangement that did not differ from peers' expectations.

4. Sampling Techniques

4.1 Sample and Data Collection

Six sex-disaggregated FGD sessions were conducted in the first growing season of 2019 selected based on the user profiles of SI practices. These included three for women only and three for men only. The FGD for profiles 1 and 2 had 12 women and 12 men respectively, because these profiles were constituted by a single sex/gender. For profiles 3 and 4, two FGDs were conducted (12 women and 12 men) for each profile because they had comparably equal numbers of women and men. Specifically, each FGD involved 12 farmers totaling 72 FGD participants. A simple random method was used to select the FGD participants using the lists of farmers under each of the four categories of SI practice user profiles. Random selection within profiles was done based on the assumption that members in each profile had closely the same attributes and would give similar information when enrolled in the study.

FGD settings usually suffer from bias particularly when discussing sensitive topics like the distribution of resources and earned incomes in mixed-gender sessions. Such biases are minimized by holding separate sessions for women and men (Medina et al., 2013). During the discussions, a discussion schedule was used as a guide to avoid presenting differing questions for the separated groups. The schedule was designed to generate spontaneously unique and vivid responses from women and men. This arrangement enabled farmers to reflect on their feelings and stories. To encourage easy descriptive answers, farmers were asked questions beginning with words like what, who, where, when, or how. Quite often phrases such as 'please tell me more', and 'please can you explain in detail', were used to obtain the connection between the farmers' resource access situations and their use of SI practices (Kallio et al., 2016). Expert assessment and field testing were conducted to ensure the FGD guide was appropriate (Chenail, 2011). Expert assessment exposed the preliminary guide to three gender specialists. These had Masters degrees in gender studies and had been conducting gender research for seven years. The experts provided feedback regarding the appropriateness and comprehensiveness of the guide contents concerning the study's aims and subjects. Reflection with the experts also permitted FGD session facilitators to discuss the correctness of the questions and to assess the reasons for sticking to the wording and the arrangement of the questions (Barriball and While, 1994). Field-testing was done in an FGD with 3 men and 3 women in Bugoto village, Bukabooli sub-county Mayuge district among maize commercializing farmers who had used SI practices and offered insights about session time, and whether the guide would truly elicit the desired responses (Chenail, 2011).

The final FGD guide focused on helping the researcher better understand gender dynamics in SI practice use and, it covered several topics including access to and control over productive assets, revenues, and how the division of labor was being implemented within the maize commercializing household. In addition, it explored how differing or equal rights and powers over productive access accelerate or exacerbate the participants' ability to use SI practices in their maize fields. During the implementation of the session, the main themes/content of the research subject were explored, one at a time in the FGD sessions that a female and male facilitator and a female and male note taker facilitated. The participants were encouraged to speak freely by discussing generic topics first to allow them to relax (Cridland et al., 2015) fully. The discussion could be advanced to more specific questions of a theme, before moving to the lighter contexts of a new main theme again. Follow-up questions were often used to clarify responses and to direct the dialogue towards the gist of the study. This was done to keep the discussion flowing naturally and to gain accurate and optimal information (Barriball and While 1994). Pre-designed and/or, spontaneous questions could be used as follow-up questions, depending on the response of the participants (Chenail 2011). Pre-designed questions could be used to exhaust the theme whereas spontaneous questions were necessary for expanding some of the points of interest that the participants had raised. Verbal and non-verbal probing techniques were used as follow-up questioning strategies. The verbal probes involved repeating or paraphrasing an insight given by the participants, expressing interest with verbal agreement, or pointing to the participants that the facilitators were aware of certain expressions related to the response. Non-verbal probes

involved silent moments that could allow participants to think aloud.

5. Data Analysis

FGDs were analyzed in NVivo 10. The procedure involved reviewing the English transcripts every day after the FGD sessions, which yielded edited scripts, fieldwork notes, and identification of relevant quotes. Edited transcripts were then imported into NVivo. Content analysis was performed using a two-step coding tree process. The first tree was developed based on the three initial guiding research questions that is: 1) *how do the motives of women and men differ regarding maize cultivation; 2) does a shift to producing maize as a cash crop result in dynamic shifts in who owns productive resources and gains from sold maize and; 3) how do any dynamic shifts affect the use of SI practice by women and men.* Then, in the second coding, questions were refined, and sub-nodes were created based on a thorough review of the texts that helped identify emergent relevant sub-themes. Text passages were coded and queries were run to compare men's and women's identified nodes and sub-nodes, which were aggregated to form the stem of the evidence to support the key findings of this study.

6. Results

6.1 Motives of Women and Men in Regard to Maize Cultivation

Women and men cultivate maize for different reasons across the four profiles. Women's and men's motives within married households are on average gender-differentiated. Men are regarded as household heads and respected as the primary breadwinners and are expected to safeguard the income security of the household. Men are consulted and banked on by women within married households for financing any external expenditure, including school fees, farm inputs, and other utilities. This typically means that men naturally exercise authority over most decisions related to income, and as such men produce maize to be sold and control gains made from each sale. Thus, the production of commercial maize remains typically an assigned cultural role of men.

In a typical rural household, women carry out all tasks related to reproductive functions, including ensuring that food for the household members is available at all times. This also includes its preparation and service to the husband, children, and other household members.

> *…. men make decisions regarding money and things that bring money for the family, and we respect our culture and tradition. So, women believe men must continue to make decisions because they are the heads of families whom they run when they need money or when they want to spend or invest wisely, (Female FGDs, profile 1 and 3)*

Within Busoga and Bugisu cultural histories, women are not expected to deviate from their husbands, in speech or action because of the consequences that may include desertion, marriage annulment, and or domestic violence. For example:

> *In Busoga traditions, women are expected to be submissive to their husband's actions and decisions. Attempts to resist a husband's decision can result in a woman being divorced or abandoned by the husband. (Female FGD, Profile 1)*

6.2 Commercial Maize within Gender Dynamics of Sharing Productive Resources and Gains

6.2.1 Gender Roles and Farming Practices

The practices of women and men originate from the gender roles of men and women in many ways. Men and women have differing preferences regarding the type of crops to cultivate and how they farm them. A farming method or crop is considered to belong to women and men depending on how they fit specific gender roles. Women have control over crops grown for food, many of which are usually of annual type, while men manage crops intended for income, including maize meant for sale. Explanations for this differentiated role included cultural references that endorse the authority of men as symbols of financial stability in households and men-dominated power over decision-making. Men access more information and opportunities due to their frequent mobility outside the household compared to women.

> *Husbands are the ones who make decisions about the crop to be grown and where because they bring new opportunities and knowledge to the family from their frequent nobilities outside the household and community. (Women's FGD, Profile 1)*

Maize is one of the most important crops in smallholder farming households in study districts cultivated culturally to serve households' food demands and most recently for income. Women grow maize mainly intercropped with beans, and ground nuts while men usually grow the crop mainly in pure stand. Women and men discussed the differing preferences in cropping systems. The differing choices reflect the changing roles and responsibilities women and men have within the household, for example, women provide food while men look for income.

> *"As a man, I control all incomes either from maize sales or otherwise. But before I spend, I consult my wives. Where we disagree, I use my powers and decide. But most times, we agree because agreement builds trust." (Male FGD, August 2019, Profile 4).*

Married men have more control over the households' earnings. They often reinvest households' earnings into improved seeds and fertilizers without consulting women. Women typically have to consult men on how to use earnings from sell of maize.

> *"Men always want to control everything. We have to seek men's approval when to sell or use gained money from selling maize" (Female FGD, August 2019, profile 1).*

Men and women prefer different maize varieties because they are based on the intended use and control over resources, which is also linked to gender roles. Men's exercised authority over income gives them more interest in knowing the quality of yield to serve market interests, which forces men to invest in improved maize varieties, and associated needed fertilizers to attain yield of economic significance. The role of women to avail food at the table for the household members has made them prefer local maize varieties that are considered tastier and whose seed can be re-used/ recycled without compromising the quality of yield as is the case with most improved varieties.

> *"To us women, crops that constitute an ingredient in the meals for household or the extent to which the crop can be used for food is given priority in planting. We have to provide daily meals to our children and husbands" (Female FGD interview in Bugoto, August, 19th, 2019, Profile 1)*

Maize is an important source of income and food security because it has a short maturity period with two to three 2-3 cycles of cropping that can be cultivated every year. Men manage and control the income from maize whereas women manage and control maize meant for household consumption. However, women's control over the maize field depends on seasons. During seasons of high demand women have less control over maize as men use their authority and sell it to the market. In less frequent cases, women also sell maize, particularly in the local market, but only after endorsement by the husbands.

> *"When a man buys domestic animals from maize income and there is separation for whatever reason, a woman forfeits everything including those animals to where she contributed. To their husbands the "animals belong to the family and if separated women cannot take the animals". (Female FGD, August,2019).*

Women are frustrated that men have to sell off their maize during high demand because immediately women become worried about how to feed members of the households. But it is risky to disapprove of men's authority because men beat and or divorce their women who rebel against their decisions.

Women are not pleased with men dominating the use of gained income from maize.

> *Men also sell maize belonging to women but the woman cannot harvest from men's fields. Even in the case of a poor harvest, men can sell women's maize leaving the household food insecure. Women cannot sell maize without the approval of their husbands otherwise they will be considered thieves and can be punished or divorced by their husband(s) (Female FGD, August 2019, profile 1).*

In female FGDs, women report that polygamous husbands distribute the harvests of one wife to her co-wives without seeking consent from the one who produced it. Other men are reported as buying things or spending on expenses that only benefit men, as exemplified below:

> *"Men always want to control everything just because they are men and ignore household concerns including paying off school fees", (Female FGD August 2019, Profile 1)*

> *"When a man buys domestic animals from maize income they worked together with their wives, men retain everything at divorce claiming that animals belonged to the family and the women are no longer members of the families". (Female FGD, August, 2019, Profile 3).*

6.2.2 Dynamic Shift in Maize Production and the Use of SI Practice by Women and Men

Gendered roles and practices within the household and in the maize farming system are said to account for how women and men use sustainable intensification practices. Farmers usually use different farming practices including only intensification practices (improved varieties and or inorganic fertilizer), only sustainable practices (use maize-legume intercrop and or organic fertilizer), and sustainable intensification practices. Users of SI practices were in four profiles: the "non-adopters"; "intensifying farmers" (use of improved varieties and or inorganic fertilizers); "sustainable farmers" (use maize-legume intercrop and or organic fertilizers); and the "sustainable intensifying farmers" (joint use of sustainable and intensification practices). The use of SI practices in maize commercializing households is based on gender roles and changing dynamics which increase women's challenges to use these

innovations/ practices.

6.2.3 Gender Dynamics in Non-Use of Sustainable Intensification Practices

The non-users of sustainable intensification practices were predominantly women. These women exercised limited authority and power over gained earnings from commercial maize and grew maize on small land holdings. As such, they had little interest in joining commercial maize production. This affected their ability to implement SI practices. Women in this profile did not have rare animals and were busy with childcare and food production routines. This makes it difficult for them to move out of their households and learn new methods or to make claims on opportunities and earned income gained by men. In sum, women in this profile have no manure nor cash by which they can buy improved seeds and fertilizers. By resorting to using local seeds, they looked out to recycle the seeds as a way to minimize recurring costs.

6.2.4 Gender Dynamics among Users of Intensification Practices

Farmers using intensification practices were mainly men. Men are traditionally endowed with unlimited authority over money, compared to women. This consequently gives them leverage to acquire more information, knowledge, and ability to buy seeds and inputs, including fertilizers that can boost yield and the volume of maize they take to the market. The explanation is that culture puts the power over cash enterprises in the control of men. This gives men unchecked liberties to spend on inputs. These users were motivated to use inputs because of the associated higher yields:

> *'Using fertilizers and improved maize seeds jointly gives better yields particularly in season two and during drought', (male farmer FGD, August 2019, profile 2).*

6.2.5 Gender Dynamics among Users of Sustainable, and Sustainable Intensification Practices

The study revealed that both men and women used sustainable practices, and sustainable intensification practices, although through different strategies. Culture elevates men as the primary household members to move out and seek information, including market information and control over resources both possessed and those gained through the sale of maize. Thus, in a married household setting, men gain more frequent access to information and resources and push forward investments that are likely to increase income. This ultimately influences the choice of the specific SI practice(s) used.

6.2.6 Sustainable Farmers (Use Maize-Legume Intercrop and or Organic Fertilizer)

Men did not want to crowd their maize crop, and men considered intercropped maize fields to be for women. Intercropping maize with beans (maize-legume intercrop), is typically a 'woman's crop' management strategy. Intercrops fit the role of women, who are expected to provide food, hospitality, and childcare in the household.

Intercropping maize with legumes is not a new practice. The practice had been there before and largely done by women who wanted to provide every type of food to the table. Findings revealed that most women's gardens were characterized by having many crops, partly because women lacked enough arable land and because of their interest in having a variety of crops for food. Male FGD in Profile 3 farmers noted that: *"Intercropping maize with legumes is for women. Women want to plant every crop. In fact, it is easy to identify a woman's plot here based on the number of crops on it" (Male FGD, August 2019).*

Men dislike maize-legume intercrops because intercrops do not bring pride among peer farmers. However, women can overcome men's dislike for intercropped maize.

> *"Women sow beans in maize plots without the knowledge of men. Men see the beans at the time of germination. This removes guilt from men among peers". (Women's FGD, August 2019)*

However, non-adoption of fertilizers was attributed to the farmers' inability to finance fertilizers and improved varieties.

> *"Buying fertilizers comes at the expense of other family expenses. You may plan to buy fertilizers and when the child falls sick or is sent for school fees, the money is diverted to child care and education". (Female FDG, August 2019).*

Men and women prefer to use manure and local seeds because they are locally available. This saves money that could have been spent on improved seeds and fertilizers. Additionally, local maize has other advantages including being tasty, local seeds can be recycled, and does not need many fertilizers to maintain a good yield. However, men own the big livestock, such as cows and goats while women own chicken. Consequently, within married households, men tend to control crop residues, such as maize and sweet potato vines that serve as or can serve as animal feeds. Men also control the manure the animals produce. In these contexts, married women reported that

they could not use crop residues and manure without the husband's consent. Women in Profile 3 overcome men-dominated control over manure through high jacking the decision-making process, as exemplified below:

> *We begin transferring manure into the garden without informing the man. Men see manure when it is already in the garden and then support us in spreading it. (Women's FGD, August 2019, Profile 3)*

Women's involvement in activities with hard tasks is minimal. Applying manure is one of the heavy tasks. As such, women carry out cropping activities that are less physical and less demanding. The explanation for the less involvement of women in physical tasks is a culture that reinforces women as delicate members of the household.

6.2.7 Sustainable Intensifying Farmers (Joint Use of Sustainable and Intensification Practices)

Women and men showed the ability to use sustainable intensification practices. In this profile, men and women shared roles and responsibilities to implement SI practices to safeguard household food and income interests. Men frequently share information, opportunities, and joint concerns on owned fields with their spouses.

For example, most men in this group prefer maize-legume intercrop because it helps them support their women to get food for the household as they focus on commercial maize. It also permits role sharing, as weed labor is reduced, and when needed men and women have the same concerns for the same field that is expected to provide food and income, which improves the use of SI practices. Although men, especially those in profile 4, were involved in activities of food cultivation, they seldomly participated in making decisions regarding when food was to be harvested or allocated into household feeding routines because men considered this role to be a preserve of women. Whereas women were engaged in maize commercialization, they had limited authority over how gained earnings were to be spent. The reasons behind gender-differentiated motives in maize cultivation often included references to cultural norms that elevate men as the main decision-makers and the symbol of financial stability in married households.

Women who used sustainable intensification practices mostly live in women-headed households. These are households where women serve as heads, as was the case in the other households where men had migrated temporarily to work in distant locations, and single and widowed women-headed households. Women assumed both the roles of producing maize for food and cash. These women managed resources independently and the agency over gained earnings from maize was higher and gave them liberty to invest in SI practices as opposed to their female counterparts in married households.

> "As a female household head, I decided what to plant and what to use without having to consult a man. (a Widow in Female FGD, August 2019, Profile 4).

Women in a female FGD for profile 4 agreed noting,

> *"When a husband is away for distant work in far districts often in Jinja and Kampala, women gained full liberty to decide and invest independently without regular consultation with the husband, (female FGD, August 2019).*

7. Discussions

The study makes an important contribution to the use of sustainable intensification practices by highlighting the significance of gender roles and relations in the implementation of SI practices by maize commercializing households. Broadly, our findings reveal that the decision to use sustainable intensification practices is embedded in culture and traditions that assign different roles and responsibilities to men and women. These cultures and traditions restrict women's access to productive resources and gained incomes required to implement SI practices. The findings of this study concur with the theorization of population ecology and resource exchange theory (Hannan and Freeman, 1977).

Women's agency to use sustainable intensification practices was crippled by the inability to access the necessary resources, such as dung needed to for example apply manure. In addition, women had limited control over gained earnings, which made it more difficult for women to acquire inputs such as fertilizers and improved maize varieties than men. Within the culture and traditions of tribes in eastern Uganda, women's and men's roles, duties, and activities are gender-differentiated in maize commercialization and the uptake of SI practices. This finding is similar to that of Fagrach et al. (2024). Also, women carried out less demanding tasks while men were expected to do the hard tasks, which concurs with Feyisa, and Megersa, (2020). Their study examined gender roles and preferences of female and male-headed fruit producers regarding the selection of avocado and banana varieties. Their results showed that men exceedingly participated in hard tasks such as land preparation (93%), seedling preparation (90%), transplanting (90%), and weeding (76%) whereas, women highly participated in less demanding tasks that required precisions, such as fruit collection (72%), transporting fruits to the market (83%)

and selling the fruit (90%). Results show that socioeconomic, behavioral, and technological factors influence SI practice use among maize smallholder farmers (Mulugo et al., 2020; Adaku et al. 2023; Fagrach et al., 2024). The gendered use of SI practices observed may be explained through social norms and the expected roles of the wife and household in male-headed household traditions (Lambrecht et al., 2017; Iradukunda et al., 2019).

Historically, roles and relations within households in Uganda differ by one's gender. Men and women are expected to do differing roles because men produce cash crops and women food crops, which in a way, invites them to use differing strategies, most of the time conflicting and yet expected to use the same land and productive resources. Moreover, women are expected to comply with the decisions of their husbands. This means that if women continue to trail their husbands' actions, the adoption of SI practice can be slowed. For example, men tend to prefer pure stand maize and overuse of intensification practices (improve varieties and fertilizers), but these can lead to maize commercialization outcomes that damage the environment (Byrnes, 1990; Hart, 2004; Bronick and Lal, 2005) whereas women like intercrops that ensure food secure households. Intercropping is friendly to the environment through nitrogen-fixing to the soil. This paints a picture that women use sustainable and men intensification practices that help them to respond to their culturally assigned roles. However, the dynamics in these households are not straightforward and can vary. We found some women in married households in Busoga to have uniquely bypassed men-dominated decision-making structures and implemented SI practices, which concurs with Iradukunda et al. (2019). Osei-Adu et al. (2015) also found women's decisions on when to sell grain legumes and livestock to be limited among West African communities, although they participated in marketing activities. Thus, while women can face more difficulties, negotiating and cooperating interests and shared goals with their husbands increase the use of SI practices (Doss, 2011). For example, when women implemented the maize-legume intercrop without men's knowledge, the act helped their husbands to overcome male social networks that disapproved of or saw maize-legume intercrop as a women's practice. Like Feyisa and Megersa (2020), this study found women's decision-making increased as women emerged as household heads due to absentee husbands or when divorced or widowed.

While the four profiles of users of SI practices identified by Mayambala et al (2024) informed the starting point of this study, we find that each profile is embedded in gender dynamics where women and men are either accepting the assigned roles as the case for profile 1 and 2 or are embedded in the dynamics of negotiation and defiance against cultural histories and norms, which embeds profiles 3 and 4. Katungi (2007) similarly found gender norms do influence women's participation in Uganda. The major challenges, however, are likely to be two. First, information access to men and women remains symmetrically skewed towards men who easily and frequently move outside the household. Therefore, extension agents are advised to widen women's access to information on sustainable intensification practices with maize commercialization (Erbaugh et al., 2003). Second, despite the accumulated resources through maize commercialization, the mutual expectations and roles of women and men within married households do not change as fast to support SI practice use in households. Cultural traditions overlook women who go against their husbands' decisions, and such women may face physical and economic harm. The asymmetric control over resources by men coupled with culturally reinforced perceived or actual punishments men give to women are reported by Petesch et al. (2018) and Iradukunda et al. (2019).

8. Conclusion and Recommendations

Our study finds women's use of sustainable intensification practices to differ from that of male counterparts due to variations in authority over productive and gained resources, particularly embedded in gender roles, responsibilities, and tasks. Social-cultural histories and values make it difficult for women to acquire or use productive resources and gain earnings from maize, which makes women constrained to access inputs to implement SI practices. Gendered roles are very static and retain men as the primary centre of authority and control over resources whereas the reproductive roles and the task of ensuring food security is a task reserved for women. However, SI practices shall be easily implemented when authority and power in a household are fairly distributed between men and women by allowing women to take part in leadership and the appropriation of income. Otherwise, men implement intensification practices whereas women typically fail to adopt any sustainable intensification practice and both cases threaten the environment.

Pragmatically, it is recommended that transformation interventions introduced to improve the survival of smallholder farmers living in rigid patriarchal contexts should be aware that differing roles and relations of women and men towards an intervention can bring differing engagements, and results that disadvantage women. Thus, promoting the participation of all genders in SI practices and enhancing the capacity of married women and men to arrive at negotiated decisions could improve the uptake of SI practices (Spring and Rutashobya 2009; Doss, 2011). Future studies can examine the structures within households that hinder men and women from benefitting from interventions. Such studies are likely to offer ways on how men and women should be engaged to challenge,

and possibly change the norms and power relations that prolong gender inequalities and inequities, which also constrain gains from many agriculture-related interventions.

Methodologically, this study used descriptive design. Therefore, its findings can suffer from a lack of generalizability beyond the contexts. Nevertheless, the roles and relations of men and women tend to be very closely related to African traditions. This means that if the focus is assigned to the roles and responsibilities of men and women and such constrain the use of innovations, the study findings gain wider relevance. Thus, the study advances the relevance of descriptive designs in understanding the gendered use of SI practice among smallholder farmers. In addition, the study insightfully invites academics to assign attention to the unbalanced gender contexts embedded in ongoing household negotiation processes that rotate around who accesses and uses resources driven by household structure and the different agency over resources that culture prescribes for men and women.

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Conflicts of Interest

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Data availability

This article is part of a study leading to the award of a PhD in agricultural and rural innovation at Makerere University. The data used for this study will only be available upon request from the corresponding author.

Author contributions statement

This paper was co-authored by Siraj Ali Mayambala, Professor Paul Kibwika, Professor Herbert Talwana, and Dr. Frank Matsiko. The paper conceptualization, writing, and finalization were done by Mr. Mayambala. Professor Kibwika, Professor Talwana, and Dr. Matsiko were core advisors at the conception and design, analysis, and interpretation of the data; revising it critically for intellectual content; and final approval of the version to be published. All authors agree to be accountable for all aspects of the work contained in this article.

Ethical issues

Before conducting fieldwork, clearance was obtained from Makerere University, College of Agricultural and Environmental Studies, CAES- *Research and Ethics Committee.* This committee is mandated to ensure ethical standards for all research processes and outputs in the college.

Informed consent of participants.

Participation was voluntary and based on informed consent confirmed by each participant signing a consent letter.