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Journal of International Development
J. Int. Dev. (2020)
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/jid.3497

GENDERED INTRA-HOUSEHOLD DECISION-MAKING DYNAMICS IN AGRICULTURAL INNOVATION PROCESSES: ASSETS, NORMS AND BARGAINING POWER

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Abstract: This article explores intra-household decision-making in smallholder farmers' innovation uptake and use of outputs within a bargaining framework. Research was conducted in selected locations representing contrasting economic, social and agroclimatic environments in Uganda using a combination of qualitative and quantitative methods (including a survey of 531 farmers). Decision-making in innovation processes was highly gendered and shaped by intra-household allocation of production assets as well as social norms. The findings highlight the male capture of decision-making regarding innovation uptake and use of outputs, especially for income-generating crops, and that this can both reflect and reinforce gender inequalities in asset ownership. © 2020 The Authors. Journal of International Development published by John Wiley & Sons Ltd

Keywords: Intra-household dynamics; decision-making; gender; bargaining; agricultural innovations; smallholder farmers

1 INTRODUCTION

Innovations are increasingly important for tackling development challenges, including poverty, food and nutrition insecurity, climate change, degraded natural resources and population pressure on scarce lands (Spielman, Ekboir & Davis, 2009; Wiggins, 2014; World Bank, 2007a, 2012). Nevertheless, the fact that innovation processes and outputs are highly gendered is often neglected in Agricultural Innovation System literature and innovation support interventions, resulting in a low uptake of innovations (Cardey &

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Garforth, 2013; Kingiri, 2013; Pyburn, 2014; Reij, Waters-Bayer & Tripp, 2001). Moreover, linear 'transfer of technology' perspectives and simplistic innovation studies prevent a profound understanding of innovation as collective and negotiated processes which involve the reordering of social relationships (Leeuwis & Aarts, 2011).

Men and women introduce innovations and benefit from them differently. 'Traditionally' defined gendered divisions of labour is a key factor that shapes the characteristics of innovations that farmers adopt. Women are more likely to be engaged in subsistence farming, while men are more likely to be involved with cash crops (Moser, 2012). This explains the higher uptake rate for food crop-related changes for women, while more men prefer cash crop-related changes, as highlighted in a range of case studies in innovation and extension literature (Mazur & Onzere, 2009; Miiro, Chritchley, Van Der Wal & Lwakuba, 2001; World Bank, 2007b).

Gender differences in innovation uptake are attributed to the unequal access to resources, which result from gendered roles and responsibilities. The Future Agricultures Consortium found that those households with more land, assets and resources took advantage of agricultural opportunities, often leaving out female farmers with fewer resources (Wiggins, 2014). Further empirical evidence suggests that women are more likely to be engaged in subsistence farming and less likely to cultivate cash crops because of gender inequality in terms of limited access to fertile soil, tenured security of plots and credit (Doss & Morris, 2001; Fisher & Carr, 2015; Mazur & Onzere, 2009; World Bank, 2007b).

This study investigates how such gender inequalities are embedded in local innovation processes at farmer level in Uganda, focusing particularly on intra-household decisions. Uganda ranks 14th highest in the world for the rate of its male and female population employed in agriculture (70.4 per cent of total employment; 65.5 per cent of male employment; and 75.8 per cent of female employment) in 2016, according to ILOSTAT. As the majority of farmers (96.3 per cent) are engaged in subsistence farming (UBOS, 2014), the sector holds great importance for poverty alleviation. However, it is reported that women's agricultural productivity is lower than men's by some margin, as a result of gender inequalities in access to the factors of production (MAAIF, 2016; World Bank, 2016).

1.1 Intra-Household Decision-Making and Bargaining Power in Innovation Processes

Innovation is a process which constitutes a series of intra-household decisions which are strongly affected by existing decision-making patterns on production and consumption and perceived institutions, such as social norms and culture. Earlier studies of 'New Home Economics', founded by Becker (1965), applied a unitary model which assumes that a household is a single production or consumption unit, thus failing to understand intra-household dynamics (Agarwal, 1997; Moghadam *et al*., 2011; Wolf, 1990). However, the bargaining framework emerged to claim that the outcomes of households' decisions are affected by the allocation of resources and the power relationship within the household, as opposed to the unitary model's predictions of a single consumption unit (Anderson, Reynolds & Gugerty, 2017; Browning, Chiappori & Lechene, 2010; Doss, 2001; Doss, 2013; Meinzen-Dick *et al*., 2011).

Agarwal (1997) and Doss (2013) further categorise the bargaining framework into cooperative bargaining models, collective models and non-cooperative bargaining models,

DOI: 10.1002/jid

whereby the former two presume the Pareto efficiency in household outcome in which no one could be better off without making someone else worse off, while the latter models reject this. The cooperative bargaining and collective models argue that individual household members bargain over how to allocate both pooled resources and household expenditure; hence, there are different outcomes because of different preferences among household individuals. Non-cooperative bargaining models assume that individuals in households make separate decisions about their own resources, that is, resources are not pooled but rather spent individually (Doss, 2001). However, Malapit (2012) claims that cooperative models and non-cooperative models are not mutually exclusive. Much of the literature in the area supports non-cooperative models or a combination of the three models, as the best explanation of intra-household decision-making in developing country contexts (Browning, Chiappori & Lechene, 2010; Kebede, Tarazona, Munro & Verschoor, 2014; Mcpeak & Doss, 2006; Njuki, Kaaria, Chamunorwa & Chiuri, 2011; Udry, 1996). This could be true in sub-Saharan Africa (SSA) where resources are not often pooled but are typically controlled by men (Njuki, Kaaria, Chamunorwa & Chiuri, 2011). In SSA, decisions about gender roles and responsibilities are seemingly governed by strong social norms or institutions, not necessarily with the aim of maximising household productivity, with daily negotiations among household individuals. In other words, in any model, gender inequalities in decision-making authorities are apparent; in cooperative and collective bargaining models, production and consumption decisions are affected by gender inequalities in bargaining power which are often led by unequal asset endowment and control. In parallel, in non-cooperative bargaining models, gender inequalities in asset endowment limit the share of decisions, which come under women's control.

Intra-household bargaining or dynamics influences the uptake of new agricultural technologies, but it is seldom examined by innovation and adoption studies literature. Many empirical studies reveal that women farmers have relatively low rates of adoption of agricultural technologies associated with higher productivity. However, these studies do not consider the intra-household context and the bargaining framework, which may affect the technology adoption (Doss, 2001; Doss, 2013; Haider, Smale & Theriault, 2018). Some of the first contributions to the analysis of technology adoption in intra-household contexts were those of Von Braun (1988) and Jones (1983) who investigated how the allocation of labour changed when irrigated rice was introduced in West Africa. Those studies demonstrate that women's insufficient bargaining power allows benefits of the new technologies to be captured by men, as predicted earlier by Boserup (1970). More recently, Fisher and Carr (2015), in their adoption study on drought-tolerant maize in eastern Uganda, found that women farmers have much lower adoption rates of drought-tolerant maize compared with men farmers because of differences in resource access. Moreover, Haider, Smale and Theriault (2018) analysed fertiliser adoption in Burkina Faso and demonstrated that technology adoption status differs among household members depending on whether their plots are collectively or individually managed. Thus, based on gender and sociocultural dynamics relating to resources and labour (re)allocations associated with innovation, it is clear that intra-household bargaining influences adoption. It is also noteworthy that the gendered division of labour by crop and by task is not static; rather, it changes in accordance with new economic opportunities (Doss, 2001). This implies that change in the economic value of a certain crop may change gender power relations in intra-household resource allocation and in who benefits from the crop.

There is again scarce literature on the intra-household decision-making which concerns the output of innovations. Women and men in SSA may not pool household incomes, but

DOI: 10.1002/jid

they may negotiate and choose to spend the money they control differently from one another (Doss, 2013; Meinzen-Dick *et al*., 2011; Njuki, Kaaria, Chamunorwa & Chiuri, 2011). Some studies have shown that women's bargaining power affects the household budget share spent on food, education, health, private goods or other goods. However, the practical difficulty of distinguishing between goods for the entire family and those purchased purely for individual members makes it difficult to assess the bargaining power of household individuals. Doss (2013) also suggests that consumption patterns may be strongly related to measures of bargaining powers, particularly income and asset ownership.

As determinants of bargaining power, a range of studies identify factors including income and employment, ownership and control over assets, such as land, livestock and agricultural equipment, social networks and access to credit (Doss, 2013; Meinzen-Dick *et al*., 2011; Mishra & Sam, 2016). Additional determinants identified are women's education, age, health and their participation in the market (Anderson, Reynolds & Gugerty, 2017), as well as the strength of the person's fall-back position, which is the outside option if cooperation failed (Agarwal, 1997). The ownership and types of such assets are gendered, conditioned and perpetuated by sociocultural context and intra-household allocation rules (Doss, Meinzen-Dick, Quisumbing & Theis, 2018; Johnson *et al*., 2016; Quisumbing *et al*., 2015). Those studies which investigate determinants of bargaining power can provide significant insights for understanding decision-making patterns in innovation contexts.

Thus, many studies suggest that innovations are influenced by gendered resource allocations, such as land, labour, credit, agricultural inputs and extension, as well as gender norms. However, few studies have attempted to reveal such influence in an intra-household context. Moreover, many adoption studies typically focus only on a specific crop or technology, thereby failing to capture holistic views of innovation processes or of farmers' subjective reasoning behind their decision-making patterns (Leeuwis, 2004). Therefore, taking an intra-household bargaining perspective, this article aims to analyse how men and women farmers within the household make decisions about their agricultural innovations and what determines the decision-making authority over the innovation processes. The study was guided by the following research questions:

- How do men and women within the same households make decisions regarding the uptake of innovations and the use of products from them?
- What influences decision-making authority by men and women within the household?

2 METHODS

The study was conducted in Uganda between November 2016 and February 2018 and applied an exploratory and inductive approach. In order to examine a wide range of innovation process scenarios, two villages, the most advantaged and most disadvantaged in terms of enabling environment for innovations,[1] were chosen for each of two agroecological zones (AEZs) in Uganda, namely, North Western Savannah Grasslands (NWSG) and South Western Farmlands (SWF). Thus, four villages in total were

[1]The indicator of Enabling Environment for Innovations (EEI) was created by the author, based on a set of criteria purposively chosen from the readily available data from the Agriculture Census 2008/9 (UBOS, 2010) and interviews with the local government production department.

DOI: 10.1002/jid

focused on (see Figure 1). World Bank (2012) defines 'innovation' as 'the process by which individuals or organizations master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to their competitors, their country or the world'. On the other hand, an innovation here is defined as a new change that is made to farming activities or practices by a household member(s) (Leeuwis, 2004; Nielsen, 2001). It may not be new to the area or location but is to that particular individual (Hall, Mytelka & Oyelaran-Oyeyinka, 2006; World Bank, 2012). In this study, an innovation was identified by farmers themselves, not by researchers, as a new practice which they think actually worked for them.

The field research process is summarised in Table 1. For 'Wealth Ranking' pioneered by Grandin (1988) and widely used by both academia and practitioners (Hargreaves *et al*., 2007), all the farming households in each village were categorised into three wealth groups—poor, moderate and rich—based on the wealth factors identified by key informants, commonly the combination of land size and use, livestock type and number, livelihood type, housing type, food security status and so on. Furthermore, Focus Group Discussions were organised for various gender and wealth categories of farmers; this provided the basis on which structured questionnaires were formulated. Regarding the household and individual surveys, all the household heads and their spouses (if any) available during the survey period were interviewed face-to-face, using a structured questionnaire, whereby the enumerators input the data using smartphones with Open Data Kit. The individual farmers were interviewed about their experiences of key innovations (up to maximum three) introduced in the last 10 years (2008–2017). Specifically, the respondents were asked who the first person was to know about innovations within the household and who decided to introduce the key innovations. Table 2 shows the number

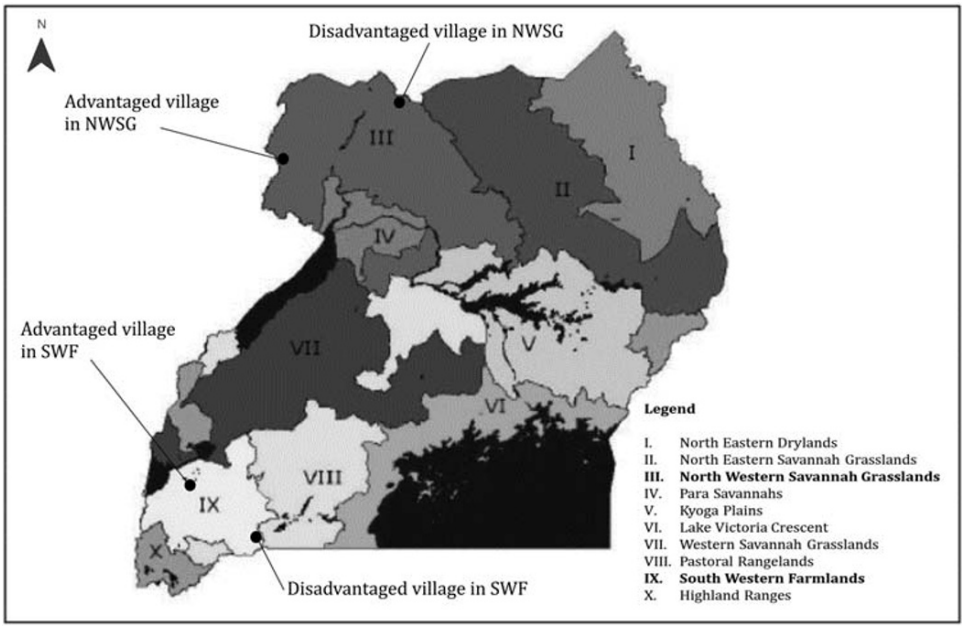


Figure 1. Research sites in agricultural production zones of Uganda. Source: MAAIF (2016)

DOI: 10.1002/jid

Table 1. Research process

Data collection tools	Sessions	Female	Male	Total
Livelihood/farm system mapping (changes between present & 20 years ago)	8	24	24	48
Wealth ranking	4	12	12	24
FGDs	49	94	72	166
Household questionnaire survey	358	207	151	358
Individual questionnaire survey	531	312	219	531
In-depth individual interviews	90	56	34	90
Participatory budgeting and effects diagrams	83	44	39	83

of respondents and innovation cases collected in total. During the visit to each household, either the household head or the spouse was interviewed (based on alternating selection) and asked about household characteristics, their three main crops and their main livestock. In this way, data were generated on the gender role divisions for each farming activity and the control of profits and outputs from each enterprise.

In-depth interviews were conducted with farmers randomly selected from each stratified category of gender and wealth; questions asked covered whether the respondent must seek permission from his or her partner to introduce innovations and give reasons for its implementation; if there are any enterprises or activities that the respondent is allowed to do without permission from his or her partner; and who controls the profit from innovations. All interviews were audio recorded and transcribed for content analysis. Moreover, regarding the most frequently mentioned innovations, usually two to three per village, 84 farmers randomly selected from the stratified categories of farmers who responded that they had introduced the selected innovations were selected for two participatory activities, namely, participatory budgeting and an effects diagram. The former activity investigated cash and in-kind inputs and outputs, comparing gross margins with and without innovations. During the latter activity, the farmers were asked about intra-household decision-making on innovation outputs in terms of expenditure of innovation profits, that is, what the benefits (specific amounts of cash or food produce gained from the innovation) were used for, who made the decisions about their use and what the knock-on effects of their use were.

Table 2. Number of questionnaire respondents and innovations introduced[a]

Gender category	Poor		Moderate		Rich		Total	
	Farmer	Innov.	Farmer	Innov.	Farmer	Innov.	Farmer	Innov.
Single men	18	23	12	13	1	0	31	36
Married men	58	108	104	178	25	44	187	330
Single women	39	64	48	73	2	5	89	142
Married women	72	123	124	182	28	40	224	345
Total	187	318	288	446	56	89	531	853

[a]Respondents were divided into four categories: single men; married men; single women; and married women. 'Married' signifies 'with partner/s' rather than official marital status, while 'single' means either widowed, separated or divorced.

DOI: 10.1002/jid

3 RESULTS

This section shows the main innovations which were reported to have been introduced over the previous 10 years, and who within the households decided to introduce those innovations. These innovation overviews are followed by the perceived reasons behind the gendered decision-making patterns on both uptake and use of outputs. Furthermore, farmers' perceptions were used to guide the study in to generate empirical evidence regarding relationships between decision-making patterns and the identified factors such as gendered enterprises and assets.

3.1 Innovation Overview

Importantly, there are statistically significant differences between men and women in terms of innovation types (x^2 = 23.833, d.f. = 14, p = 0.048) (Table 3). For example, the

Table 3. Innovation types by gender

		Married men		Married women		Total	
	Innovation types	Count	%	Count	%	Count	%
Crop*	Soil management*	63	19.1%	49	14.2%	112	16.6%
	New crop	48	14.5%	66	19.1%	114	16.9%
	Land preparation and planting method	38	11.5%	52	15.1%	90	13.3%
	Expansion in area planted	33	10.0%	33	9.6%	66	9.8%
	New variety	30	9.1%	42	12.2%	72	10.7%
	Managerial practices (pruning, de-suckering, staking)	25	7.6%	19	5.5%	44	6.5%
	Pest and disease control*	14	4.2%	25	7.2%	39	5.8%
	Improved farming tools	13	3.9%	5	1.4%	18	2.7%
	Change in planting timing	8	2.4%	4	1.2%	12	1.8%
	Weeding method	3	0.9%	8	2.3%	11	1.6%
	Harvesting/post-harvesting method (storage, processing, marketing)	2	0.6%	2	0.6%	4	0.6%
	Irrigation/water harvesting	2	0.6%	2	0.6%	4	0.6%
	Reduction in area planted	1	0.3%	3	0.9%	4	0.6%
	Other	1	0.3%	0	0.0%	1	0.1%
Livestock*	New animal	23	7.0%	16	4.6%	39	5.8%
	Animal disease control	15	4.5%	13	3.8%	28	4.1%
	Expansion in no. of animals	5	1.5%	6	1.7%	11	1.6%
	New breed	3	0.9%	0	0.0%	3	0.4%
	Reduction in no. of animals	2	0.6%	0	0.0%	2	0.3%
	Other	1	0.3%	0	0.0%	1	0.1%
Total		330	100.0%	345	n.a.	675	100.0%

Respondents were asked to name up to a maximum of three innovations that they had made in the last 10 years and that they were directly involved in.

*$p < 0.1$.

**$p < 0.05$.

***$p < 0.01$ (χ^2-tests were run for only innovations which have more than 10 samples for both numbers of men's and women's innovations.)

DOI: 10.1002/jid

proportion of livestock-related innovations is larger for men (14.8 per cent) than women (10.1 per cent), with a statistically significant difference ($x^2 = 3.533$, d.f. = 1, $p = 0.060$).

3.2 Intra-Household Decision-Making on Uptake of Innovations

The study investigated gender differences in intra-household decision-making authority for their main innovations (Table 4). Consequently, the study found that a higher percentage of self-decision is seen for men's innovations (69.7 per cent), compared with that for married women (50.7 per cent). The χ^2-test found that there are statistically significant differences between men's and women's innovations regarding who decided to introduce the innovation ($x^2 = 53.458$, d.f. = 3, $p < 0.000$).

Regarding wealth differences in gendered patterns of decision-making on innovation uptake (Figure 2), stronger male dominance is seen in the wealthier households. Innovations made by rich married women were dominated to a greater degree by their husbands (19.5 per cent), compared with the innovations made by poor (16.3 per cent) and moderate (13.2 per cent) married women. On the other hand, the largest proportion of the innovations made by rich married men (83.7 per cent) tends to be decided by themselves, compared with innovations made by poor (68.5 per cent) and moderate (66.9 per cent) married men.

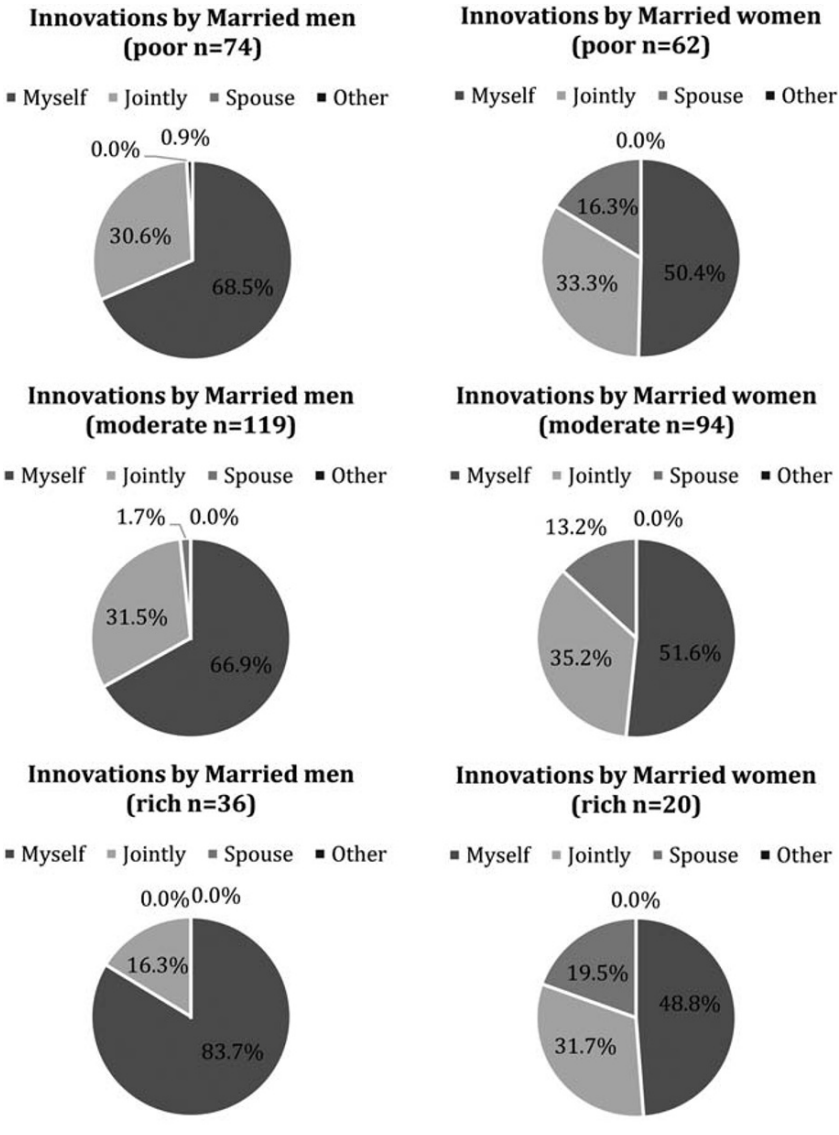
The results of the in-depth interviews provide further insights into the above-mentioned gender patterns, which concern decision-making on innovation uptake. Husbands mostly do not need to seek agreement from their wives, while wives must seek permission from their husbands to introduce any new innovations. Typically, married women are only allowed to plant vegetables and other food crops for the purpose of home consumption without first asking permission from their husbands.

The reasons raised by men for why they make decisions without discussing them with their wives are that men are family heads, that they are the owners of land and that the particular crops being grown are deemed 'men's' crops. Reasons related to land ownership were more strongly pronounced among the rich men. However, poor and moderate male farmers reported that they share innovation ideas with their wives in advance because the work requires their wives' efforts, especially their labour. Unlike the poor and moderate males, rich women have no bargaining tools because rich men can hire labour and, therefore, are not dependent on their wife's labour to support their innovations. This finding resonates with the results seen in Figure 2, which demonstrates that the rich men have more decision-making authority regarding their innovations than poor and moderate men. Furthermore, husbands indicated that their wives could possibly introduce new ideas if the husbands are not around, as long as the wives report them later.

Table 4. Intra-household decision-making on innovation uptake

		Who decided to introduce innovation?				
Gender		Myself	Jointly	Spouse	Other	Total
Married men's innovations	*N*	230	96	3	1	330
	%	69.7%	29.1%	0.9%	0.3%	100.0%
Married women's innovations	*N*	175	118	52	0	345
	%	50.7%	34.2%	15.1%	0.0%	100.0%

DOI: 10.1002/jid



poor: $x^2 = 22.043$, d.f. = 3, $p < 0.000$; moderate: $x^2 = 19.759$, d.f. = 2, $p < 0.000$;
rich: $x^2 = 14.332$, d.f. = 2, $p = 0.001$

Figure 2. Intra-household decision-making on introducing innovations by wealth.

I own land, it is mine and to open up any enterprise, no one should first authorise me. I'm in control and I'm the manager … Of course my wife and sons have to seek for approval (from me). (Ru8/Rich married man in disadvantaged village, SWF AEZ)

I do not need to ask permission from her, but I shared the idea with her, because she is a concerned party. Because when I am not around, she has to take care of animals. (Ry3/Poor married man in advantaged village, SWF AEZ)

DOI: 10.1002/jid

The reasons given by women in this study for seeking approval from men are the following: men are their bosses and women are their subordinates; the innovations require capital from their husbands to buy seeds and materials and to pay for casual labour; such innovations require labour from their husbands (e.g. spraying pesticides); and that the women do not know the boundary of their land. Some moderate-income married women claim that they do not ask permission from their husbands because the resources, such as land rent and seeds, are paid for by women themselves, as seen in the statement below from a female farmer (Ru15). Women's decision-making power for innovations appears therefore to be stronger where land is rented by women, or jointly purchased, especially in the land-scarce SWF AEZ compared with the land-abundant NWSG AEZ and where large areas are customary land. Furthermore, a rich married woman (N15) expressed her fear of divorce if she does not follow what her husband tells her to do regarding innovations. This is consistent with results in Figure 2 and indicates that rich women's innovations are more strongly controlled by their husbands. Furthermore, men claim that women should seek approval from them for reasons similar to those raised by the women noted above.

> *Why seek permission? It was my own money I used to buy the Irish potatoes from selling millet. I planted where I wanted. In case he stops me from using it, I would go out and rent in. He does not ask permission from me either, because he is growing his own crops*. (Ru15/Moderate married woman in disadvantaged village, SWF AEZ)

> *If I do not follow his advice, he will divorce me. I have to ask permission from my husband when introducing new practices. When he introduces, he will just say he is going to do this, not necessarily getting an approval*. (N15/Rich married woman in advantaged village, NWSG AEZ)

3.3 Intra-Household Decision-Making on Innovation Outputs

In a similar way to the production process discussed previously, men maintain stronger decision-making power over innovation outputs than women. The decisions on how to spend cash income from innovations are typically made by husbands, while wives decide on how much harvest is to be kept for home consumption and distributed to neighbours and relatives, as revealed by the participatory budgeting and effects diagrams. Buying land and animals and paying school fees are often suggested or decided by men, while buying clothes and domestic basic necessities such as soap, salt and cooking oil are often decided by women (Table 5). The reasons why the women in this study give part of their harvest to their neighbours is said to be primarily in expectation of their help in return in case of sickness and/or food shortage. This is consistent with female responsibility for domestic food and welfare provision, although the reciprocity culture differs between NWSG and SWF AEZs. Table 5 depicts that men have more authority over outputs for assets and investment, where off-farm investment seems stronger than on-farm investment, and social expenditure such as education and medical treatment, while women tend to control home consumption and produce distribution to helpers or others.

Findings from in-depth interviews suggest that decision-making on outputs is strongly influenced by the type of crops that are being grown, particularly whether it is a cash crop or a food crop, as claimed by some respondents (E7 and Ru18). Men typically control profit from men's crops, such as banana, while women are relatively free to use the petty

DOI: 10.1002/jid

Table 5. Intra-household decision-making on innovation outputs

Innovation	Mainly musband	Jointly	Mainly wife
Expansion of sesame	Maize, goats, chicken, medical treatment, school fee, in-kind contribution to helpers, capital for brick-laying business, hiring ox-plough	Seeds for next season, home consumption, funeral donation	Home consumption, soap, cooking oil, salt, in-kind contribution to helpers, clothes, seeds for next season
Irrigation for tomato	Hiring ox-plough, hiring casual labour for maize, school fee, cows, motorbike,	Home consumption, donation to neighbours, building materials for permanent house, land, ox-plough, goats, hiring casual labour for maize	None
Line-planting for beans	Goats, home consumption, seed exchange, seeds for next season, hiring casual labour for next season, medical treatment	Saving for permanent house, home consumption	Home consumption, in-kind contribution to neighbours
Mulching/manure for banana	School fees, uniforms, books, land purchase, land hire (for Irish potato, beans, sweet potato), Irish potato and beans seeds, saving for emergency, group saving for cow, clothes, goats, pigs, medical treatment, treatment for cows, hiring casual labour for banana expansion, soap, salt, cooking oil, home consumption	In-kind contribution to neighbours, pigs, soap, salt, medication, tea plantation, school fees, hiring casual labour for banana, medical treatment, meat, clothes business for wife, mulches, goats, chickens	Home consumption, in-kind contribution to mother, pigs, uniform, scholastic materials, food, fish, meat, soap, salt
Introduction of Irish potato	School fees, land purchase, land hire, saving for emergency, home expenses (salt, soap), seeds, shop items for his business, medical treatment, home consumption	Seeds for next season, school fee, uniform, land hire, saving for emergency, cows, hiring casual labour, clothes, medical treatment, saving group, home expenses (salt, soap), home consumption, in-kind payment for casual labour	Home consumption, seeds for next season, uniform, seed exchange with neighbours, construction of house

cash gained from selling surplus food crops, such as beans, maize, millet, groundnuts and soybeans. However, the profit that women can use is limited to the purchase of family necessities like soaps and salt, as described by Ru14.

> *She can sell and use money from vegetables at small scale, as long as she meets the basic family needs. Yes, we always sit and budget this money together as a family.*

DOI: 10.1002/jid

But I have more say on money, because I am the head of the family. (E7/Moderate married man in disadvantaged village, NWSG AEZ)

I'm only allowed to sell sweet banana, and I can use that money for my personal use, like sanitary pads, knickers and skirts. For groundnuts and soybeans, I grow mostly for food but the surplus I can sell and use the money for my personal purpose. (Ru18/Rich married woman in disadvantaged village, SWG AEZ)

Man has control over the benefits (from innovation). For example, it is when deciding to buy land, which banana to eat or sell while I'm only allowed to decide for petty issues like buying salt and soap. (Ru14/Moderate married woman in disadvantaged village, SWF AEZ)

Cultural beliefs and norms of gender roles and responsibilities appear to be dictating the decision-making authority over innovation outputs, according to the in-depth interviews. For example, women are believed to be responsible for home food provision, as outlined in the examples above. In addition, intra-household allocation of resources, such as land, labour and farm inputs, influence the decision-making on innovation outputs, similar to decision-making about innovation uptake (as previously discussed). This comes from the belief that production outputs which used men's assets belong to men. On the contrary, wives can decide on outputs if they use their own land, as Ru12 insists. When innovation requires the wife's labour participation, the profit tends to be more jointly decided, while profit from off-farm labour is typically kept and controlled by the one who did the work (Ry17).

It is me who decide how much to give him after selling Irish, beans, and banana. It is me, because the plantation is on my own land. He (husband) spends his money on waragi (local brewery). Wife is in charge of food. (Ru12/Poor married woman in disadvantaged village, SWG AEZ)

It is me who decides (earning from sweet potato) and also I decide on the money I earn from tea plucking. And my husband also decides on what he earns from spraying. (Ry17/Moderate married woman in advantaged village, SWG AEZ)

3.4 Empirical Evidence of Gendered Enterprises and Decision-Making Power

As discussed above, intra-household decision-making which concerns innovation implementation and outputs is strongly related to the type of crops and livestock which are gendered by perceived social norms and household rules. This section verifies the farmers' claims on men's and women's crops or animals in relation to decision-making authority and to further unpack decision-making patterns based on the different levels of the enterprise's contribution to household income. With regard to crops, results of the household survey on intra-household decision-making about crop management and control over the resultant profit (Table 6) reveals that decision-making authority differs depending on crop type. This is consistent with findings of the in-depth interviews which disclosed that women are relatively free to make innovations for food crops, such as sweet potatoes,

DOI: 10.1002/jid

Table 6. Intra-household decision-making on management and profit control by crop type

	Who decides to grow and how to grow the crop?			Which person within your household manages the profit from this crop?		
	Mainly husband	Jointly	Mainly wife	Mainly husband	Jointly	Mainly wife
NWSG AEZ						
Beans	36.2%	36.2%	27.7%	37.8%	35.6%	26.7%
Cassava	35.5%	50.0%	14.5%	39.7%	35.6%	24.7%
Maize	34.0%	50.9%	15.1%	44.2%	30.2%	25.6%
Groundnuts	27.6%	52.9%	19.5%	35.7%	44.0%	20.2%
Sesame	24.3%	67.6%	8.1%	31.4%	54.3%	14.3%
SWF AEZ						
Coffee	66.7%	33.3%	0.0%	16.7%	66.7%	16.7%
Banana	58.7%	35.9%	5.4%	49.3%	42.0%	8.7%
Tea	57.1%	42.9%	0.0%	42.9%	57.1%	0.0%
Irish potato	54.8%	32.3%	12.9%	60.0%	30.0%	10.0%
Maize	46.3%	42.6%	11.1%	53.2%	40.4%	6.4%
Cassava	33.3%	28.6%	38.1%	41.7%	41.7%	16.7%
Beans	32.2%	48.3%	19.5%	52.9%	32.9%	14.3%
Sweet potato	30.0%	46.7%	23.3%	33.3%	55.6%	11.1%

[a]Only major crops are listed in the table. The original data contain 683 and 577 crop cases for production decision and output decision, respectively.

Table 7. Intra-household decision-making on management and profit control by livestock type

	Who decides whether and when to sell or consume the animals?				Which person within your household manages the profit from this animal?			
	Mainly husband	Jointly	Mainly wife	Other	Mainly husband	Jointly	Mainly wife	Other
NWSG AEZ								
Pigs	60.0%	30.0%	10.0%	0.0%	75.0%	12.5%	12.5%	0.0%
Cows	53.8%	42.3%	0.0%	3.8%	53.3%	46.7%	0.0%	0.0%
Goats	51.5%	40.9%	7.6%	0.0%	50.0%	37.0%	13.0%	0.0%
Chickens	40.7%	42.6%	16.7%	0.0%	40.0%	45.0%	15.0%	0.0%
SWF AEZ								
Cows	63.6%	36.4%	0.0%	0.0%	61.9%	33.3%	4.8%	0.0%
Goats	58.1%	35.5%	6.5%	0.0%	57.4%	31.1%	11.5%	0.0%
Pigs	55.6%	44.4%	0.0%	0.0%	50.0%	37.5%	12.5%	0.0%
Chickens	52.4%	28.6%	14.3%	4.8%	60.0%	22.9%	17.1%	0.0%

[a]Only major crops are listed in the table. The original data contain 304 and 251 livestock cases for production decision and output decision, respectively.

millet, beans, maize, groundnuts and vegetables for home consumption, while they are often not allowed to make innovations which concern men's crops, such as banana, tobacco and onion.

Analysis of livestock management analysis reveals greater male dominance in decision-making regarding livestock compared with crop management (Table 7). Women have either no or little authority to decide whether and when to sell or consume animals, except chickens. Control over the profits from livestock similarly male dominated.

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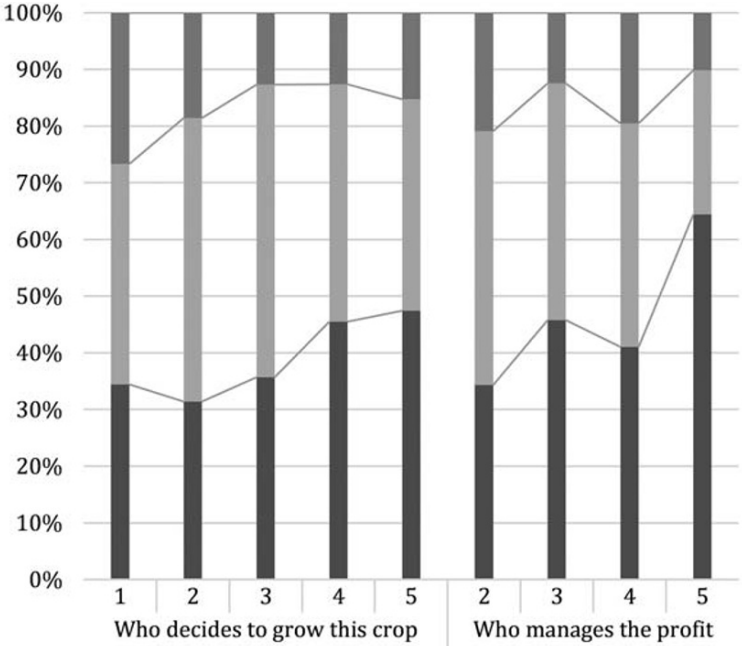
The difference in crops alone, particularly cash or food crops, does not fully capture realities of household decision-making. Because 'traditional' food crops are increasingly commercialised because of rapid urbanisation, such crops are no longer 'women's' crops. Therefore, gendered patterns of decision-making over crops are not static. Hence, crops were categorised into their different degrees of importance to household income, rated by each household using a five band Likert scale (where 1 = of little importance; 2 = less important; 3 = moderately important; 4 = important; and 5 = very important) in the household survey section about crop management. Consequently, the level of decision-making authority was found to differ in accordance with the importance of the crop to household income (Figure 3). More specifically, results demonstrate that the husbands' decision-making powers increase in accordance with the level of importance to household income. Binary logistic regression analysis (Table 8) supports at a statistically significant level the hypothesis that men's decision-making power (on both crop management and profit) increases with the level of importance of the crop to household income, while



	Who decides to grow this crop and how? (p=0.009)					Who manages the profit of the crop? (p=0.20)			
	1	2	3	4	5	2	3	4	5
Mainly Wife	26.7%	18.6%	12.7%	12.6%	15.3%	20.9%	12.4%	19.5%	10.2%
Jointly	38.9%	50.0%	51.6%	41.9%	37.3%	44.8%	41.8%	39.4%	25.4%
Mainly Husband	34.4%	31.4%	35.7%	45.5%	47.5%	34.3%	45.8%	41.1%	64.4%

*The importance of crop for household income (level 1) from 'who manages the profit of the crop?' is removed, because there is no case for this category (which means that there is no profit at all from the crop). This analysis used Likert-scales as a continuous variable as other studies (Knudsen & Roman, 2015; Lalani *et al.* , 2016)

Figure 3. Intra-household decision-making on crop management and profit in order of the level of contribution to household income

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Table 8. Binary logistic regression analysis predicting whether decision-makings (on crop management and profit) are related to importance of the crop for household income

	Mainly husband			Jointly			Mainly wife		
	b	SE	exp(*b*)	*b*	SE	exp(*b*)	*b*	SE	exp(*b*)
Who decides this crop and how?									
Importance for HH income (1–5)	0.19	0.07***	1.20	−0.04	0.07*	0.96	−0.25	0.09***	0.78
−2 Log likelihood	903.67			932.69			573.8		
Cox and Snell R^2	0.01			0.00			0.01		
Nagelkerke R^2	0.01			0.00			0.02		
Who manages the profit of the crop?									
Importance for HH income (1–5)	0.21	0.10**	1.24	−0.20	0.10*	0.82	−0.03	0.14	0.97
−2 Log likelihood	784.14			765.77			508.51		
Cox and Snell R^2	0.01			0.01			0.00		
Nagelkerke R^2	0.01			0.01			0.00		

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

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women's decision-making power declines (on crop management). Moreover, the analysis shows some statistical evidence that joint decision-making (on both crop management and profit) decreases in accordance with the level of importance of the crop.

3.5 Empirical Evidence of Gendered Production Assets and Decision-Making Power

3.5.1 Land

Decisions over innovation processes are determined by the gendered endowment and allocation of production assets, as indicated in previously discussed in-depth interviews. Many interviewees claimed that land ownership is one of the most crucial factors to affect decision-making power with regard to innovations. Land ownership is clearly male dominated at the research sites. The household survey found that 73.1 per cent of 238 households with spouses stated that their land belongs to the husband, 5.9 per cent claim it belongs to the husband's father, while only 15.5 per cent of the households said the land belong to both husband and wife and 4.2 per cent to the wife alone. However, in-depth interviews suggest that women have more decision-making power over innovations implemented on the jointly owned land or on land rented solely by women. The trend of land ownership has not changed drastically compared with the data of 10 years ago. Nonetheless, the proportion of households with spouses who rent land increased from 26.8 per cent to 45.0 per cent over the last 10 years, although it is not clear who rented the land, the wife or the husband.

Despite gender inequalities in land ownership, the noteworthy finding here is that decision-making authority about innovations is affected by land ownership (Figure 4). Because of the lack of more precise data on whose land each of the innovations is undertaken, land ownership analysed here is the ownership of the household's land in general. Despite this data shortage, Figure 4 clearly reveals empirical evidence to show that

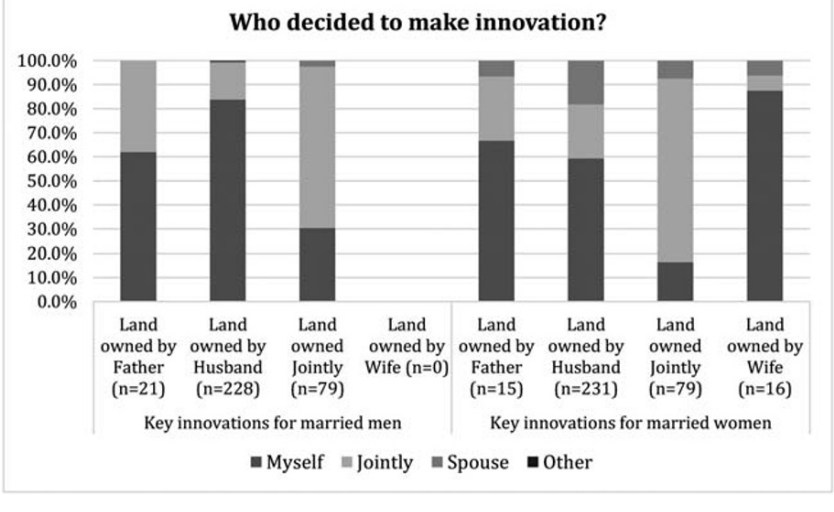

Figure 4. Relationship between intra-household decision-making over innovations and land ownership

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joint decision-making on innovations is associated with the jointly owned land. Furthermore, the wife's autonomy in decision-making over her innovations is seen for household land owned by the wife, while it is predominantly the husband who decides on innovations if the household's land belongs to him.

3.5.2 *Capital inputs*

The source of inputs strongly influences who makes decisions on the innovations and their outputs, as noted by both male and female in-depth interview respondents. Figure 5, which is based on the household survey, shows that the party who paid for the inputs to grow the crops has a greater voice over the management of the crop and the profit generated.

3.5.3 *Labour*

A gendered division of labour is related to decision-making power over crop and profit management. Figure 6 demonstrates the relationships between intra-household labour contribution (work carried out by mainly men, women or jointly) and decision-making pattern on management (decided by mainly men, women or jointly). It shows that each farming activity has its own tendencies for labour allocation between men and women. For instance, ploughing and planting are often carried out by both, while weeding, harvesting and post-harvesting activity (e.g. peeling and drying) are carried out either by women alone or by both. Spraying pesticides is typically carried out by men. These gendered divisions of labour, clearly shown in Figure 6, were consistently reported by farmers during in-depth interviews. Nevertheless, most importantly, who provides labour at each stage of crop production and marketing is associated with the decision-making power over management and profit, although the causality is uncertain. Figure 6 supports the claims made in the in-depth interviewees that the party who contributed his or her own labour has more say on innovation processes and outputs. It is noteworthy, however, that women's labour contribution appears greater than the men's, despite their lower decision-making power. The data seem to imply that women who mainly decide how to grow the crop and control the profit are mostly working on the crop alone. The data

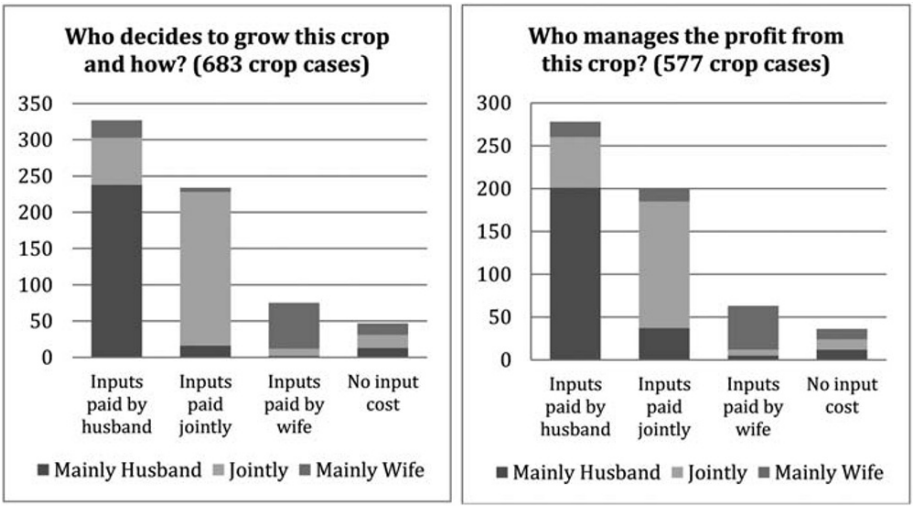

Figure 5. Intra-household decision-making on crop management and profit control and who paid for inputs

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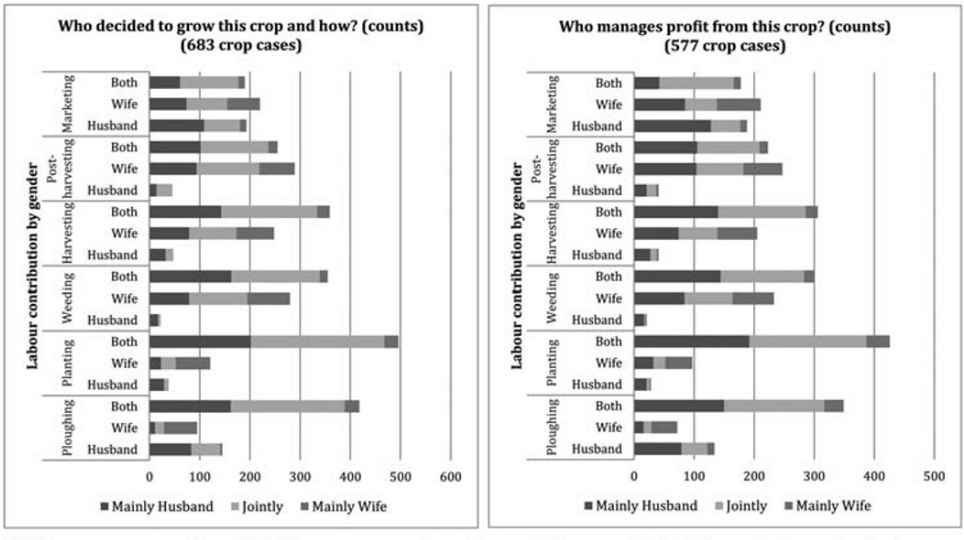

Figure 6. Gender role division and intra-household decision-making on crop management and profit control

displayed in Figure 6 further captured the high rate of each farming activity jointly performed, although it is clear that husbands have greater authority on decision-making, even for crops for which the work is jointly carried out.

4 DISCUSSION

This study identified and explored factors which influence intra-household decision-making authority which concerns innovation uptake and outputs from innovations. It used a mixed method guided by the reasons that farmers perceived as influencing who has decision-making authority. The study found a gender disparity with regard to decision-making over both innovation uptake and benefits. On the one hand, married women themselves decide whether or not to adopt approximately half of the innovations with which they are directly involved, while the rest of their innovations are decided either jointly or by their husbands. On the other hand, married men decide on the majority of their innovation uptakes by themselves, while some of their innovations are decided jointly. Moreover, the richer the households, the more male dominated the decision-making process. Gendered enterprises (either food or cash crops and the importance of the crop to household income) for which innovations are adopted, and the assets (land ownership, labour participation and cash input contribution) used for those innovations, are found to be the major factors influencing decision-making authority. Hence, intra-household decision-making about innovations is greatly gendered because of norms, which stipulate gendered roles and responsibilities, and to the gender inequalities associated with asset endowment and control.

This study found that intra-household decision-making patterns on innovation uptake are attributed to complex, intertwined reasons with a range of influencing factors. This tells us that men and women have different levels of autonomy in deciding whether to adopt

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innovations and that this depends on the power relationship between husband and wife. This, in turn, is determined by whether the required resources or assets can be mobilised to undertake the innovations. It is crucial to emphasise, however, that gender inequality in asset allocation causes unequal bargaining power, so that generally, the only bargaining tool women have is their own labour. In addition, both social norms and individual perceptions of gendered enterprise types (e.g. crop and livestock) and the gendered division of labour play key roles (e.g. women's responsibility for food provision) in shaping decision-making patterns concerning innovations, which do not usually necessitate 'explicit negotiations' (Agarwal, 1997). Such norms are shared by both men and women at community, household and individual levels. Women's status as subordinate leads them to acquiescing with regard to which innovations are adopted, and men's superior position results in underestimating women's capacity and/or knowledge, which blocks intra-household information flow from women to men.

Intra-household decision-making over innovation outputs follows a similar logic. Who has more say about the outputs from innovations is strongly related to who contributed to the enterprise in terms of assets, such as resources and labour. The common pattern is that men control cash profit from marketing produce, especially when purchasing assets such as land and cows, financing off-farm business and paying school fees for children, while women decide how much produce is retained for family consumption and for donating to neighbours or relatives. Women can negotiate over the harvest as long as the outcomes are beneficial to the family food supply. For the purpose of buying basic home groceries, such as soap, salt and cooking oil, women have more authority over spending remuneration gained from their own casual labour and from part of the cash profit, as well as profit earned from the little surplus of food crops grown primarily by them. Such crops, socially perceived as 'women's crops', include leafy vegetables and sweet banana. Again, social norms and individual perceptions of gender roles (e.g. women as food providers) and gendered crop types (e.g. food crops) greatly affect decision-making patterns in innovation outputs. This reality demonstrates that the unitary model, and even Becker's model of 'benevolent dictators', cannot fully explain this gender difference in decision-making authority and intra-household decision-making dynamics, but the different varieties of bargaining models clearly coexist, as many authors claim (Agarwal, 1997; Browning, Chiappori & Lechene, 2010; Doss, 2013; Kebede, Tarazona, Munro & Verschoor, 2014; Mcpeak & Doss, 2006; Moghadam *et al*., 2011; Njuki, Kaaria, Chamunorwa & Chiuri, 2011; Udry, 1996; Wolf, 1990).

The methodology employed in this study allowed farmers' voices to identify factors influencing decision-making patterns and then confirmed the patterns using quantitative data obtained by household and individual questionnaire surveys. The factors identified were enterprise types (such as the types of crops and animals), land ownership, capital input contribution and labour participation. The quantitative data in this study greatly supported farmers' claims. Firstly, whether crops are 'women's crops' or 'men's crops' determined decision-making authority over their management. The data verified that men have greater decision-making authority and control of profits than women for all crops and animals, but they have even greater authority for socially and culturally perceived 'men's crops' or 'men's animals' than 'women's crops'. Secondly, regardless of whether crops are 'women's crops' or 'men's crops', the more the crops contribute to the household income, the higher the rate of male dominance in decisions about how to grow the crops and spend the profits. Thirdly, who provided the necessary assets (e.g. land, capital inputs and labour) for producing the crops determines the degree of decision-making power.

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The first key finding, regarding farmers' claims about 'men's crops' or 'women's crops', evidence from analysis of crop management confirmed that men have greater decision-making authority on what farmers recognise as 'men's crops'. However, what determines 'women's crops' and 'men's crops' has not been fully addressed in much of the literature, even though it supports the notion that men grow cash crops and women grow food crops (Mazur & Onzere, 2009; Miiro, Chritchley, Van Der Wal & Lwakuba, 2001; World Bank, 2007b), and this narrative is often oversimplified. Doss (2002), who examined whether there are men's crops and women's crops in Ghana, argues that most crops are grown both by men and women and cannot be simply classified as either men's crops or women's crops, in spite of complicated gendered patterns of crops grown on lands held by men or women and whether households are male or female headed. Analysis of crop management in this study came to similar conclusions as Doss (ibid.), that is, that all key household crops are grown both by men and women, although men and women contribute their labour to different crops and to different degrees. More importantly, as many farmers expressed, social norms and their personal beliefs about what are 'women's crops' and 'men's crops' determine the gendered pattern of decision-making authority over different crops. In other words, social norms and personal beliefs not only dictate that food crops should be grown by women and cash crops by men, but they also influence the use of profits from different crops for household expenditure (World Bank, 2007b). The difference in bargaining power between men and women does not always result from an explicit process of negotiation (Agarwal, 1997) but from pre-established social norms of gendered crops and gendered responsibilities.

Nevertheless, the second key finding further shows that the higher the contribution of particular crops to household income, the greater the degree of men's decision-making authority over management and expenditure. This finding is similar to that made by Njuki, Kaaria, Chamunorwa and Chiuri (2011), who found that the higher mean income of a commodity is characterised by a lower percentage income share with women in Malawi and Uganda. This finding provides evidence of men's capture of profits, even from food crops, meaning that decision-making patterns are beyond a simple classification of traditional 'women's crops' and 'men's crops'.

The third key finding revealed that gender inequality in decision-making authority concerning innovations is influenced by gender inequalities, which exist in asset ownership. This finding is consistent with the work of a range of other authors (Agarwal, 1997; Doss, 2013; Johnson *et al*., 2016; Meinzen-Dick *et al*., 2011; Quisumbing *et al*., 2015) who claim that a significant determinant of intra-household bargaining power is asset endowment and ownership, as well as the use and control of such assets defined by institutions. The implicit rules binding decision-making authority over crop management and innovations are that the party who contributes more input to grow the crops retains higher bargaining power over the innovation process and outputs. These underlying rules are often neglected in poverty reduction interventions. Clearly, men hold ownership of most of the land in the research sites. In the meantime, men have greater capacity to mobilise the labour of all household members, while female farmers mostly rely on labour provided by their children during school holidays (Mazur & Onzere, 2009). Consequently, men's higher intra-household bargaining power over innovation outputs is exerted to further accumulate men's assets, which, in turn, provides greater bargaining power over new innovations. This situation is similar to that which Agarwal (1997) describes as 'iterative bargaining', whereby assets accumulated at one point of bargaining, which either strengthen or weaken a person's fall-back position, would affect the outcomes in the next round.

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Finally, this study unveiled different gendered patterns of bargaining power and negotiation in the different wealth categories of households. Following Chant's (2011) criticism of the lack of attention paid to differences among women, there remains scarce literature on intra-household decision-making which captures the heterogeneity of women. Although beyond the scope of this article, there are large differences between those households headed by single women (e.g. widowed, separated or divorced) and those of women with partners in terms of decision-making authority in innovation processes. Chant (2011) challenges the notion of the 'feminization of poverty' which regard female household heads to be the most vulnerable of women; this study supports such a challenge as it found that women in this position have much more freedom in innovation decisions than has previously been reported. Even married women are not homogeneous. This study analysed how the wealth status of the household influences intra-household decision-making patterns. The key finding here is that the richer the household, the more dominant male the decision-making authority over innovations, with fewer joint decisions being made. While this finding may initially seem surprising, the reasons for it were clearly evident from farmers. According to the poor and moderate farmers, women have to be more involved in decision-making processes so that men can secure their wives' labour. For these wealth categories, plots are sometimes jointly purchased or rented by women themselves, which encourages joint decision-making patterns and those which are less male dominated. On the other hand, for richer men, who often have the capacity to hire casual labour, their wives' labour is less important to them, so women lack the bargaining power that their less well-off counterparts gain through their labour. Thus, a person's bargaining power is defined by the person's 'fall-back position', which is the outside option in case of cooperation failure (Agarwal, 1997). This concept of a 'fall-back position' helps understanding of why rich women expressed their fear of divorce.

The decision-making processes in terms of uptake and outputs of innovation in the context of intra-household decision-making are highlighted in Figure 7. Deciding whether or not to introduce innovations in the production domain is greatly affected by the bargaining power of household individuals over the use of assets that are necessary for

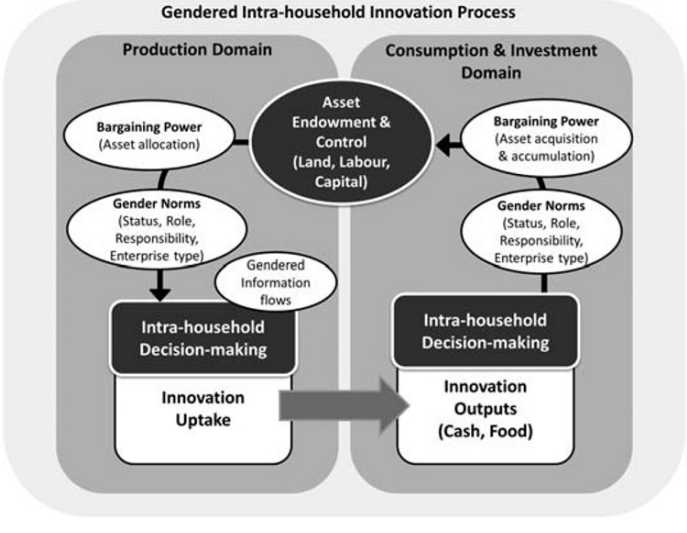

Figure 7. Gendered intra-household innovation process. Source: Authors

DOI: 10.1002/jid

innovations, such as land, labour and agricultural inputs. Which innovations to be introduced concerning which crops tend to be conditioned by social norms and individual perceptions of gender roles and responsibilities? After uptake, a further intra-household decision is made over how to allocate outputs for home consumption and sale and how to spend the profit on consumption. This decision is based on the consumption preferences shaped by social norms of gender roles and responsibilities, as well as how much assets were contributed from which party in order to produce the output. The outputs are often used to accumulate further assets, which influences further innovation uptake in an 'iterative' bargaining process. Thus, innovations may act as to change bargaining power for intra-household asset allocation, either reproducing the existing male-dominant power structure or empowering women.

5 CONCLUSION

Innovations are crucial for the development and adaptation of livelihoods of smallholder farmers in SSA. At the same time, innovations have the potential to challenge conventional gender norms and institutions and to reallocate assets within households (Quisumbing *et al*., 2015), hence, 'reordering of social relationships' (Leeuwis & Aarts, 2011). By unpacking farmers' perceptions of gendered decision-making processes, this study has demonstrated significant statistical associations between decision-making authority and gendered enterprises, as well as gendered allocation of production assets, which are supported by qualitative evidence. As shown in Figure 7, gendered assets determine who controls innovation processes in both production and consumption domains, and this reallocates assets within the household and results in either enhancing or challenging cultural gender norms in the iterative processes. Therefore, this article suggests a broader perspective is required to understand gender inequalities and innovation processes, including bargaining power, which is greatly influenced by gender norms and asset ownership and control.

This study challenges the unitary approach to bargaining power by analysing intra-household dynamics. However, intra-household asset reallocation processes are highly complex because both collective and cooperative bargaining models and non-cooperative models coexist within the same household. It is clear from this study, and from a number of other studies (Meinzen-Dick *et al*., 2011), that men have more assets and, hence, more decision-making authority than women. Nonetheless, women have their own spaces of opportunity for decision-making autonomy using their own labour and available inputs. In addition, it is noteworthy that there is a high proportion of cases whereby jointly purchased assets lead to joint decision-making. As some authors (Chant, 2011; Doss, Meinzen-Dick, Quisumbing & Theis, 2018; Palacios-Lopez, Christiaensen & Kilic, 2017) contest, it is important to scrutinise the validity of traditional static gender narratives and attempt to comprehend a holistic picture of gendered situations in the context of agricultural development.

Furthermore, a dichotomised approach which divides farmers into men and women is not sufficient to fully understand the intra-household decision-making processes; certainly, this study has proven that wealth also influences decision-making patterns. The study found that key innovations reported by richer women are decided by their husbands to a larger degree than for women in other wealth categories, while men's innovations are decided without involvement of their wives, especially in the case of rich men (Figure 2).

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Therefore, future policy and interventions in agriculture and rural development should not simplistically adopt a unitary approach regarding a household as a minimum unit to target; rather they should take into account intra-household communication and decision-making processes in their innovation support as this greatly influences both innovation processes and outcomes. Furthermore, it is crucial to recognise the risk of overburdening women in a society, which defines women's roles and responsibilities in terms of food security. Added to this is the danger of imposing innovations that may widen gender gaps in asset endowment and control, thereby weakening the women's bargaining power over new innovations and their benefits in the future. Innovation support should encourage an increase in more gender equal stocks of, and economic returns from, agricultural assets with a gender-transformative approach. Nevertheless, care must be taken, as women tend to lose control of traditionally perceived food crops once they gain higher market value. Studies are therefore needed to explore how potential changes, such as commercialisation of food crops and expansion of the land rental market, affect women's freedom to make decisions on innovation processes and use of outputs. Such studies may lead to better gender-sensitive and transformative policy and interventions.

REFERENCES

Agarwal B. 1997. "Bargaining" and gender relations: within and beyond the household. *Feminist Economics* **3**: 1–51.

Anderson CL, Reynolds TW, Gugerty MK. 2017. Husband and wife perspectives on farm household decision-making authority and evidence on intra-household accord in rural Tanzania. *World Development* **90**: 169–183.

Becker GS. 1965. A theory of the allocation of time. *The Economic Journal* **75**: 493–517.

Boserup E. 1970. *Women's role in economic development*. London: Allen & Unwin.

Browning M, Chiappori P-A, Lechene V. 2010. Distributional effects in household models: separate spheres and income pooling. *The Economic Journal* **120**: 786–799.

Cardey S, Garforth C. 2013. Incorporating gender in innovation systems research in sub-Saharan Africa, *Agriculture for Development; Toropical Agriculture Association*.

Chant S. 2011. The 'feminization of poverty' and the 'feminization' of anti-poverty programmes: room for revision? In N. Visvanathan, L. Duggan, N. Wiegersma, L. Nisonoff (Eds), *The Women, Gender and Development Reader* (2nd ed.). London: Zed Books.

Doss C. 2013. Intrahousehold bargaining and resource allocation in developing countries. *World Bank Research Observer* **28**: 52–78.

Doss C, Meinzen-Dick R, Quisumbing A, Theis S. 2018. Women in agriculture: four myths. *Global Food Security* **16**: 69–74.

Doss CR. 2001. Designing agricultural technology for African women farmers: lessons from 25 years of experience. *World Development* **29**: 2075–2092.

Doss CR. 2002. Men's crops? Women's crops? The gender patterns of cropping in Ghana. *World Development* **30**: 1987–2000.

Doss CR, Morris ML. 2001. How does gender affect the adoption of agricultural innovations?: the case of improved maize technology in Ghana. *Agricultural Economics* **25**: 27–39.

Fisher M, Carr ER. 2015. The influence of gendered roles and responsibilities on the adoption of technologies that mitigate drought risk: the case of drought-tolerant maize seed in eastern Uganda. *Global Environmental Change* **35**: 82–92.

DOI: 10.1002/jid

Grandin BE. 1988. *Wealth ranking in smallholder communities: a field manual*. London: Intermediate Technology Publications.

Haider H, Smale M, Theriault V. 2018. Intensification and intrahousehold decisions: fertilizer adoption in Burkina Faso. *World Development* **105**: 310–320.

Hall AJ, Mytelka LK, Oyelaran-Oyeyinka B. 2006. *Concepts and guidelines for diagnostic assessments of agricultural innovation capacity.* United Nations University–Maastricht Economic and social Research and training centre on Innovation and Technology: Maastricht.

Hargreaves JR, Morison LA, Gear JSS, Makhubele MB, Porter JDH, Busza J, Watts C, Kim JC, Pronyk PM. 2007. "Hearing the voices of the poor": assigning poverty lines on the basis of local perceptions of poverty. A quantitative analysis of qualitative data from participatory wealth ranking in rural South Africa. *World Development* **35**: 212–229.

Johnson NL, Kovarik C, Meinzen-Dick R, Njuki J, Quisumbing A. 2016. Gender, assets, and agricultural development: lessons from eight projects. *World Development* **83**: 295–311.

Jones C. 1983. The mobilization of Women's labor for cash crop production: a game theoretic approach. *American Journal of Agricultural Economics* **65**: 1049–1054.

Kebede B, Tarazona M, Munro A, Verschoor A. 2014. Intra-household efficiency: an experimental study from Ethiopia†. *Journal of African Economies* **23**: 105–150.

Kingiri AN. 2013. A review of innovation systems framework as a tool for gendering agricultural innovations: exploring gender learning and system empowerment. *The Journal of Agricultural Education and Extension* **19**: 521–541.

Knudsen HK, Roman PM. 2015. Innovation attributes and adoption decisions: perspectives from leaders of a national sample of addiction treatment organizations. *Journal of Substance Abuse Treatment* **49**: 1–7.

Lalani B, Peter D, Garth H, Erwin W. 2016. Smallholder farmers' motivations for using Conservation Agriculture and the roles of yield, labour and soil fertility in decision making. *Agricultural Systems* **146**: 80–90.

Leeuwis C. 2004. *Communication for rural innovation: rethinking agricultural extension*. Oxford: Blackwell Publishing.

Leeuwis C, Aarts N. 2011. Rethinking communication in innovation processes: creating space for change in complex systems. *The Journal of Agricultural Education and Extension* **17**: 21–36.

Maaif. 2016. *Agriculture Sector Strategic Plan 2015/16–2019/20*. Ministry of Agriculture Animal Industry and Fisheries: Uganda.

Malapit HJL. 2012. Why do spouses hide income? *The Journal of Socio-Economics* **41**: 584–593.

Mazur R, Onzere S. 2009. Social networks and status in adopting agricultural technologies and practices among small-scale farmers in Uganda. In *Innovation Africa: Enhancing Farmers' livelihoods*, Sanginga PC, Waters-Bayer A, Kaaria S, Njuki J, Wettasinha C (eds). London: Earthscan Publications.

Mcpeak JG, Doss CR. 2006. Are household production decisions cooperative? Evidence on pastoral migration and Milk sales from northern Kenya. *American Journal of Agricultural Economics* **88**: 525–541.

Meinzen-Dick R, Johnson N, Quisumbing A, Njuki J, Behrman J, Rubin D, Peterman A, Waithanji E. 2011. Gender, assets, and agricultural development programs: A conceptual framework.

Miiro D, Chritchley W, Van Der Wal A, Lwakuba A. 2001. Innovation and impact: a preliminary assessment in Kabale, Uganda. In *Farmer innovation in Africa: a source of inspiration for agricultural development*, Reij C, Waters-Bayer A, Tripp R (eds). London: Earthscan Publications.

Mishra K, Sam AG. 2016. Does Women's land ownership promote their empowerment? Empirical evidence from Nepal. *World Development* **78**: 360–371.

DOI: 10.1002/jid

Moghadam V, Hochschild AR, Mohanty CT, White S, Wolf DL, Shankaran D, Beneria L, Sev'er A, Fernandez-Kelly MP, Ehrenreich B. 2011. *The women, gender and development reader*. London: Zed Books.

Moser C. 2012. *Gender planning and development: theory, practice and training*. London, New York: Routledge.

Nielsen F. 2001. Why do farmers innovate and why don't they innovate more? Insights from a study in East Africa. In *Farmer innovation in Africa: a source of inspiration for agricultural development*, Reij C, Waters-Bayer A, Tripp R(eds). London: Earthscan Publications.

Njuki J, Kaaria S, Chamunorwa A, Chiuri W. 2011. Linking smallholder farmers to markets, gender and intra-household dynamics: does the choice of commodity matter? *European Journal of Development Research* **23**: 426–443.

Palacios-Lopez A, Christiaensen L, Kilic T. 2017. How much of the labor in African agriculture is provided by women? *Food Policy* **67**: 52–63.

Pyburn R. 2014. Gender dimensions of agricultural innovation. In *Dynamics of Rural Innovation - A primer for emerging professionals*, Pyburn R, Woodhill J (eds). Arnhem: LM Publishers.

Quisumbing AR, Rubin D, Manfre C, Waithanji E, Van Den Bold M, Olney D, Johnson N, Meinzen-Dick R. 2015. Gender, assets, and market-oriented agriculture: learning from high-value crop and livestock projects in Africa and Asia. *Agriculture and Human Values* **32**: 705–725.

Reij C, Waters-Bayer A, Tripp R. 2001. Farmer innovation in Africa: a source of inspiration for agricultural development.

Spielman DJ, Ekboir J, Davis K. 2009. The art and science of innovation systems inquiry: applications to sub-Saharan African agriculture. *Technology in Society* **31**: 399–405.

UBOS (2010). *Uganda Census of Agriculture 2008/2009: Volume III Agricultural Household and Holding Characteristics Report, ed*. Uganda Bureau Of Statistics: Uganda.

UBOS. 2014. National Population and Housing Census 2014. *In:* Uganda Bureau Of Statistics (ed.). Kampala.

Udry C. 1996. Gender, agricultural production, and the theory of the household. *Journal of Political Economy* **104**: 1010–1046.

Von Braun J. 1988. Effects of technological change in agriculture on food consumption and nutrition: Rice in a West African setting. *World Development* **16**: 1083–1098.

Wiggins S. 2014. Presidential address African agricultural development: lessons and challenges. *Journal of Agricultural Economics* **65**: 529–556.

Wolf DL. 1990. Daughters, decisions and domination: an empirical and conceptual critique of household strategies. *Development and Change* **21**: 43–74.

World Bank. 2007a. Enhancing agricultural innovation how to go beyond the strengthening of research systems. In *Agriculture and rural development*. World Bank: Washington, D.C.

World Bank. 2007b. *World Development Report 2008: Agriculture for Development*. Published. World Bank: Place.

World Bank. 2012. Agricultural innovation systems: an investment sourcebook. In *Agriculture and rural development*. World Bank: Washington, D.C.

World Bank. 2016. Levelling the field: improving opportunities for women farmers in Africa.

DOI: 10.1002/jid