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 labour and decision-making in crop management may lead to designing better interventions targeted at improving efficiency in smallholder agriculture. A household quantitative survey with heads of households involving 261 women and 144 men in Burundi and 184 women and 222 men in Rwanda was conducted in 2014. Most of the decisions and labour provision during 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 labour 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 recognise men as the main decision-makers at both the household and community levels.

Keywords: banana, cassava, potato, sweet potato, gender division-of-labour, 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 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 sweet potato are cultivated in nearly all provinces of Rwanda and Burundi. In Rwanda and Burundi, banana and potato are both food and cash crops while sweet potato and cassava are cultivated mainly for home consumption. Banana is important for cash-generation in both Rwanda and Burundi, especially the beer-banana type, which is processed into several types of beverages, [2]. Annual production of banana, cassava, potato and sweet potato in Rwanda and Burundi is estimated at 1.729 (Rwanda) vs 1.239 (Burundi), 1.042 vs 2.294, 0.846 vs 0.151 and 1.079 vs 0.712 million tons, respectively in 2017 [3]. While sweet potato ranks lower than other RTB crops in terms of quantity produced, it plays and important role in household food and nutritional security. 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 very important for both producers and consumers in Rwanda and Burundi, agricultural productivity and on-farm yield are generally low [5]. This is a result of a diverse set of productivity constraints including crop management, biotic and abiotic stresses [6-8]. RTBs are predominantly produced by smallholder farm households in mixed farming systems [9]. There are important gender differences in intra-household roles and responsibilities with regards to RTB production, processing and commercialisation in the African Great Lakes region; men and women having distinct sets of tasks and contrasting levels of control over these crops [2,10-12]. Sikod [13] states that intra-household division of labour is an economic strategy to position the household to meet its needs, although it is often done in ways that can constrain development . Other authors argue that intra-household division of labour 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 labour 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 labour is important for policy-makers, programme managers, agricultural researchers and agricultural extension workers when trying 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. The decision-making process is shaped by a process of negotiation, knowledge of the others' preferences, gender norms, as well as power dynamics [19] 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 and this power is dependent on a number of complex factors including the access to agricultural land and inputs, training and financial loans through formal and informal credit institutions [20]. This, 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]. [26] even suggest that because of very unequal gender norms on an institutional or collective level, women's individual 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]. This 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. This means that when women do not have access to this information they cannot effectively participate in decision-making or make informed decisions.

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In many countries, certain crops have been loosely categorised 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]. It has been found 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 with 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 the gendered division of labour (GDoL) is challenged by every new innovation which enters the agricultural arena. 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 labour and intra-household decision-making with regards to RTB in Rwanda and Burundi.

1.1 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 micro-finance institutions, cooperatives, 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$70.07 from VSLA groups with most of the loans not exceeding US$12.58 [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 are somewhat empowered (i.e. increased land rights especially for married women and friendly education policies for girls). This is because of the strong activism and good representation of women in the leadership of the government. Women hold over 50% of the seats in parliament. The Rwandese parliament has passed gender progressive laws such as the 2004 National Land Policy, the 1999 Inheritance Law and the 2005 Organic Land Law that advocate for gender equality and antidiscrimination [36]. Additionally, one study reported that after the 1994 Rwandan genocide, most men were imprisoned due to war crimes and they spent many years away from their homes. During these years, the wives were in charge of decision-making within most households. After the return of the husbands, changes had to be made to decision making processes [12].

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 make it rather easy for the government to implement locally, hence giving room to following of 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 labour intensive, manual and time-consuming allowing very little acreage to be cultivated. For instance, land preparation (ploughing), hilling or ridging is done by using a hand hoe. Planting, fertilizer application and harvesting of potato is 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 labour? and 3) Which factors influence decision-making and labour allocation within a household? For this study decision-making was defined 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. Data were grouped into cash crops (banana and potato) and food crops (sweet potato and cassava) and analysed using STATA software (Version 14) and descriptive statistics such as means, percentages and frequencies were used to describe the socio-economic demographics. A multinomial logistic regression model was used to analyse 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. T-test was conducted to determine the significant difference between the means of variables among male- and female- headed households such as education, age, and main occupation of the household heads.

2.1 Farm survey

Data for this study was 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 larger questionnaire that examined the impact of pests and diseases on the livelihoods of rural smallholder farmers within 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 RTB crop farmers 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, potato or sweet potato. Pre-testing of the questionnaire was done prior to formal data collection in districts outside of the study area. Enumerators were trained prior to 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 who in the family was a member of a farmers' organization, who was trained by the agricultural extension worker, who received credit, 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). The objectives and methods of the study were explained to farmers and verbal informed consent was sought. Interviews were only conducted when a farmer had accepted.

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2.2 Diagnostic tests.

Prior to data analysis the following tests on the data were undertaken.

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 presence of IIA. If IIA was violated, other statistical methods which relax the assumption, Multinomial probit, Nested Logit [42] and Random parameter Logit model [43] were used.

2.2.2 Testing for Multicollinearity

Multicollinearity in data arises when there are correlations between independent variables. In the current study, the Variance Inflation Factor (VIF) method was used to test for presence of multicollinearity. This was arrived at by estimating artificial ordinary least squares (OLS) regressions with each of the decision makers as the "dependent" variable and the rest as independent variables Madalla (2001). VIF values of <10 were considered to have no multicollinearity. A VIF >10 indicates that the variable is highly collinear.

2.2.3 Testing for Heteroscedasticity

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 (Greene 2000). 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 verses the alternative that the error variances were a multiplicative function of one or more variables.

3. Results

3.1 Household characteristics:

Most households surveyed were headed by men: 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 MHHs had significantly larger household size (5.5 persons) than FHHs (4.6 persons) in Rwanda, no such statistical difference was observed among households in Burundi (5.9 vs 6.4 persons) (Table 1). 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 but 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 1: Demographic and socio-economic characteristics of the surveyed households

	Burundi		Rwanda	
Farm and household characteristics	**Male-Headed Households (n=322)**	**Female-Headed Households (n=83)**	**Male-Headed Households (n=342)**	**Female-Headed Households (n=64)**

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Household size (number)	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
Main occupation (% responses)				
Farming	77.5	98.1	89.49	100
Salaried employment	11.4	1.9	5.41	0
Retail business (shops)	4.1	0.0	1.5	0
Secondary occupation (% responses)				
None	40.8	42.3	51	100
Farming	14.1	6.0		
Salaried employment	3.9	3.9	5	
Retail business	13.1	19.2	4.5	
Casual labour-on farm	10.7	7.7		
Casual labour-off farm	5.3	3.9	8.5	
*Mean Annual income in US$**				
Total farm income	238.8	238.2	346.4	151.1
Total off-farm income	295.6	224.7	468.6	203.5

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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 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 [44].

3.2 Division of Labour and Decision-making

Perceptions about decision-making and labour 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 labour provision than of male or female alone respondents who grew potato and banana (Table 2). Even in FHHs growing potato and banana in the two countries under study, male household members made most of the decisions and provided most of the labour.

Table 2: Gender roles in potato and banana production in Rwanda and Burundi

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

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

Weeding is when the highest proportion of women in MHHs made decisions (16%) and provided labour (14%). Most of the joint decisions (55%) and joint labour provision (57%) in MHHs were made during pesticide application for farmers of potato and banana. However, when male and

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female respondents within MHHs were compared, we noticed that male respondents perceived themselves as making more decisions and providing farm labour across all activities in the production of potato and banana.

In female-headed potato and banana growing households in Rwanda and Burundi, men were perceived to provide labour 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 labour (16%) was during weeding. The highest proportion of respondents in FHHs who jointly made decisions (20%) and provided labour (22%) was during land preparation. When comparing men and women in FHHs growing potato and sweet potato, men were perceived to make more decisions and provided more labour than their female counterparts.

Similarly, for decision-making and labour provision in all activities regarding food crop production (sweet potato and cassava), these were mostly done jointly in MHHs (Table 3). In FHHs, the same trend of male household members taking most of the decisions and providing labour was also observed among farmers of food crops. Although most of the decisions and labour provision among both cash and food crops were done jointly by both men and women in Rwanda and Burundi in MHHs, male members were perceived to make more decisions and provide more labour 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 labour 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.

Table 3. Gender roles in food crop (cassava and sweet potato) production in Rwanda and Burundi

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

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From the results of both cash and food crops, we also observe a trend in the differences of perceptions by both men and women irrespective of the sex of the household head and crop. There is a tendency by men to always say that decisions were mostly made jointly while women tend to report that decisions were mostly made by men. This difference in the perception by men and women within a household may reflect a different understanding regarding joint decision-making. However, consistent feature of the dataset is the correlation between decision-making and labour provision, where the higher the labour provisioning, the more likely a household member is to make decisions. It was surprising to see that men in FHHs took most of the decisions and provided most of the labour 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 or that when it came to cash crops (banana and potato) other men (for instance sons, brothers or hired workers) who may not necessarily be the women's husband made decisions. Although this was not investigated in this study, it could be related to land ownership.

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 4).

Table 4: Marginal effects of factors influencing decision making in production of RTB crops in Rwanda and Burundi

	Male decision			Joint decision		
Variable	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**	0.0052	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

Distance to market was positively and significantly associated with the probability of men being a sole decision maker. With every increase in the distance to the market by a kilometre, there is a significant change in 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 woman can jointly be decision-makers. This could be because if the market is close to the farm, it is easy for both the man and women to know the market price, or if it is in a walkable distance, women won't require expensive forms of transport like the use of a vehicle or motorbike.

Farm income was positively and significantly associated with the frequency of both husband and wife making decisions and providing labour for both Rwanda and Burundi. Farm income was negatively and significantly associated with the frequency of male decision making. A decline in the amount of income from farming reduces the participation of men as decision makers.

The type of RTB crop grown by the household had an influence on the decision made by the household head. In the current study, production of food crops was positively and significantly associated with the frequency of joint decision making by men and women. Land size was positively and significantly associated with the frequency of joint decision making.

Total household income positively and significantly influenced household decision-making by male decision makers. The positive coefficient implies that an increase in total household income by a dollar increases the probability of a male decision maker participating in RTB crop production relative to female decision maker. By contrast, total farm income negatively and significantly influenced the probability of joint decision making. The likelihood of male and female household members jointly participating in decision making increases significantly when the main occupation of the household head is farming. Men's participation in decision-making may be driven by the desire to generate incomes from farming activities.

3.4 Qualitative observations made during the survey

It was noted that cultural norms exist in Burundi that prohibit married women from preparing fields for banana and planting banana because they do not own the land. This 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 was born as a boy, I would plant banana on my father's land". Such beliefs could explain why men were perceived to dominate decision-making and labour 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. 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 of 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. Once men appreciate the role and significance of women taking decisions

and handling of cash from crop sales, then cultural norms as a gender-based constraint will 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 settings 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 labour with decision-making within a household in smallholder agriculture. Similar to the findings reported by Doss [45] in Ghana that men participate more in cash than food crop production, our results showed that men are perceived to dominate labour provision and decision-making during production of potato and banana. This 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 whilst 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 [46]. Our results for some activities, such as pest and disease control, align with findings from elsewhere in East Africa. For example, Erbaugh [47] reported that pesticide application is mainly done by men in Uganda. Other studies also have shown that women are less likely than men to adopt IPM practices that require more labour, although they are likely to be involved in fetching water for men to mix the chemicals for spraying [48]. Little [29] linked this to the issues of traditional agrarian ideologies where masculine pride is associated with doing hard physical labour while 'feminine pride' relates to nurturing and helping roles which could explain women's dominance in sweet potato and cassava which are mostly regarded as food crops.

It has been noted elsewhere that 'family labour is not a simple factor of production' [49] but is influenced by variables such as age and gender. This study showed this clear division of labour and decision-making power across crops by gender. It was also clear that women and men tend to invest most of their labour 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 labour where they are likely to receive most returns. Women's labour is not automatically controlled by the household head' [50]. It is possible therefore that women in Rwanda and Burundi were investing their time in sweet potato and cassava (food crops) because that is where they could get most returns. In a similar vein, Bryceson [51] 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 banana by their husbands. Growing a semi-permanent crop, such as banana, may be perceived as making a claim on land ownership. However, this threat on land ownership is not

posed by the two main food security crops of sweet potato and cassava because they are typically grown for periods of less than a year and are seen as serving an important function in protecting household food security. Additionally, there is a strong cultural sentiment that women do not need to handle cash, specifically in Burundi, and this could have reduced the participation of women in buying inputs and marketing.

The finding of land size being positively and significantly associated with the frequency of joint decision-making could be because women in households that own large pieces of land are also co-owners (dual land ownership) and therefore have equal rights with their husbands. It could also be that when cropped land is large, especially for commercial large-scale farmers, a single person is not adequate to oversee all the crops grown and support is required from the spouse. Another possible explanation is that most men with large pieces of land are better educated and recognise the value of involving their spouses in decision-making and running of family farming businesses. The huge difference in incomes by gender observed Rwanda and 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 arena of decision-making to find out how decisions are made and who decides what. For example, in Kenya, Okitoi [52] 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 cash-related decisions on purchase of farm inputs and marketing were dominated by men. 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 labour in agricultural production in Rwanda and Burundi [46,53]. Although women contribute to all stages of each farm activity, men generally still lead both in decision-making and labour provision. Our findings provide empirical evidence demonstrating that it is not true that women provide 60-80% of the agricultural labour force. At least for Burundi and Rwanda, this is simply a myth [54]. The proportion of agricultural labour provided by women in SSA has been reported in household surveys to be quite variable and can be 24% in Niger, 37% in Nigeria, 56% in Uganda [55]. Some activities in the production chain, such as pesticide application, are dominated by men in many countries of east Africa [47]. The dominance of men, particularly in potato and banana production in Rwanda and Burundi, may be because a great percentage of these crops are cultivated for sale.

5. Conclusions and recommendations

We recommend that future studies should not just stop in capturing the role of women in crop production and management but go deeper into identifying 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 for men or women singly. An interesting follow-up study would be to assess the division of labour when it comes to household chores. It may be that men don't 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. This could therefore be the explanation for men dominating both decision-making and labour 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. This would also eliminate instances of under reporting or undervaluing of women's labour.

Supplementary Materials: The following are available (Questionnaire at https://www.mdpi.com/1660-4601/16/3/400/s1).

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