

Article

The Role of Women in Production and Management of RTB Crops in Rwanda and Burundi: Do Men Decide, and Women Work?

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Abstract: This paper evaluates the determinants of decision-making in relation to the production of four crops (banana, cassava, potato, and sweet potato). Understanding the division of labor and decision-making in crop management may lead to designing better interventions targeted at improving efficiency in smallholder agriculture. In 2014, the research team conducted a quantitative household survey with heads of households involving 261 women and 144 men in Burundi and 184 women and 222 men in Rwanda. Most of the decisions and labor provision during the production of both cash crops (potato and banana) and food crops (sweet potato and cassava) were done jointly by men and women in male-headed households. Higher values for ‘credit access’, ‘land size’, and ‘farming as the main occupation of the household head’ increased the frequency of joint decision-making in male-headed households. A decline in the amount of farm income reduced the participation of men as decision-makers. A reduction in total household income and proximity to the market was correlated with joint decision-making. Gender norms also contributed to the lower participation of women in both decision-making and labor provision in banana and potato cultivation. Although a large proportion of decisions were made jointly, women perceived that men participate more in decision-making processes within the household during the production of cash crops. Increased participation by women in decision-making will require an active and practical strategy which can encourage adjustments to existing traditional gender norms that recognize men as the main decision-makers at both the household and community levels.

Keywords: banana; cassava; potato; sweet potato; gender division of labor; decision-making

1. Introduction

Root, tuber, and banana (RTB) crops are important for food and income security in the African Great Lakes region. They are an important staple food, and some are rich in micro-nutrients. As such,

they are vital, not only for alleviating poverty among resource-constrained smallholder farmers but also in reducing malnutrition, especially among pregnant women and children [1]. Except for potato, which is grown at mid-to-high altitudes, banana, cassava, and the sweet potato are cultivated in nearly all provinces of Rwanda and Burundi. In Rwanda and Burundi, bananas and potatoes are both food and cash crops while sweet potatoes and cassava are cultivated mainly for home consumption. Bananas are important for cash-generation in both Rwanda and Burundi, especially the beer-banana type, which farmers process into several types of beverages [2]. Annual production values for RTBs in 2017 (Rwanda and Burundi) were as follows: Banana (1.73 million tonnes (MT)); 1.24 MT, cassava (1.04; 2.29 MT), potato (0.85 MT; 0.15 MT), and sweet potato (1.08; 0.71 MT) [3]. Globally, Rwanda has the highest per capita consumption of sweet potato roots at 89 kg compared to the global average of 14 kg [4].

Although RTB crops are important for both producers and consumers in Rwanda and Burundi, agricultural productivity and on-farm yield are generally low [5]. Low productivity rates are a result of a diverse set of productivity constraints, including crop management as well as biotic and abiotic stresses [6–8]. Smallholder farm households predominantly produce RTB crops in mixed farming systems [9]. There are important gender differences in intra-household roles and responsibilities with regards to RTB production, processing, and commercialization in the African Great Lakes region. Men and women have distinct sets of tasks and different levels of control over these crops [2,10–12]. Sikod [13] states that the intra-household division of labor is an economic strategy to position the household to meet its needs, although households often divide labor in ways that can constrain development. Other authors argue that the intra-household division of labor and control over crops is primarily subject to power relations and gender norms rather than economic considerations [14,15].

Studies have illustrated that dominance in labor provision to the management of a specific crop does not always translate into dominance in control over this crop in terms of decision-making [16–18]. Understanding who in a household makes decisions on crop management or sales and who provides labor is important for policy-makers, program managers, agricultural researchers, and agricultural extension workers to address constraints causing low productivity in RTB crops in Rwanda and Burundi.

The question of who in the household makes which kind of decisions, in the cropping system, is important because it affects the household's crop productivity. A process of negotiation, knowledge of others' preferences, gender norms, as well as power dynamics [19] are also referred to as 'bargaining'. Bargaining depends on the endowments of the parties [20]. Some of these endowments and entitlements are based on social norms [20].

Intra-household decision-making power is associated with the bargaining power of a given household member. This power is dependent on a number of complex factors including access to agricultural land and inputs, training, and financial loans through formal and informal credit institutions [20]. Access to these physical and financial resources, however, cannot be disentangled from gender, because women's differential and disadvantaged access to these resources and services as compared to men's is thoroughly documented throughout the world and specifically for smallholder farm households in developing countries [21–25]. The authors in [26] even suggest that because of unequal gender norms on an institutional or collective level, women's increased access or ownership of resources and assets might decrease their intra-household decision-making and bargaining power. Moreover, gender norms also influence decision-making processes in the home, which, in turn, affect the ability of women to access training opportunities [23]. Lack of access to training is particularly problematic since according to Anderson and Feder [27], agricultural extension is assumed to lead to better decision-making, improved agricultural performance, and better outcomes. When women do not have access to this information and training, they cannot effectively participate in decision-making or make informed decisions.

In many countries, certain crops have been loosely categorized as either a 'male crop' or a 'female crop' depending on either the gender of the household head, the owner of the land on which a crop is grown, or the gender of the person who keeps the proceeds from crop sales [21]. Research evidence

suggests that women are more likely to control the production and output of the subsistence crops for home consumption, whereas men may have more decision-making power over the production and output of the household's cash crops [21,28].

While food production is extremely important, it has been noted elsewhere that the agrarian activities on which women spend most of their time are often undervalued or associated with nurturing and helping roles because masculine agrarian ideology dictates what is to be valued [29]. A study in Nigeria found that following the introduction of cassava markets and better processing technologies, men began to participate in cassava activities that had previously been dominated by women [30]. Padmanabhan [31] argues that every new innovation which enters the agricultural arena challenges the gendered division of labor (GDoL). Based on this argument, we should emphasize that GDoL tends to be dynamic over time. This paper contributes to a growing body of literature on the role of gender in RTB farming and focuses specifically on the gender division of labor and intra-household decision-making with regards to RTB in Rwanda and Burundi.

Context

Rwanda has a population of 10.5 million, of which 52% are women, and 71% of the total population lives in rural areas [32]. The population of Burundi was 8.05 million in 2008, with nearly 90% of people living in rural areas and depending on subsistence agriculture [33]. In most parts of rural Rwanda and Burundi, formal credit does not exist, and households rely on informal or semi-formal borrowing from institutions such as microfinance institutions, cooperatives, Non-Governmental Organizations (NGOs), village savings and loan associations (VSLA), and input suppliers [34,35]. The amount of credit borrowed per capita per year in Rwanda is relatively small. On average, it ranges from US\$34 for informal sources to US\$55 for semi-formal sources. Some studies in Burundi have reported average credit sizes of US\$70 from VSLA groups with most of the loans not exceeding US\$12 [35]. Male-headed households (MHHs) in Rwanda are less credit-constrained than female-headed households (FHHs) [34].

Most policies in Rwanda are gender-sensitive, and women's legal rights are strengthened by a set of laws aiming to promote gender equality such as the 2004 National Land Policy, the 1999 Inheritance Law, and the 2005 Organic Land Law that advocate for gender equality and anti-discrimination [36]. Additionally, Rietveld and Farnworth [12] reported that after the 1994 Rwandan genocide, many men had fled, were killed, or were imprisoned due to war crimes spending many years away from their homes. Consequently, women had to take up more responsibilities both in the public sphere (50% of seats in parliament are for women) and within households. Even when men returned from jail or exile, women maintained their positions. In Burundi, unlike in Rwanda, no national land and inheritance laws exist but rather more general international laws. Laws are waiting to be passed by the national assembly, which makes it rather easy for the government to implement them locally, hence giving room to apply local customary rules that limit access to- and inheritance of- land by women [37].

Average land size in Rwanda and Burundi is very similar and often less than 1.25 ha [38,39]. In both countries, land scarcity and continued land fragmentation are enormous challenges [39]. At the moment, most of the farm activities for RTB crops in Rwanda and Burundi are labor-intensive, manual, and time-consuming, which also contributes to the small average acreage cultivated. For instance, land preparation (ploughing), hilling, or ridging is done by a hand hoe. Planting, fertilizer application, and harvesting of potatoes are similarly done by hand. Poverty levels are high in the two countries, with over 50% (Rwanda) and 70% (Burundi) of the population living on less than 1 US\$ per day.

2. Materials and Methods

This study sought to answer three research questions: (1) What are the intra-household dynamics regarding decision-making on crop production? (2) What is the gender division of labor? and (3) which factors influence decision-making and labor allocation within a household? This study defines decision-making as 'the selection of a course of action from among two or more possible alternatives in order to arrive at a solution for a given problem' [40]. Joint decision-making involved husband and

wife in the same household to decide together on a given crop production activity. For the purpose of this study, the banana and potato were grouped together and considered as cash crops since they are often sold for cash whilst cassava and the sweet potato are primarily grown for household food. Data were analyzed using STATA software (Version 14) and descriptive statistics; means, percentages, and frequencies were used to describe the socio-economic demographics. A multinomial logistic regression model was used to analyze factors influencing decision-making in relation to production of RTB crops in a household. The dependent variable was the decision-maker in the household, either male, female, or joint. The independent variables assessed included the size of land owned by the household, household size, distance to the main road, access to extension services, type of crop grown (cash crop, food crop), age of the household, years of education of the household head, occupation of the household head, gender of the household head, total household income, farm income, access to credit, and the distance to the market. Several diagnostic tests such as Independence from Irrelevant Alternatives (IIA), Multicollinearity, and Heteroscedasticity were conducted (Table 1). T-tests were used to identify significant differences between the means of variables among male- and female-headed households such as education, age, and the main occupation of the household heads.

Table 1. Variance Inflation Factor (VIF) results for testing multi-correlation of variables.

Variable	VIF	1/VIF
Log total income	6.33	0.158028
Log farm income	5.95	0.168048
The education level of the household head	1.16	0.859044
Age of household head	1.16	0.865157
Distance to the main road	1.15	0.873021
Distance to the market	1.13	0.887617
Log land size1	1.12	0.890373
Household size2	1.12	0.890918
Crop is grown mainly for cash	1.10	0.910246
Crop is grown mainly for food	1.07	0.937992
Access to extension services	1.06	0.939040
Sex of household head	1.06	0.946871
Access to credit	1.04	0.964202
Occupation of the household head	1.04	0.965327
Mean VIF	1.82	

2.1. Farm Survey

Data for this study were collected in 2014 through a cross-sectional survey of RTB crop farmers in the Ruhengeri watershed of Rwanda (covering Musanze, Burera, Gakenke, Ngororero, and Nyabihu districts) and the Rusizi watershed of Burundi (covering Bujumbura Rural, Bubanza, Cibitoke, and Muramvya provinces). The study provinces were chosen since they all cultivated the four RTB crops. In each watershed, 27 villages where the Pest Risk Assessment (PRA) project had a weather station were purposely selected based on altitude [41]. This study was part of a more extensive questionnaire that examined the impact of pests and diseases on the livelihoods of rural smallholder farmers through the PRA Project ‘Management of RTB-critical pests and diseases under changing climates, through risk assessment, surveillance and modeling’ (see questionnaire at <https://www.mdpi.com/1660-4601/16/3/400/s1>). Within each village, 15 households were randomly selected for interviews and enumerated with the help of local community leaders. In total, our sample comprised 811 households, including 405 (261 women and 144 men) respondents in Burundi and 406 respondents (184 women and 222 men) in Rwanda. This sample size is representative of farmers of RTB crops in Rwanda and Burundi.

Quantitative data on banana, cassava, potato, and sweet potato production and marketing were collected using a structured questionnaire with either the household head, the spouse to the household

head, or any adult in the household who was responsible for the production of bananas, cassava, potatoes, or sweet potatoes. Pre-testing of the questionnaire was done prior to formal data collection in districts outside of the study area. Enumerators were trained before conducting the interviews and were supervised by the first author. Local languages (Kinyarwanda in Rwanda and Kirundi in Burundi) and French were used by enumerators to conduct individual farmer interviews.

Quantitative data were collected on the following: Who in the family was a member of a farmers' organization; who was trained by the agricultural extension worker; who received credit. Data were also collected on who decided or did the following farm activities: (i) Land preparation, (ii) input purchase, (iii) selection of the variety to plant, (iv) planting, (v) weeding, (vi) application of chemical pesticides, (vii) harvesting, (viii) transporting the harvest to the market, (ix) processing the harvest, and (x) selling the harvested crop or the planting material (seed). Enumerators explained the objectives and methods of the study to farmers and sought verbal informed consent. Enumerators only conducted interviews with farmers that consented.

2.2. Diagnostic Tests

Prior to econometric analysis, data were tested for independence from irrelevant alternatives, multicollinearity, and heteroscedasticity as follows:

2.2.1. Testing for Independence from Irrelevant Alternatives (IIA)

The IIA test assumes that the inclusion or exclusion of categories does not affect relative risks associated with the covariates in the remaining categories. The IIA property requires that the relative probabilities of two options being selected are unaffected by the introduction or removal of other alternatives [42]. In this study, the Hausman test was carried out to determine IIA. The choices (male, female, or both) gave a p -value of unity, implying the presence of IIA. If IIA was violated, other statistical methods which relax the assumption, including Multinomial Probit, Nested Logit [42], and Random Parameter Logit models [43] were used.

2.2.2. Testing for Multicollinearity

Multicollinearity in data arises when there are correlations between independent variables. To test for the presence of multicollinearity, the Variance Inflation Factor (VIF) method was used. This VIF method estimated artificial ordinary least squares (OLS) regressions with each of the decision-makers as the 'dependent' variable and the rest as independent variables [44]. A mean VIF value of <10 for the independent variables indicates that the estimated variables are not highly correlated and there is no multicollinearity. A mean VIF value >10 indicates that the estimated variables are highly collinear. In the current study, the estimated model variables had an average VIF of 1.82, indicating that they are not highly collinear.

2.2.3. Testing for Heteroscedasticity

Results for testing of heteroscedasticity of variances were as follows: H_0 : Constant variance, Variables: Fitted values of RTB decision-maker, $\chi^2(1) = 0.01$ and $\text{Prob} > \chi^2 = 0.9344$. In the regression model, skewing of regressors or measurement errors can result in error terms not having a constant variance, in which case they are said to be heteroscedastic [45]. Heteroscedasticity causes the variances of regression coefficients to be under or overestimated. To ensure that the variances of regression coefficients were not under or overestimated, a Breusch–Pagan method was employed to test the null hypothesis that the error variances were all equal versus the alternative that the error variances were a multiplicative function of one or more variables. In the current study, using fitted values, the null hypothesis that there is constant variance was tested. The chi-square value was 0.01, and the p -value was 0.934. Therefore, we failed to reject the null hypothesis and concluded that there is constant variance, which means that there was no heteroscedasticity in the model.

3. Study Results

3.1. Household Characteristics

Most households surveyed were headed by men: A total of 80% in Burundi and 84% in Rwanda. It is implicitly assumed that for every household in which an adult man is present (often the husband and father), he is the household head. Whereas Male-Headed Households (MHHs) had a significantly larger household size (5.5 persons) than Female-Headed Households (FHHs) (4.6 persons) in Rwanda, no such statistical difference was observed among households in Burundi (5.9 vs. 6.4 persons) (Table 2). Education levels were also generally very low; i.e., <6 and <5 school years in Burundi and Rwanda, respectively. Family members within MHHs had, on average, received more years of formal education than those in FHHs. Both farm and off-farm incomes in FHHs in Rwanda were less than half of those of MHHs although there was no such difference in Burundi. Although no significant difference was observed in the age of men in Rwanda and Burundi, female household heads in Rwanda were older than their male counterparts.

Table 2. Demographic and socio-economic characteristics of the surveyed households.

Farm and Household Characteristics	Burundi		Rwanda	
	Male-Headed Households (n = 322)	Female-Headed Households (n = 83)	Male-Headed Households (n = 342)	Female-Headed Households (n = 64)
Household size (number of people)	5.9	6.4	5.5	4.6
Formal education of HH head (years)	4.6	4.2	5.6	5.3
Mean age of household heads (years)	46.5	44.9	42.3	44.2
<i>Main occupation (% responses)</i>				
Farming	77.5	98.1	89.5	100
Salaried employment	11.4	1.9	5.4	0
Retail business (shops)	4.1	0	1.5	0
Others	7.0	0	3.6	0
<i>Secondary occupation (% responses)</i>				
None	40.8	42.3	51	100
Farming	14.1	6.0	0	0
Salaried employment	3.9	3.9	5.0	0
Retail business	13.1	19.2	4.5	0
Casual labor-on farm	10.7	7.7	0	0
Casual labor-off farm	5.3	3.9	8.5	0
Others	12.1	17.0	31.0	0
<i>Mean Annual income in US\$*</i>				
Total farm income	238.8	238.2	346.4	151.1
Total off-farm income	295.6	224.7	468.6	203.5

Farming was the main occupation for both men and women in male- and female-headed households in the two countries. However, the average number of FHHs engaging in farming as the main occupation was significantly higher than for MHHs. This might mean that men tend to engage in non-farm activities as an alternative that offers higher incomes. Although there was no significant difference in the farm and off-farm income of male- and female-headed households in

Burundi, MHHs in Rwanda had a significantly higher farm and non-farm income than FHHs. In the sampled households, we could hardly find people over 60 years of age, and the 1994 genocide could be responsible for the young population in Rwanda [46].

3.2. Division of Labor and Decision-Making

Perceptions about decision-making and labor allocation within female- and male-headed households in Rwanda and Burundi were quite different. More of the members in MHHs reported joint decision-making and joint labor provision than of male or female alone respondents who grew potatoes and bananas (Figure 1, Table A1). Even in those FHHs growing potatoes and bananas in the two countries under study, male household members made most of the decisions and provided most of the labor.

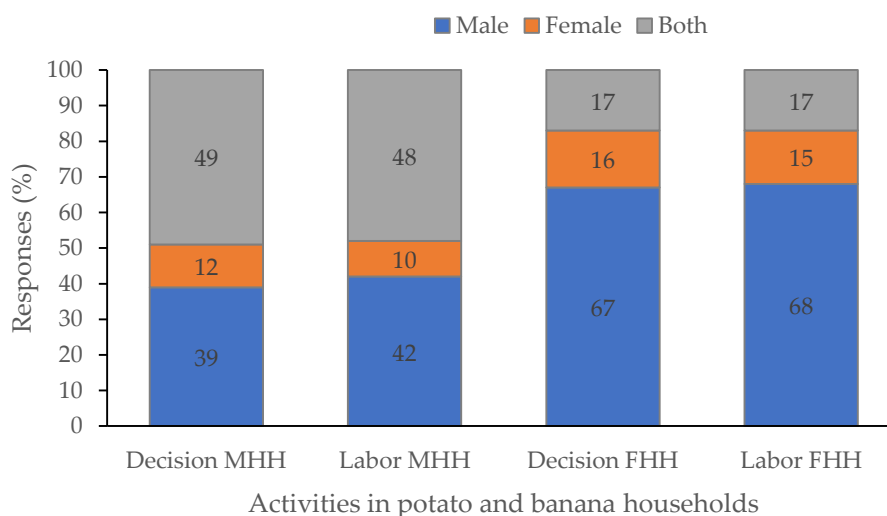


Figure 1. Gender roles in potato and banana production in Rwanda and Burundi.

In MHHs for both countries, men dominated decision-making (45% of respondents) and labor allocation related to varietal selection (64% respondents). Weeding was the main activity where women in MHHs participated the most, 16% in decision-making and 14% in providing labor.

Most of the joint decisions (55%) and joint labor provision (57%) in MHHs were made during pesticide application for farmers of potatoes and bananas. However, when male and female respondents within MHHs were compared, we noticed that male respondents perceived themselves as making more decisions and providing farm labor across all activities in the production of potatoes and bananas.

In female-headed potato and banana growing households in Rwanda and Burundi, men were perceived to provide labor most of the time, and this effect was most striking during variety selection (83%). In the same households, the highest proportion of women making decisions (18%) and providing labor (16%) was during weeding. The highest proportion of respondents in FHHs who jointly made decisions (20%) and provided labor (22%) was during land preparation. When comparing men and women in FHHs growing potatoes and sweet potatoes, men were perceived to make more decisions and provide more labor than their female counterparts.

Interestingly, for decision-making and labor provision in all activities regarding food crop production (sweet potato and cassava), these were mostly done jointly in nearly half of MHHs than FHHs (Figure 2; Table A2). In FHHs, the same trend of male household members taking most of the decisions and providing labor was also observed among farmers of food crops. Although most of the decisions and labor provision among both cash and food crops were done jointly by both men and women in Rwanda and Burundi in MHHs, male household members were perceived to make more decisions and provide more labor during cash crop production. During food crop production in MHHs, female members were perceived to make more decisions than their male counterparts during land

preparation, variety selection, planting, weeding, harvesting, transporting, and selling of the harvested crop. In terms of labor provision in MHHs, a higher proportion of females than males were involved in variety selection, weeding, harvesting, and transporting of the harvested crops to the market.

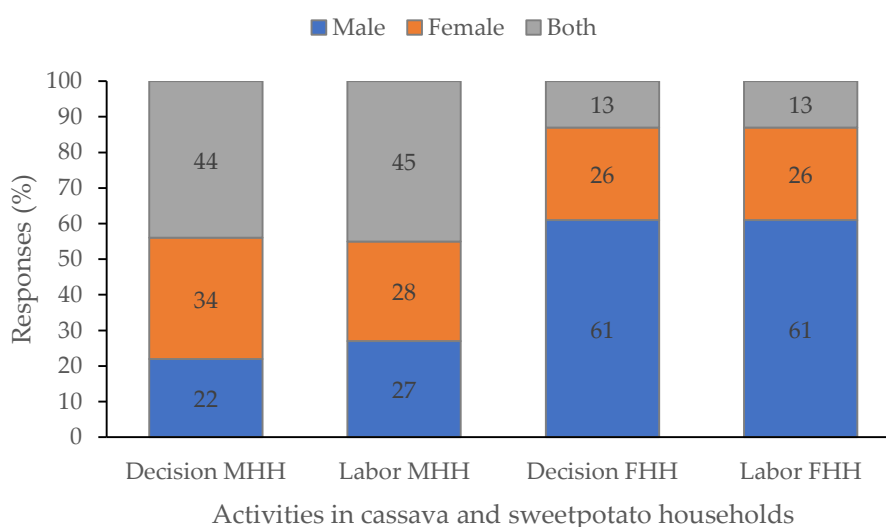


Figure 2. Gender roles in food crop (cassava and sweet potato) production in Rwanda and Burundi.

From the results of both cash and food crops, we also observed a trend in the differences of perceptions by both men and women irrespective of the sex of the household head and crop. Men tended to say that decisions are mostly jointly made, whereas women tended to say that decisions are made mostly by men. This difference in the perception of men and women may reflect a different understanding regarding the nature of joint decision-making. However, a consistent feature of the dataset is the correlation between decision-making and labor provision, where the higher the labor provisioning, the more likely a household member is to make decisions. It was surprising to see that men in FHHs took most decisions and provided most labor related to crop production and management, especially for the two cash crops. This may imply that men are de-facto decision-makers in these households, especially regarding these cash crops. Possibly these men are only decision-makers in name as they are the official owners of the land (according to customary law) that they inherited from their father. Widows may sometimes stay on the farm of their late husband but often do not have owner's rights.

3.3. Determinants of Decision-Making

In our analysis of the marginal effects of factors influencing decision-making in production of RTB crops by male, female, or both decision-makers within a household, access to credit was positively related with the frequency of joint decision-making (Table 3). A multinomial logistic regression model was used to analyze factors influencing decision-making in relation to production of RTB crops in a household. To better evaluate the effect of a unit change in covariates on the dependent variable, the marginal effects were examined [45]. Table 3 presents the marginal effects of factors influencing decision-making in relation to production of RTB crops in a household.

Distance to market was positively and significantly associated with the probability of a man being a sole decision-maker. With every increase in the distance to the market by a kilometer, there was a significant change in the likelihood of a man being the main decision-maker. Distance to the market negatively influenced the probability of joint decision-making. This negative coefficient implies that the closer the household is to the market, the more likely a man and a woman can jointly be decision-makers. The further away the market is from home, the less involved women are in decisions regarding RTB crops.

Table 3. Marginal effects of factors influencing decision-making in the production of RTB crops in Rwanda and Burundi.

Variable	Male Decision			Joint Decision		
	dy/dx	Std. Err.	P > z	dy/dx	Std. Err.	P > z
Log land size	0.017	0.013	0.207	−0.027 *	0.015	0.08
Household size	0.037	0.036	0.297	0.002	0.043	0.956
Distance to main road	0.002	0.004	0.571	−0.006	0.005	0.298
Access to extension	−0.027	0.039	0.484	−0.037	0.045	0.415
Crop grown mainly for cash	−0.129 *	0.066	0.051	0.065	0.060	0.289
Crop grown mainly for food	−0.076	0.052	0.142	0.205 ***	0.047	0
Age of household head	0.002	0.001	0.134	−0.001	0.001	0.456
Education level of household head	−0.005	0.005	0.373	−0.007	0.006	0.3
Occupation of household head	−0.003	0.014	0.79	0.028 *	0.016	0.082
Sex of household head	−0.399 ***	0.056	0	0.116 **	0.051	0.024
Log total income	0.060 **	0.029	0.041	−0.075 *	0.038	0.052
Log farm income	−0.060 **	0.029	0.038	0.095 **	0.038	0.014
Access to credit	−0.054	0.038	0.153	0.122 *	0.043	0.005
Distance to the market	0.010 **	0.005	0.043	−0.013 *	0.006	0.055

***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively; female gender was used as a reference; $n = 609$; Log likelihood = -599.2 ; pseudo $R^2 = 0.093$; LR $\chi^2 (102.75) = 95.20$ Prob > $\chi^2 = 0$.

As farm income increased, the frequency of joint decision-making and provision of labor also increased significantly in both countries. Farm income was negatively and significantly associated with the frequency of male decision-making. The pattern for total income was the inverse, however, as increased overall income was associated with more male decision-making and fewer joint decisions.

The type of RTB crop grown by the household influenced the decision made by the household head. In the current study, the production of food crops was positively and significantly associated with the frequency of joint decision-making by men and women. Land size was negatively associated with the frequency of joint decision-making. The likelihood of male and female household members jointly participating in decision-making increased significantly when the main occupation of the household head was farming.

3.4. Qualitative Observations Made during the Survey

It was noted that gender norms exist in Burundi that prohibit girls from preparing fields for bananas and planting bananas because they do not own the land. This prohibition is reflected in the folk song called '*Imana yarandiye itangize umuhungu yaba nari umuhungu noteya agatoki ku rugo kwa data: ni umwarama bigeni*' loosely translated as 'If I were born as a boy, I would plant bananas on my father's land'. Such beliefs could explain why men were perceived to dominate decision-making and labor provision in most of the activities related to banana production in the current study. Sweet potato was believed to be 'a woman's crop', and men were not interested in harvesting the roots because roots were usually not sold. Although this culture is changing, results of this study show that women in MHHs are making more decisions and doing much of the variety selection, weeding, harvesting, and transporting of the harvested crops to the market during the production of food crops.

Gender-based violence had led to some women respondents in our survey avoiding certain activities such as selling of the crop harvest or using the proceeds from crop sales before asking for permission from their husbands. One woman commented, '*never ask your husband where he has put the money from crop sales if you want your marriage to be peaceful*'. It is therefore imperative that men, rather than women, in rural central African settings such as those examined during this study, need to be continuously sensitized and enlightened about the need for increasing the involvement of women in agricultural decision-making and to desist from using violence against their wives. Once men appreciate the role and significance of women making decisions and handling the cash from crop sales, then cultural norms as a gender-based constraint may gradually dissipate.

In polygamous marriages, however, we observed that women had separate plots from men. In these cases, the women made all the decisions regarding what to grow on their plot and controlled the proceeds. The income from crop sales, however, went to taking care of the home and paying school fees for their biological children.

There were several positive accounts of gender relations amongst the RTB farmers. One potato farmer in Kinigi village, Musanze district, Rwanda expressed how he takes care of his spouse: *'My wife can rent out some rooms of this house or get a bank loan using our land title as collateral and can survive when I am gone.'* This spirit should be encouraged by setting policies that give equal rights to the ownership of production assets by both men and women in a marriage.

4. Discussion

The study reported here has illustrated the connection between gender division of labor with decision-making within a household in smallholder agriculture. Similar to the findings reported by Doss [47], in Ghana, that men participate more in cash than food crop production, our results showed that men are perceived to dominate labor provision and decision-making during the production of potatoes and bananas. This finding is in line with Sikod [13], who suggested that 'the types of activities members of households are involved in, impact on their contribution to household welfare and decision-making abilities.' For example, women were more engaged in activities and decision-making for food crops while men dominated crops that are more frequently sold for cash. Additionally, more men than women were involved in activities such as land preparation, buying of farm inputs, planting, pesticide application, processing, selling, and transportation to the market—even for food crops [48]. Our results for some activities, such as pest and disease control, align with findings from elsewhere in East Africa. For example, Erbaugh [49] reported that pesticide application is mainly done by men in Uganda. Other studies have also shown that women are less likely than men to adopt Integrated Pest Management (IPM) practices that require more labor, although they are likely to be involved in fetching water for men to use in mixing the chemicals for spraying [50]. Little [29] linked this to the issues of traditional agrarian ideologies where masculine pride is associated with doing hard physical labor while 'feminine pride' relates to nurturing and helping roles, which could explain women's dominance in sweet potato and cassava crops which communities under study mostly regarded as food crops.

It has been noted elsewhere that 'family labor is not a simple factor of production' [51] but is influenced by variables such as age and gender. This study showed this clear division of labor and decision-making power across crops by gender. It was also evident that women and men tended to invest most of their labor in crops where they had more power to decide. Although from the nature of our study, we cannot explain these differences, studies elsewhere have suggested that 'women tend to invest their labor where they are likely to receive most returns. Women's labor is not automatically controlled by the household head' [52]. It is possible, therefore, that women in Rwanda and Burundi were investing their time in sweet potatoes and cassava (food crops) because that is where they could get most returns. In a similar vein, Bryceson [53] suggested that 'when choice is exercised, there are fracture lines by gender and generation that serve to delimit coordination or cooperation of decision-making amongst household members'. However, while it is not clear from our study whether men and women in Rwanda and Burundi had a choice, the findings seem to suggest that in a significant proportion of households, decisions did not follow the model of cooperation and coordination but were made by one individual. In almost half of these households, decisions were made by women, who also had the lowest access to and engagement with extension workers. This may have implications for policies aimed at improving women's lives and well-being. It should also be noted that the low participation of women, especially in banana production, is a consequence of the cultural norm through which women are often not allowed to grow bananas by their husbands. Growing a semi-permanent crop, such as bananas, may be perceived as claiming land ownership [12]. However, this threat on land ownership is not posed by the two main food security crops of sweet potatoes and cassava because they are typically grown for periods of less than a year and are seen by men and women farmers as

servicing an important function in protecting household food security. Additionally, there is a strong cultural sentiment that women do not need to handle cash, particularly in Burundi, and this could have reduced the participation of women in buying inputs and marketing.

The finding of land size being negatively and significantly associated with the frequency of joint decision-making could be because most men in households that own small pieces of land do not mind their wives being co-owners (dual land ownership) mainly in Rwanda. However, as land size becomes large, men tend to start making decisions singly.

It could also be that when cropped land is large, especially for large-scale commercial farmers, a single manager is given full responsibility to oversee all the crops grown and spouses provide support to manage the crops. Another possible explanation is that most men with large pieces of land are polygamous, administrators of estates of their late parents, or clan leaders and are not obliged to jointly make decisions with their wives due to cultural reasons and a large scope of responsibilities. The huge difference in incomes by gender observed in Rwanda but not Burundi could be explained by the proximity of the study area in Burundi (10–30 km) to the country's capital Bujumbura, unlike the study site in Rwanda which is about 100 km away from the capital Kigali. We think that proximity to Bujumbura offered women more opportunities for off-farm income (salary or casual employment), and this could be the reason why incomes of women in Burundi were virtually the same as those of the Burundian men and slightly more than their counterparts in Rwanda.

Since the findings of the current study consistently showed that men were more likely than women to state that both men and women equally participated in decision-making over crops, this may suggest the need to look deeper into the area of decision-making to find out how decisions are made and who decides what. For example, in Kenya, Okitoi [54] stated that while both men and women made decisions regarding poultry, women's decisions were limited to non-cash decisions while men dominated cash-related decisions. In general, our study showed that men dominated cash-related decisions on purchase of farm inputs and marketing. This indicates a bias towards men in terms of control of cash income and decision-making.

Our results challenge the established notion that women provide most of the labor in agricultural production in Rwanda and Burundi [48,55]. Although women contribute to all stages of each farm activity, men generally still lead both in decision-making and labor provision. Our findings provide empirical evidence demonstrating that it is not true that women provide 60–80% of the agricultural labor force. At least for Burundi and Rwanda, this is simply a myth for these four RTB crops under study [56]. The proportion of agricultural labor provided by women in sub-Saharan Africa (SSA) has been reported in household surveys to be quite variable, ranging from 24% in Niger to 37% in Nigeria and 56% in Uganda [57]. Some activities in the production chain, such as pesticide application, are dominated by men in many countries of east Africa [49]. The dominance of men, particularly in potato and banana production in Rwanda and Burundi, may be because a high percentage of these crops are cultivated for sale.

5. Conclusions and Recommendations

This study found that labor allocation to RTB crops of household members in Burundi and Rwanda is aligned with the gender of the household member. There were also marked differences between men and women in relation to control over the different RTB crops and patterns of decision-making. Men make most of the decisions for bananas and potatoes, which are the most commercialized of the RTB crops. When asking men and women about 'joint decision-making', men classified decision-making processes within their household much more often as 'joint' than women did. This difference in perception raises questions about the nature and significance of so-called joint decision-making. There tends to be more joint decision-making in households with a raised income from farming, smaller land-sizes, and in the production of the food crops sweet potato and cassava. Overall, this study represents a landmark assessment of the role of gender in the cultivation of RTB crops in the Great

Lakes region of Africa. As such, it provides a vital base on which to design future studies of gender in agriculture, both in Africa and elsewhere in the developing world.

We recommend that future studies should not just stop at capturing the role of women in crop production and management but should identify and analyze the drivers for culture-specific gender roles that bring about the differences in the division of roles between men and women reported in the current study. A positive observation from a gender perspective is that the level of joint decision-making by both men and women in cash crops was higher than sole decision-making by men or women. An interesting follow-up study would be to assess the division of labor in household tasks. It may be that men do not participate at all in child care, home maintenance, and day-to-day household chores, which leaves women with little time to participate in farm activities. If this is the case, it could explain why men dominate both decision-making and labor provision in RTB crops. Efforts to identify the different constraints limiting the participation of men and women in food production would merit examination in future studies since this will increase household food production and hence, food security. Capturing the exact number of hours spent by each household member per activity during the cropping season, though challenging to record, would provide quantitative data on the exact amount of time allocated to each task. Such an approach would eliminate instances of under-reporting or undervaluing of women's labor.

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Appendix A

Table A1. Gender roles in potato and banana production in Rwanda and Burundi.

Activity	Variables	Male-Headed Households Responses (%)				Female-Headed Households Responses (%)			
		n	Male	Female	Both	n	Male	Female	Both
Land preparation	Decision	527	39	10	51	117	66	15	20
	Labor	511	39	6	54	108	65	13	22
Buying inputs	Decision	445	41	10	49	90	71	16	13
	Labor	432	45	9	46	82	71	12	17
Selecting Varieties	Decision	522	45	12	43	114	68	17	16
	Labor	664	64	6	30	147	83	8	9
Planting	Decision	518	42	11	47	113	65	17	18
	Labor	506	42	7	51	105	65	15	20
Weeding	Decision	535	36	16	48	120	63	18	18
	Labor	523	35	14	50	113	65	16	19
Applying pesticides	Decision	353	37	8	55	65	66	17	17
	Labor	354	38	5	57	62	63	16	21
Harvesting	Decision	526	39	12	49	118	65	16	19
	Labor	513	41	10	50	113	65	15	19
Transporting	Decision	513	36	13	51	118	67	15	18
	Labor	501	39	10	51	112	67	14	19
Processing	Decision	519	38	12	50	118	66	14	19
	Labor	197	51	6	43	51	78	14	8
Selling	Decision	504	40	11	49	110	69	15	16
	Labor	473	41	12	47	101	67	15	18
Average	Decision	496	39	12	49	108	67	16	17
	Labor	478	42	10	48	103	68	15	17

Table A2. Gender roles in food crop (cassava and sweet potato) production in Rwanda and Burundi.

Activity	Variables	Male-Headed Households Responses (%)				Female-Headed Households Responses (%)			
		n	Male	Female	Both	n	Male	Female	Both
Land preparation	Decision	530	24	25	51	122	60	20	20
	Labor	502	31	12	58	114	61	17	23
Buying inputs	Decision	388	28	25	46	77	68	25	8
	Labor	363	38	19	44	70	69	23	9
Selecting Varieties	Decision	525	18	41	41	120	59	27	14
	Labor	398	28	29	43	81	68	23	9
Planting	Decision	526	20	40	40	121	60	26	15
	Labor	502	28	25	47	113	59	26	15
Weeding	Decision	498	20	41	39	115	61	26	13
	Labor	478	18	40	42	108	56	31	12
Applying pesticides	Decision	205	24	22	54	39	51	38	10
	Labor	206	29	18	53	37	49	41	11
Harvesting	Decision	526	17	44	40	122	61	25	15
	Labor	500	27	31	42	114	59	27	14
Transporting	Decision	506	18	42	40	122	60	26	14
	Labor	479	27	29	44	114	61	25	14
Processing	Decision	196	30	27	43	49	65	27	8
	Labor	180	37	19	44	43	67	28	5
Selling	Decision	465	24	33	44	109	61	23	17
	Labor	436	28	27	45	99	63	20	17
Average	Decision	437	22	34	44	100	61	26	13
	Labor	416	27	28	45	93	61	26	13

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